eBUS SDK .NET API Quick Start Guide

Pleora Technologies

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Document Number and Revisions

Document ID: QSG-0013

Revision	Reason for Revision	Date
18.0	Final Release with eBUS SDK 6.5.0	May 2024
17.0	Final Release with eBUS SDK 6.4.0	February 2024

1 About this Guide

This chapter describes the purpose and scope of this guide, and provides a list of complementary guides.

1.1 What this Guide Provides

This guide provides you with the information you need to install the eBUS SDK (which lets you use the eBUS SDK .NET API) and an overview of the system requirements.

When conducting sales demonstrations, you can review the recommended equipment, and see how easy it is to use the sample applications to demonstrate the capabilities of the eBUS SDK .NET API. Instructions for compiling and using the sample code are provided, along with an overview of the basic calls that can be used to build custom applications using the eBUS SDK .NET API.

For troubleshooting information, frequently asked questions, and technical support contact information for Pleora Technologies, see the last few chapters of this guide.

1.2 Related Documents

eBUS SDK Related Documents

Guides are complemented by the following Pleora Technologies documents, which are available on the Pleora Technologies Support Center (supportcenter.pleora.com):

- eBUS SDK C++ API Quick Start Guide
  This guide provides you with the information you need to install the eBUS SDK (which lets you use the eBUS SDK C++ API) and an overview of the system requirements.

- Docker Support for eBUS SDK User Guide
  This guide provides instruction on how to get started with using eBUS SDK in a Docker environment. It also provides basic instruction on how to set up Docker on a Ubuntu-based system.

- Getting Started with eBUS Edge
  The eBUS Edge API (introduced in eBUS SDK 6.0) allows developers to create a software-based GigE Vision transmitter device. eBUS Edge is fully compliant with GigE Vision and GenICam and will work with any GigE Vision and GenICam compliant third-party image processing systems or software.

- eBUS Edge on OpenSTLinux (ST Micro MP2 Platform) Quick Start Guide
  This guide provides you with the steps to use the eBUS Edge on the ST Micro MP2 Platform running OpenSTLinux. This guide is intended for novice Linux users, although advanced Linux users may be interested in some of the eBUS SDK-specific elements of this guide for cross-compiling eBUS Edge application using eBUS SDK.

- eBUS SDK Licensing
  This knowledge base article explains the eBUS SDK license structure, explains how to obtain a license, and provides activation instructions. If you are experiencing difficulty activating your license,

please review the troubleshooting steps at the end of this publication.

- eBUS SDK for Linux Quick Start Guide
  This guide provides you with the steps to use the eBUS SDK on the Linux operating system, on a Linux x86_64, or ARM platform. This guide is intended for novice Linux users, although advanced Linux users may be interested in some of the eBUS SDK-specific elements of this guide.

- eBUS SDK .NET API Quick Start Guide
  This guide provides you with instructions for compiling and using the sample code are provided, along with an overview of the basic calls that can be used to build custom applications using the eBUS SDK .NET API.

- eBUS Player User Guide
  This guide provides in-depth details about setting up and using the eBUS Player software application to control your GigE Vision or USB3 Vision compliant video transmitters (cameras) and receivers.

- eBUS Player Quick Start Guide
  This quick start guide provides you with the information you need to start using the eBUS Player application, which lets you control the parameters of your GigE Vision or USB3 Vision compliant device and lets you view imaging video and data.

- eBUS SDK Python API Quick Start Guide
  This guide provides you with the information you need to install the eBUS SDK (which lets you use the eBUS SDK Python API) and an overview of the system requirements.

- eBUS SDK on Raspberry PI 4/5 Quick Start Guide
  This guide provides you with the steps to use the eBUS SDK on a Raspberry PI 4/5. This guide is intended for novice Raspberry PI 4/5 users, although advanced Raspberry PI 4/5 users may be interested in some of the eBUS SDK-specific elements of this guide.

- Supported Software Ecosystem
  This support summary provides an overview of the supported protocols, operating systems, ARM platforms, development environments, and drivers. Pleora is currently supporting eBUS SDK 5.0 and later.

2 Introducing the eBUS SDK .NET API

This chapter describes the eBUS SDK .NET API, which is a feature of the eBUS SDK that allows you to develop custom vision systems to acquire and transmit images and data using C#.NET or Visual Basic®.NET (VB.NET).

2.1 About the eBUS SDK .NET API

eBUS SDK is built on a single API to receive video over GigE, 10 GigE, and USB 3.0 that is portable across Windows, and macOS operating systems. With an eBUS SDK Seat License, designers can develop production-ready software applications in the same environment as their end-users, and quickly and easily modify applications for different media, while avoiding supporting multiple APIs from various vendors. Compared to camera vendor provided SDKs, eBUS frees developers from being tied to a specific camera, and instead they can choose the device that is best for the application.

2.1.1 eBUS Receive for Host Applications

eBUS Receive manages high-speed reception of images or data into buffers for hand-off to the end application for further analysis. Developers can write applications that run on a host computer to seamlessly control and configure an unlimited number of GigE Vision or USB3 Vision and GenICam compliant sensors.

The eBUS Universal Pro driver reduces CPU usage when receiving images or data, leaving more processing power for analysis and inspection applications while helping meet latency and throughput requirements for real-time applications. The eBUS Universal Pro driver is easily integrated into third-party processing software to bring performance advantages to end-user applications.

