IEC 61850 DLL Version 2
Edition 1 and Edition 2 Supported

Getting Started using
SystemCORP Embedded Technology
-
Client and Server Example Applications

Documentation Control

Revision:	**1.02**
Revision History:	**1.02 Added Troubleshooting**
	1.01 Clarified CID Configuration,
	** Updated Directory Structure**
	1.00 Initial Release
Revision Date:	**20 June 2014**
Document Status:	**RELEASED**

TABLE OF CONTENTS

1 Foreword and General Remarks

This document is intended to provide the basic knowledge on IEC 61850 in order to run the DLL introductory examples. The examples provide basic information, communication and system configuration information.

The examples are designed to show the core functionality of the SystemCORP's IEC61850 Stack and how easy it is to get and IEC61850 Application started using SystemCORP's IEC61850 API

For more information on SystemCORP's IEC61850 API please see the online API manual by going to http://www.systemcorp.com.au/support/iec61850-api-manual/

The current application examples consist of four parts as shown in the figure below:
• The **IEC 61850 DLL** (PIS10ED2.dll) – provides Client/Server and Publisher/Subscriber
• The **Server Application** using the PIS10ED2.dll (IEC61850_Example_Server.exe)
• The **Client Application** using the PIS10ED2.dll (IEC61850_Example_Client.exe)

The C source code and visual studio solution is included in the package so you can see the inner workings of the example applications and learn how to build your own server or client applications.

The PIS10ED2.dll provided in this evaluation package supports 50 data points (signals) to be modelled (e.g. with the ICD Designer) and implemented in the SCL file. The PIS10ED2.dll runs for three (3) months after the first time the DLL is used on the system.

The Information Model in the Server is built by reading the server.cid file during the initiation of the application. The binding of the model to the Server Application is specified by Private Elements (DAIDs) in the SCL file. Additional application data can be defined in the Server Application. The corresponding objects have to be added to the SCL file. There is no need for additional configuration to that provided in the SCL file.

The Clients and the Server can run on one PC or on different PCs. Before using the example you will need to change the ConnectedAP blocks of .CID files to reflect the configuration of the computer the example is being executed on, see section 1.1 for instructions on how to do this.

To trace messages, e.g. with Wireshark, you need to use two PCs as Wireshark will not capture packets being sent to and from local host. To only capture IEC61850 packets use the filter "goose || mms".

1.1 General

The Installer includes the source code for the example application and the visual studio solution so that you can examine how the SystemCORP IEC61850 API works and make modifications to build your own example applications.

The following description relates to the console applications.

The DLL code example can be used on one machine or on two machines with a network between the two. The SCL files need to be configured based on the network configuration of the machine(s) running the example.

> NOTE –This demonstration IEC61850 DLL is limited to:
> - A time limited of 3 months, and
> - A maximum of 50 points.

It is best practice to start the server first and then the client. On some systems the application may need to be run as an Administrator.

Here is a guide for configuring the ConnectedAP blocks of .CID files when you run the server and the client:

1. Replace the IP and MAC address entries in the Connected AP block labelled NewIED with the IP and MAC address of the device running the server application.
2. Replace the IP and MAC address entries in the Connected AP block labelled Client IED with the IP and MAC address of the device running the client application.
3. Replace the IP-GATEWAY with the default gateway for your network.
4. The IP-SUBNET on most networks will not need to be updated, please check with your systems administrator if you have problems that this value is correct.

   On complex networks you may need to contact the network administrator for support in identifying these values.

```
Server: <ConnectedAP apName="SubstationRing1" iedName="NewIED">
    <Address>
        <P type="IP">192.168.0.2</P>
        <P type="IP-SUBNET">255.255.255.0</P>
        <P type="IP-GATEWAY">192.168.0.1</P>
        <P type="MAC-Address">01-02-03-04-05-06</P>
```

```
Client: <ConnectedAP apName="SubstationRing1" iedName="NewIED">
    <Address>
        <P type="IP">192.168.0.2</P>
        <P type="IP-SUBNET">255.255.255.0</P>
        <P type="IP-GATEWAY">192.168.0.1</P>
        <P type="MAC-Address">01-02-03-04-05-06</P>

    <ConnectedAP apName="SubStationRing2" iedName="Client IED">
    <Address>
        <P type="IP">192.168.0.3</P>
        <P type="IP-SUBNET">255.255.255.0</P>
        <P type="IP-GATEWAY">192.168.0.1</P>
        <P type="MAC-Address">01-02-03-04-05-0A</P>
```

These addresses are loaded once the application starts and loads data from the ICD files. If you wish to change these values mid-operation you must restart the demo application.

1.2 Abbreviations

IED	Intelligent Electronic Device
GOOSE	Generic Object Oriented Substation Events
HMI	Human Machine Interface
ICD	IED Capability Description
CID	Configured IED Description
IEC	International Electro-technical Commission
IED	Intelligent Electronic Device
INS	Integer Status
IP	Internet Protocol
LN	Logical Node