2.2 eBUS SDK Licenses

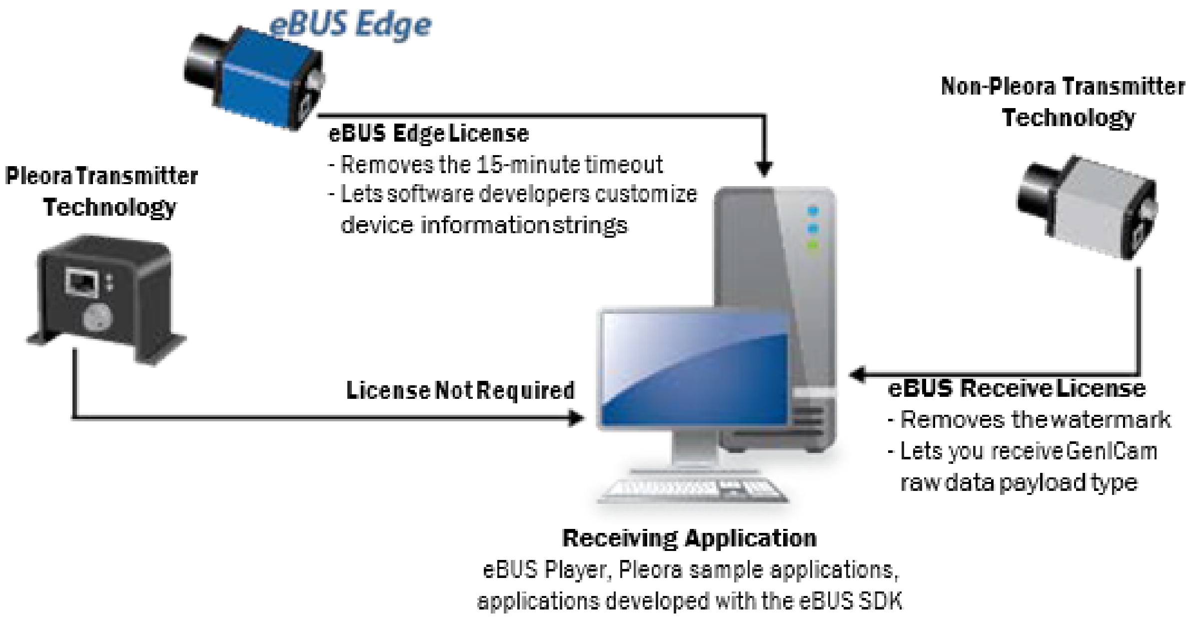
Some components of the eBUS SDK require a Pleora license to remove transmit and receive limitations.

2.2.1 eBUS Player, Sample Applications, and Software Applications Created with the eBUS SDK

When a license is not present and you are receiving images from third-party transmitter technology, an embossed Pleora watermark will appear on the images that you receive. In addition, you will not be able to receive the GenICam raw data payload type from the transmitting device.

2.2.2 GigE Vision Devices Created with the eBUS Edge API

When a license is not present, GigE Vision receivers will be disconnected from the GigE Vision device after 15 minutes. In addition, your device will report hard-coded device information (such as the device model name), instead of your organization's customized information.



2.2.3 Activating an eBUS SDK License

For detailed information about licensing, including details on activating a license, see the *eBUS SDK Licensing Overview Knowledge Base Article* available on the Pleora Technologies Support Center at https://supportcenter.pleora.com.

3 Installing the eBUS SDK .NET API

The eBUS SDK .NET API is installed on our Windows computer during the installation of the eBUS SDK.

✅ Linux x86/ARM support is not available for the .NET API.

3.1 System Requirements

Ensure the computer on which you install the eBUS SDK meets the following recommended requirements:

- At least one Gigabit Ethernet NIC (if you are using GigE Vision devices) or at least one USB 0 port (if you are using USB3 Vision devices).
- An appropriate compiler or integrated development environment (IDE):
  - Visual Studio 2019, 2017, 2015, 2013, 2012, and 2010.
  - Sample project files (.csproj or .vbproj) are compatible with Visual Studio 2012 (and later). When you open them with Visual Studio for the first time, you have the option of upgrading them.
  - The .NET assemblies use Version 4 of the .NET framework and require the .NET framework.
- One of the following operating systems:
  - Microsoft Windows 11 64-bit
  - Microsoft Windows 10, 32-bit or 64-bit
  - Microsoft Windows 8.1, 32-bit or 64-bit
  - Microsoft Windows 7 with Service Pack 1 (or later), 32-bit or 64-bit

ⓘ For supported USB 3.0 host controller chipsets, consult the eBUS SDK Release Notes, available on the Pleora Support Center.

💡 Depending on the incoming and outgoing bandwidth requirements, as well as the performance of each NIC, you may require multiple NICs. For example, even though Gigabit Ethernet is full duplex (that is, it manage 1 Gbps incoming and 1 Gbps outgoing), the computer's

PCIe bus may not have enough bandwidth to support this. This means that while your NIC can — in theory — accept four cameras at 200 Mbps each incoming, and output a 750 Mbps stream on a single NIC, the NIC you choose may not support this level of performance.

Installing the eBUS SDK

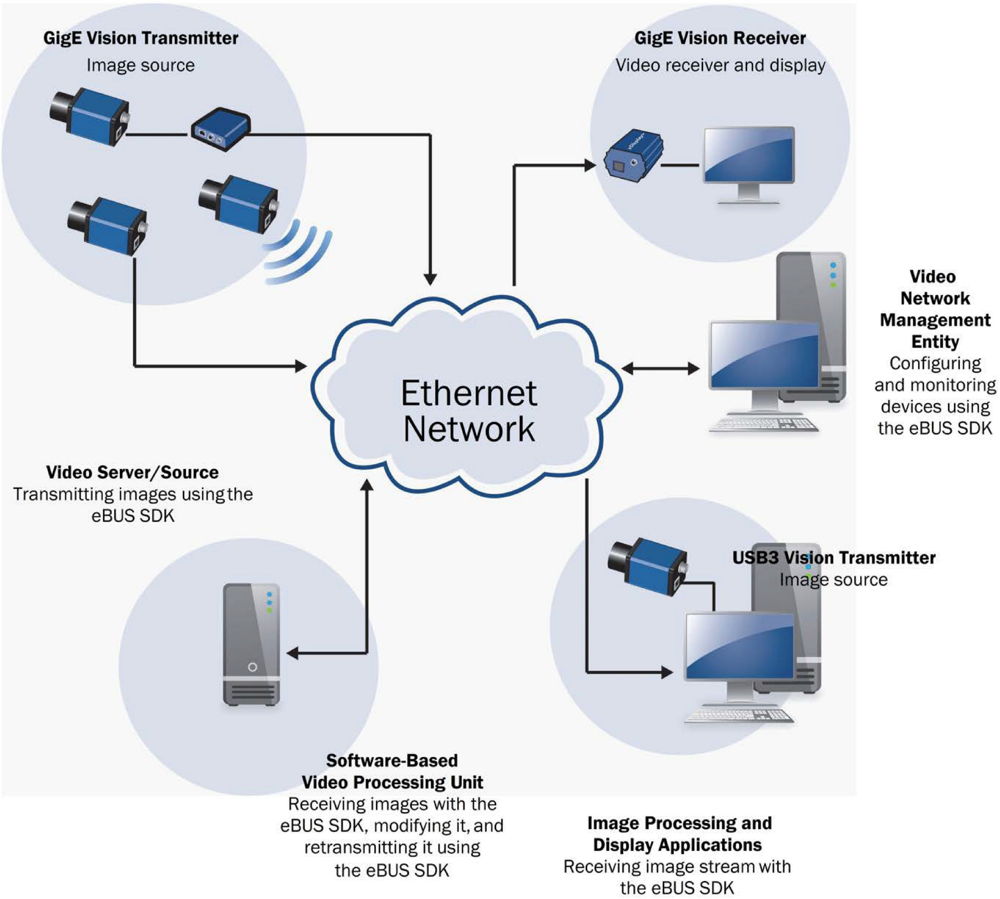
Because the eBUS SDK .NET API is part of the eBUS SDK on Windows, it is included in the eBUS SDK for Windows installation package. You can download the eBUS SDK from the Pleora Support Center at https://supportcenter.pleora.com.

4 Using the Sample Code

To illustrate how you can use the eBUS SDK .NET API to acquire and transmit images, the SDK includes sample code that you can use. This chapter provides a description of the sample code and provides general information about accessing the code to create sample applications.

4.1 Overview: System Components

The following illustration shows the components that are used, illustrating the relationship between the eBUS SDK, GigE Vision receivers, GigE Vision transmitters, and USB3 Vision transmitters.



4.2 Description of Samples

The following samples are available as C# samples in this release. Some samples are also available as VB.NET samples.

Table 1: Sample Code

Sample code	Function	Type of application that is created
Getting Started		
SimpleApplication, SimpleApplicationVB	For developers using .NET or Visual Basic.NET, this sample showcases some of the functionality of the eBUS Receive SDK, which is used to detect, connect, and configure GigE Vision and USB3 Vision devices, and display and streaming images.	UI-based: C# .NET, and VB.NET
PvStreamSample	This “Hello World” sample shows you how to connect to a GigE Vision or USB3 Vision device, receive an image stream, stop streaming, and disconnect from the device.	UI-based: C# .NET
Image Streaming		
DualSource	This GUI-based sample for GigE Vision devices extends the MultiSource sample by allowing you to view image streams from a GigE Vision device that has two streaming sources.”	UI-based: C# .NET
DirectShowDisplay	This sample shows how to integrate the eBUS SDK DirectShow source filter and how to build a filter graph that receives images from a GigE Vision or USB3 Vision device. This functionality is recommended for existing DirectShow applications to enable quick integration of GigE Vision or USB3 Vision devices. Note: This sample assumes good knowledge of DirectShow and COM.	UI-based: C# .NET
PvPipelineSample	This sample extends the "Hello World" PvStreamSample by showing how buffers are managed internally by the PvPipeline class. This removes some of the complexity of buffer management from the application when compared to the PvStream sample.	UI-based: C# .NET

ImageProcessing	This sample illustrates how to acquire an image and process it using an external buffer to interface with a non-Pleora library. This is useful when you want to interface the eBUS SDK to popular third-party SDKs for image processing or machine learning, such as OpenCV.	UI-based: C# .NET
MulticastMaster	This sample shows how to connect to a GigE Vision device and initiate a multicast stream to allow multiple slave devices to receive and process the image stream simultaneously. This sample is used in conjunction with the **MulticastSlave** sample, which listens to the multicast stream.	UI-based: C# .NET
MulticastSlave	This sample shows how to configure the eBUS SDK to receive an image stream from a GigE Vision device that is configured for multicast mode. This sample is used in conjunction with the **MulticastMaster** sample, which initiates the multicast stream.	UI-based: C# .NET
Configuration and Event Monitoring		
CameraBridge	This sample shows how to control a Camera Link camera through a compatible Pleora iPORT CL Series External Frame Grabber using the following Camera Link protocols: CLProtocol and GenCP.	UI-based: C# .NET
GenICamParameters	This sample shows how to enumerate and display the GenICam features and settings of a GenICam-compatible device by discovering and accessing the features of the device's node map. The node map is built programmatically from the device's GenICam XML file.	UI-based: C# .NET

4.3 Using H.264 Encoding

You can use eBUS Player (C++ sample application) to encode images in H.264 video format and save them on your computer in an MP4 file.

If you are interested in adding H.264 encoding to your application, you can refer to the Mp4WriterWin32 class in the eBUS Player C++ sample application for an example. At this time, Pleora does not supply sample code to save H.264 video in an mp4 file for .NET applications.

However you can use the mp4writerwin32 C++ class as a template to migrate the code to .NET. This feature can be used when you start eBUS Player from the Windows Start menu. However, it is important to note that if you are using the eBUS Player sample application, this feature is not enabled by default.

4.3.1 Video Encoder Information

When saving H.264 video in an MP4 container, the eBUS SDK uses the Microsoft Media Foundation H.264 video encoder. The default video encoder settings are used, with the exception of the frame rate and average bit rate. The video is encoded at 30 frames per second. And the average bit rate is the value set by the PvMp4Writer.AvgBitrate property.

5 Code Walkthrough: Acquiring Images with the eBUS SDK

This section walks you through the code contained in **PvStreamSample**. This sample illustrates how to detect available devices, connect to a device, and start an image stream.

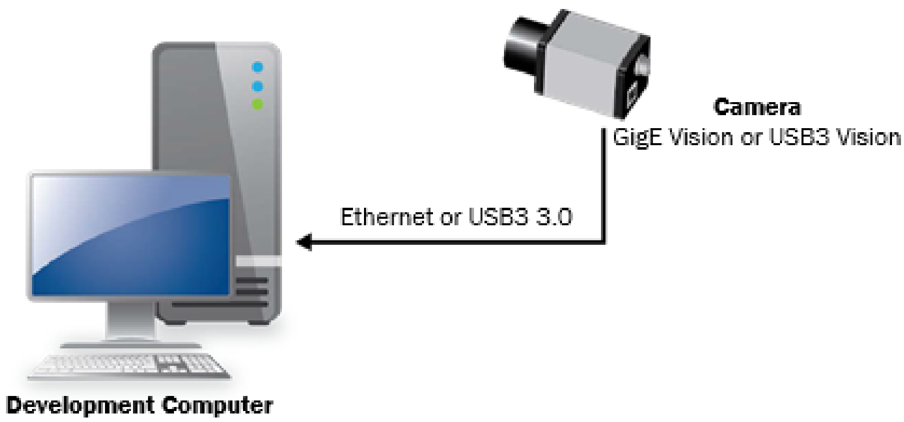
5.1 Accessing the Sample Code

The sample code is available in the following location: C:\Program Files\Pleora Technologies Inc\eBUS SDK\Samples.

> You must copy the sample code to a location on your computer (such as your C: drive) before you open the sample code in your IDE.

5.1.1 Required Items

The sample code requires that you have a GigE Vision device connected to a NIC on your computer or a USB3 Vision device connected to a USB 3.0 port on your computer.



5.2 Classes Used in the PvStreamSample

PvStreamSample uses the classes listed in the following table.

Table 2: Classes Used in the Sample

Class	Description

PvDeviceInfo	Used to access information about a device, such as its manufacturer information, protocol (either GigE Vision or USB3 Vision), serial number, ID, and version.
PvDevice	Used to connect to and control a device and initiate the image stream. Protocol and interface-specific functionality is available in two subclasses: **PvDeviceGEV** and **PvDeviceU3V**.
PvStream	Provides access to the image stream. Like **PvDevice**, there are protocol and interface-specific subclasses, **PvStreamGEV** and **PvStreamU3V**.
PvBuffer	Represents a block of data from the device, such as an image.
PvResult	A simple class that represents the result of various eBUS SDK functions methods.

5.3 Namespaces

The **PvDotNet** and **PvGUIDotNet** namespaces are required for applications that use the eBUS SDK. If you are developing an application that does not use GUI components, you can exclude **PvGUIDotNet**.

C#

```
using System;
using System.Collections.Generic;
using System.ComponentModel;
using System.Data;
using System.Drawing;
using System.Text;
using System.Windows.Forms;
using System.Threading;
using PvDotNet;
using PvGUIDotNet;
```

When you include **PvGUIDotNet**, eBUS SDK GUI components are available to drag from the Visual Studio toolbox into your application.

To add the display, browser, and status controls to the Visual Studio toolbox

1. In Visual Studio, right-click the **Toolbox** and then click **Choose Items**.
2. On the **.NET Framework Components** tab, select the following controls: **PvDisplayControl**, **PvGenBrowserControl**, and **PvStatusControl**.

5.4 Timer

The sample uses a timer to sequence through the methods of the sample. Every time that the timer ticks (every 1 second), the sample executes the next method. The use of the timer helps demonstrate concepts within the eBUS SDK, and you do not need to include it in your application.

The timer is only enabled when one of the methods completes.

5.5 FormClosing Event

On form closing, if a stream has been started, the stream stops. If there is a connection with the device, the application disconnects from the device.

5.6 Step1Connecting Method

Step1Connecting calls methods that allow the user to select a device from a dialog box, connect to a device, open the image stream, and set the browser parameters.

This sample demonstrates the display of available devices to the user, using a device finder window. Another option is to select a device programmatically, using the **PvSystem** class to iterate through all **PvInterface** objects (network adapters or USB host controllers) and within those, iterate through **PvDeviceInfo** objects. Alternatively, you can hard-code the device identifier (the IP address, MAC address, or USB GUID) or read it from a configuration file.

The first section of the sample provides the user with a way to see all of the available GigE Vision and USB3 Vision devices, and select one. A device finder dialog box presents all of the devices that are available to the user. If the user selects a GigE Vision or USB3 Vision device and clicks the **OK** button, then we proceed to connect to the device and open the image stream, as discussed in the next paragraph.

C#

```
    private void Step1Connecting()
        {
            oneLabel.Enabled = true;

            // Pop device finder, let user select a device. PvDeviceFinderForm lForm
 = new PvDeviceFinderForm();
            if (lForm.ShowDialog() == DialogResult.OK)
            {
                try
                {
                    PvDeviceInfo lDeviceInfo = lForm.Selected;
```

Next, the sample connects to the selected device. GigE Vision and USB3 Vision devices are represented by different classes (**PvDeviceGEV** and **PvDeviceU3V**) and they share a parent class (**PvDevice**) that abstracts most of the differences. When possible, you should use a **PvDevice** object instead of a protocol-specific object to reduce code duplication. To create a **PvDevice** object from a **PvDeviceInfo** object without explicitly checking the protocol of the device, use the **CreateAndConnect** static factory method from the **PvDevice** class, which abstracts the device type.

ⓘ If it is not important for your application to support both GigE Vision and USB3 Vision devices (for example, your organization only uses devices of a particular type), you can call the **GetType** method of the **PvDeviceInfo** object (**aDeviceInfo**) to determine whether the device is GigE Vision or USB3 Vision. Then you could create a new **PvDeviceGEV** or **PvDeviceU3V** object and call the **Connect** method directly.

When the sample initiates the image stream, it uses a static factory method (**CreateAndOpen**) to create and open the **PvStream** object, which allows your application to support both GigE Vision and USB3 Vision devices.

Finally, it retrieves a reference to an array of GenICam features that represent the stream statistics and parameters and stores them in the UI element on the form.

ⓘ The eBUS SDK .NET API uses exceptions for error management. For more information, see “Error Management”.

C#

```
                // Connect device.
                mDevice = PvDevice.CreateAndConnect(lDeviceInfo);
                // Open stream.
                mStream = PvStream.CreateAndOpen(lDeviceInfo.ConnectionID);
                if (mStream == null)
                {
                    MessageBox.Show("Unable to open stream.", Text); return;
                }

                // Set browser parameters.
                browser.GenParameterArray =
                mStream.Parameters;
            }
            catch (PvException ex)
            {
                Step6Disconnecting();
                MessageBox.Show(ex.Message, Text, MessageBoxButtons.OK,
                MessageBoxIcon.Error); Close();
            }
        }
        else
```

```
            {
                Close();
            }
}
```

5.7 Step2Configuring Method

For most of this sample, there is no need to distinguish between GigE Vision or USB3 Vision devices, as the eBUS SDK classes abstract the device type. However, when using a GigE Vision device, you must set a destination IP address for the image stream. In this sample, the destination is automatically set to be the IP address of the network interface card on the PC used to interface with the device (which is the most common configuration).

Also, for optimal performance over Gigabit Ethernet, it is necessary to determine the largest possible packet size for the connection (ideally the link would use jumbo frames — typically about 9000 bytes). This is the only place in the application where we check the device type.

Jumbo frames are configured on your computer's network interface card (NIC). For more information, see the operating system documentation or the *Configuring Your Computer and Network Adapters for Best Performance Knowledge Base Article*, available on the Pleora Support Center at https://supportcenter.pleora.com.

When developing your application, you may prefer to hard-code the packet size based on your target system, instead of using **PvDeviceGEV**.**NegotiatePacketSize**.

First, we use a dynamic cast to determine if the **PvDevice** object represents a GigE Vision device. If it is a GigE Vision device, we do the required configuration. If it is a USB3 Vision device, no stream configuration is required for this sample.

C#

```
private void Step2Configuring()
        {
            oneLabel.Enabled = false;
            twoLabel.Enabled = true;
            try
            {
                // Perform GigE Vision only configuration
                PvDeviceGEV lDGEV = mDevice as PvDeviceGEV;
                if (lDGEV != null)
                {
                    // Negotiate packet size
                    lDGEV.NegotiatePacketSize();
```

```
                        // Set stream destination.
                        PvStreamGEV lSGEV = mStream as PvStreamGEV;
                        lDGEV.SetStreamDestination(lSGEV.LocalIPAddress,
lSGEV.LocalPort);
                    }
```

Next, the sample allocates memory for the received images.

PvStream contains two buffer queues: an “input” queue and an “output” queue. First, we add **PvBuffer** objects to the input queue of the **PvStream** object by calling **PvStream.QueueBuffer** once per buffer. As images are received, **PvStream** populates the **PvBuffers** with images and moves them from the input queue to the output queue. The populated **PvBuffers** are removed from the output queue by the application (using **PvStream.RetrieveBuffer**), processed, and returned to the input queue (using **PvStream.QueueBuffer**). The queuing and retrieval of buffers is managed by a worker thread that executes the **ThreadProc** method, which appears near the end of the sample code and is described in “The Worker Thread” .

The memory allocated for **PvBuffer** objects is based on the resolution of the image and the bit depth of the pixels (the payload) retrieved from the device using **PvDevice.GetPayloadSize**. The device returns the number of bytes required to hold one buffer, based on the configuration of the device.

> When designing applications that deal with higher frame rate streams or that run on slower platforms, it may be necessary to increase the BUFFER_COUNT (to give you some margin for performance dips when you cannot process buffers fast enough for a short period). This allows the application to avoid a scenario where all buffers are in the output queue awaiting retrieval, and none are available in the input queue to store newly-received images.

C#

```
                // Read payload size, preallocate buffers of the pipeline.
                Int64 lPayloadSize = mDevice.PayloadSize;

                // Get minimum buffer count, creates and allocates buffer.
                UInt32 lBufferCount = (mStream.QueuedBufferMaximum < cBufferCount) ?
                            mStream.QueuedBufferMaximum : cBufferCount;
                PvBuffer[] lBuffers = new PvBuffer[lBufferCount];
                for (UInt32 i = 0; i < lBufferCount; i++)
                {
                    lBuffers[i] = new PvBuffer();
                    lBuffers[i].Alloc((UInt32)lPayloadSize);
                }
                // Queue all buffers in the stream.
                for (UInt32 i = 0; i < lBufferCount; i++)
                {
                    mStream.QueueBuffer(lBuffers[i]);
                }
            }
            ...
```

5.8 Step3StartingStream Method

In this method, we acquire images from the device.

Step3StartingStream creates a new thread, which executes the **ThreadProc** method that manages the queueing and retrieval of buffers. While it is not necessary to queue and retrieve buffers on a separate thread, we use this approach in the sample to allow the user interface to be updated independently of buffer management.

To start the image stream, we enable streaming on the device (**PvDevice.StreamEnable**) and execute the GenICam **AcquisitionStart** command (**IStart**).

For GigE Vision devices, **StreamEnable** sets the **TLParamsLocked** feature, which prevents changes to the streaming related parameters during image acquisition.
For USB3 Vision devices, it sets the **TLParamsLocked** feature, configures the USB driver for streaming, and sets the stream enable bit on the device.

C#

```
private void Step3StartingStream()
    {
        twoLabel.Enabled = false;
        threeLabel.Enabled = true;

        // Start display thread.
        mThread = new Thread(new ParameterizedThreadStart(ThreadProc));
        MainForm lP1 = this;
        object[] lParameters = new object[] { lP1 };
        mIsStopping = false;
        mThread.Start(lParameters);

        // Enables streaming before sending the AcquisitionStart command.
        mDevice.StreamEnable();

        // Start acquisition on the device
        mDevice.Parameters.ExecuteCommand("AcquisitionStart");
    }
```

5.8.1 The Worker Thread

As the acquisition thread runs, we retrieve the first **PvBuffer**, and check the results. When we retrieve the **PvBuffer** object, we remove it temporarily from the **PvStream** output buffer queue and process it. When processing is complete, we add the **PvBuffer** object back into the input buffer queue.

To verify that a buffer has been retrieved successfully from the stream object and to verify the acquisition of an image, we examine the two values supplied by **RetrieveBuffer**. First, we check the value of a **PvResult** object (**IResult**) to determine that a buffer has been retrieved. If a buffer has been retrieved, then it checks the value of the **PvResult** object (**lOperationResult**) to verify the acquisition operation (for example, it checks if the operation timed out, had too many resends, or was aborted.)

C#

```
private static void ThreadProc(object aParameters)
    {
        object[] lParameters = (object[])aParameters;
        MainForm lThis = (MainForm)lParameters[0];

        for (;;)
        {
            if (lThis.mIsStopping)
            {
                // Signaled to terminate thread, return.
                return;
            }
            PvBuffer lBuffer = null;
            PvResult lOperationResult = new PvResult(PvResultCode.OK);
            // Retrieve next buffer from acquisition pipeline
            PvResult lResult = lThis.mStream.RetrieveBuffer(ref lBuffer, ref
 lOperationResult, 100);
            if (lResult.IsOK)
            {
                // Operation result of buffer is OK, display.
                if (lOperationResult.IsOK)
                {
                    lThis.displayControl.Display(lBuffer);
                }
                // We have an image - do some processing (...) and VERY IMPORTANT,
                // re-queue the buffer in the stream object.
                lThis.mStream.QueueBuffer(lBuffer);
            }
        }
    }
```

Now that we have obtained a **PvBuffer** with an image, we display the image in the application. This is also the point at which your application would typically process the buffer. After we display the image, we requeue the **PvBuffer** object in the input queue by calling **PvStream.QueueBuffer**.

If **lOperationResult** returns something other than **OK**, a **PvBuffer** object has been retrieved, but it is not valid (for example, only part of the image could be retrieved or a timeout occurred). In this case, we also re-queue the **PvBuffer** object back to the **PvStream** object so it can be used again.

If **lResult** returns something other than **OK**, a **PvBuffer** object was not retrieved and therefore there is no **PvBuffer** to requeue.

C#

```
        private void Step5StoppingStream()
                {
```

```
                    stopButton.Enabled = false;
                    fourLabel.Enabled = false;
                    fiveLabel.Enabled = true;

                    try
                    {
                        PvBuffer lBuffer = null;
                        PvResult lOperationResult = new PvResult(PvResultCode.OK);
                        PvResult lResult = new PvResult(PvResultCode.OK);
       ...
```

5.9 Step5StoppingStream Method

The remainder of the sample is used to stop acquisition and clean up resources when the user presses the **Stop** button. First, we execute the GenICam **AcquisitionStop** command (**IStop**). Then, we disable the stream and stop the worker thread.

For GigE Vision devices, **StreamDisable** resets the **TLParamsLocked** feature, which allows changes to the streaming related parameters to occur.
For USB3 Vision devices, **StreamDisable** resets the **TLParamsLocked** feature and sets the stream enable bit on the device.

C#

```
                        // Stop acquisition.
                        mDevice.Parameters.ExecuteCommand("AcquisitionStop");

                        // Disable streaming after sending the AcquisitionStop
command.
                        mDevice.StreamDisable();

                        // Stop display thread.
                        mIsStopping = true;
                        mThread.Join();
                        mThread = null;
```

Now that streaming has stopped, we mark all of the buffers in the input queue as aborted (using **PvStream.AbortQueuedBuffers**), which moves the buffers to the output queue.

For **PvStreamGEV** objects, before resuming streaming after a pause, you should flush the queue using **PvStreamGEV.FlushPacketQueue**, which removes all unprocessed UDP packets from the data receiver.

If your application does not abort queued buffers, your application will receive timeout errors when you restart **PvStream**, since the buffers in the input queue will have exceeded the timeout value.

> While our sample does not necessarily require that we abort and remove the buffers from the queue (because we do not restart **PvStream** in this sample), it is included in this sample to illustrate the concept of clearing buffers.

Finally, we remove all of the buffers from the queue (using **PvStream.RetrieveBuffer**) so they can be requeued the next time the stream is enabled.

C#

```
                    // Abort all buffers in the stream and dequeue
                    mStream.AbortQueuedBuffers();
                    for (int i = 0; i < mStream.QueuedBufferCount; i++)
                    {
                        lResult = mStream.RetrieveBuffer(ref lBuffer, ref
lOperationResult);

                        if (lResult.IsOK)
                        {
                            lBuffer = null;
                        }
                    }
                }
                catch (PvException lExc)
                {
                    MessageBox.Show(lExc.Message, Text);
                }
            }
```

5.10 Step6Disconnecting Method

Step6Disconnecting releases the browser parameter array reference. The stream is closed (if it was opened) and then the connection to the device is disconnected.

C#

```
        private void Step6Disconnecting()
            {
                fiveLabel.Enabled = false;
                sixLabel.Enabled = true;

                // Release browser parameters reference.
                browser.GenParameterArray = null;
```

```
            if (mStream != null)
            {
                // Close and release stream
                mStream.Close();
                mStream = null;
            }
            if (mDevice != null)
            {
                // Disconnect and release device
                mDevice.Disconnect();
                mDevice = null;
            }
        }
```

6 Troubleshooting

This chapter provides you with troubleshooting tips and recommended solutions for issues that can occur when using the eBUS SDK .NET API, GigE Vision, and USB3 Vision devices.

Not all scenarios and solutions are listed here. You can refer to the Pleora Technologies Support Center at https://supportcenter.pleora.com for additional support and assistance. Details for creating a customer account are available on the Pleora Technologies Support Center.

Refer to the product release notes that are available on the Pleora Technologies Support Center for known issues and other product features.

6.1 Troubleshooting Tips

The scenarios and known issues listed in this chapter are those that you might encounter during the setup and operation of your device. Not all possible scenarios and errors are presented. The symptoms, possible causes, and resolutions depend upon your particular setup and operation.

If you perform the resolution for your issue and the issue is not corrected, we recommend you review the other resolutions listed in this table. Some symptoms may be interrelated.

Table 3: Troubleshooting Tips

Symptom	Possible cause	Resolution
SDK cannot detect or connect to the Pleora device	Power not supplied to the device, or inadequate power supplied	Both the detection and connection to the device will fail if adequate power is not supplied to the device. Verify that the Network LED is active. For information about the LEDs, see the documentation accompanying the device. Re-try the connection to the device with your application.

	The GigE Vision device is not connected to the network	Verify that the network LED is active. If this LED is illuminated, check the LEDs on your network switch to ensure the switch is functioning properly. If the problem continues, connect the device directly to the computer to verify its operation. For information about the LEDs, see the documentation accompanying the device.
	The GigE Vision device and computer are not on the same subnet	Images might not appear in your application if the GigE Vision device and the computer running your application are not on the same subnet. Ensure that these devices are on the same subnet. In addition, ensure that these devices are connected using valid gateway and subnet mask information. You can view the IP address information in the **Available Devices** list in your application. A red icon appears beside the device if there is an invalid IP configuration.
SDK cannot detect the API or transmitter	NIC that is receiving and NIC that is transmitting are on different subnets	Ensure the transmitting and receiving NICs are on the same subnet.
Errors appear	For GigE Vision devices, the drivers for your NIC may not be the latest version	Ensure you have installed the latest drivers from the manufacturer of your NIC.
SDK is able to connect, but no images appear in your application. In a multicast GigE Vision configuration, images appear on a display monitor connected to a vDisplay HDI- Pro External Frame Grabber but do not appear in your application.	In a multicast configuration, the device may not be configured correctly	Images only appear on the display if you have configured the device for a multicast network configuration. The device and all multicast receivers must have identical values for both the **GevSCDA** and **GevSCPHostPort** features in the **TransportLayerControl** section. For more information, see the documentation accompanying the device.
	In a multicast configuration, your computer's firewall may be blocking your application	Ensure that your application is allowed to communicate through the firewall.

	Anti-virus software or firewalls blocking transmission	Images might not appear in your application because of anti-virus software or firewalls on your network. Disable all virus scanning software and firewalls, and re-attempt a connection to the device with your application.
	Ensure jumbo packets are properly configured for the NIC	Enable jumbo packet support for the NIC and network switch (as required). If the NIC or network switch does not support jumbo packets, disable jumbo packets for the transmitter.
Dropped packets: eBUS Player, or applications created using the eBUS SDK	Insufficient computer performance	The computer being used to receive images from the device may not perform well enough to handle the data rate of the image stream. The GigE Vision driver reduces the amount of computer resources required to receive images and is recommended for applications that require high throughput. Should the application continue to drop packets even after the installation of the GigE Vision driver, a computer with better performance may be required.
	Insufficient NIC performance	The NIC being used to receive images from the GigE Vision device may not perform well enough to handle the data rate of the image stream. For example, the bus connecting the NIC to the CPU may not be fast enough, or certain default settings on the NIC may not be appropriate for reception of a high-throughput image stream. Examples of NIC settings that may need to be reconfigured include the number of Rx Descriptors and the maximum size of Ethernet packets (jumbo packets). Additionally, some NICs are known to not work well in high-throughput applications. For information about maximizing the performance of your system, see the *Configuring Your Computer and Network Adapters for Best Performance Application Note*, available on the Pleora Support Center.

7 Reference: C++ eBUS SDK and .NET SDK Comparison

This chapter outlines the differences between the C++ version of the eBUS SDK and the C# version.

The *eBUS SDK .NET API Help File* provides detailed information about the .NET classes available in the eBUS SDK C++ API. The Help file is available from the Windows **Start** menu (**All Programs** > **Pleora Technologies Inc.** > **eBUS SDK** > **eBUS SDK .NET API**).

7.1 Types

The eBUS SDK types used in C++ are replaced by native .NET types. For example, **PvString** (which is used to input and output strings to/from the eBUS SDK) is replaced with a string.

Table 4: .NET Equivalent of eBUS SDK C++ Types

C++ type	Replaced by the following .NET type
PvString	string
int_64	Int64
uint64_t	UInt64
int32_t	Int32
uint32_t	UInt32
int16_t	Int16
uint16_t	UInt16
uint8_t	UInt8

7.2 Properties

The Get and Set methods in C++ are replaced by properties in the .NET version of the eBUS SDK. A property internally defines Get and Set methods but it is only accessed through its property name. This is because Get and Set methods without properties are not commonly used in .NET.

Exceptions to this rule are the Get and Set methods that require additional parameters (for example, accessing values in the GenICam node tree). Because these methods cannot be replaced with properties, they remain the same as their C++ counterparts.

C++

```
PvSerialPort lPort;
PvUInt32 lSize = lPort.GetRxBufferSize();
lPort.SetRxBufferSize( lSize );
```

C#

```
PvSerialPort lPort = new PvSerialPort();
UInt32 lSize = lPort.RxBufferSize;
lPort.RxBufferSize = lSize;
```

7.3 Enumeration Types

Typed native .NET enumerations (not to be confused with GenICam enumerations) are used to wrap C++ enumerations. The same underlying C++ values are used when defining the .NET enumerations.

.NET enumerations are different from C++ enumerations in the following ways:

- They throw an exception when you attempt to set them to an unsupported integer value.
- They can be converted to strings and the strings can be parsed and turned into an enumeration value.
- They can be enumerated in statements, such as foreach statements.

7.4 Error Management

The .NET version of the eBUS SDK uses exceptions for error management, whereas the C++ version uses methods that return error codes. For example, the eBUS SDK uses a void return type and throws a **PvException** object when an error occurs, whereas the C++ version returns a **PvResult** object.

A **PvException** object contains a Result property, which is the **PvResult** that the method would have returned. The **ToString** and Description members of **PvException** are adapted to return a string-based representation of the **PvResult** containing the error code and description.

The only exception to this rule is streaming methods that manage buffers in the **PvStream**, **PvPipeline**, and **PvTransmitterGEV** classes. For performance reasons try/catch and exception management are not used to handle these errors. For these methods, there is no change from the C++ approach — these methods return a **PvResult** object.

C++ eBUS SDK methods that have a **PvResult** return value and take a reference to a parameter to return the true return value, now simply return the return value (or are implemented as properties). A good example is the **GetValue** method of the **PvGenParameter** class.

C++

```
PvInt64 lValue = 0;
PvResult lResult = lInteger.GetValue( lValue );
if (!lResult.IsOK())
{
    // ...
}
```

C#

```
try
{
    Int64 lValue = lInteger.Value;
}
catch (PvException lEx)
{
    // ...
}
```

C++

```
PvResult lResult = lDevice.Connect( "192.168.138.164" );
if ( !lResult.IsOK() )
{
    // ...
}

lResult = lStream.Open( "192.168.138.164" );
if ( !lResult.IsOK() )
{
    // ...
}

lResult = lPipeline.Start();
if ( !lResult.IsOK() )
{
    // ...
}
```

C#

```
try
{
    lDevice.Connect( "192.168.138.164" );
    lStream.Open( "192.168.138.164" );
    lPipeline.Start();
}
catch (PvException lEx)
{
    // ...
}
```

7.5 Enumerators

Some eBUS SDK classes are containers for other objects that can be enumerated. .NET interfaces are implemented for these classes to allow the program to go through all of the objects with a foreach statement:

- The **PvInterface** class enumerates **PvDeviceInfo** objects.
- The **PvSystem** class enumerates **PvInterface** objects.
- The **PvGenEnum** class enumerates **PvEnumEntry** objects.
- The **PvGenParameterArray** enumerates **PvGenParameter** objects.

C# (Without an Enumerator)

```
UInt32 lCount = lArray.Count;
for (UInt32 i = 0; i < lCount; i++)
{
    PvGenParameter lP =
        lParameterArray.Get(i);
    // …
}
```

C# (With an Enumerator)

```
foreach (PvGenParameter lP in lArray)
{
    // ...
}
```

7.6 Collections

The C++ version of the eBUS SDK has collection classes such as **PvStringList**, **PvPropertyList**, and **PvGenParameterList**. In .NET, native List templates are used instead, such as **List<string>**, **List<PvProperty>**, and **List<PvGenParameter>**.

7.7 Callbacks

All C++ eBUS SDK callbacks or virtual methods used as callbacks are implemented in **PvDotNet** as .NET events of typed delegates.

Registering to an event is done in .NET using the += operator next to an event. The IntelliSense® feature of Visual Studio then automatically generates an event handler in the .NET code.

This rule ensures that the callback mechanism is as expected by .NET users. It also leverages the automated code generation performed by Visual Studio to help developers quickly and effortlessly hook up events to their own code.

C++

```
class MyClass : PvDeviceEventSink
{
    void OnLinkDisconnected( PvDevice *aDevice )
    {
        // ...
    }
}

MyClass lMyObject;
lDevice.RegisterEvenSink( &lMyObject );
// ...
lDevice.UnregisterEventSink( &lMyObject );
```

C#

```
private void Device_OnLinkDisconnected( PvDevice aDevice)
{
    // ...
}
lDevice.OnLinkDisconnected += new
OnLinkDisconnectedEvent(Device_OnLinkDisconnected);
    // ...
lDevice.OnLinkDisconnected -= new
OnLinkDisconnectedEvent(Device_OnLinkDisconnected);
```

Technical Support

On the Pleora Support Center, you can:

- Download the latest software and firmware.
- Log a support issue.
- View documentation for current and past releases.
- Browse for solutions to problems other customers have encountered.
- Read knowledge base articles for information about common tasks.

To visit the Pleora Support Center:

- Go to supportcenter.pleora.com.

- Most material is available without logging in to a Support Center account.
- To access software and firmware downloads, in addition to other content, log in to the Support Center.
- If you do not have an account, click Request Account.
- Accounts are usually validated within one business day.

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Document ID: QSG-0013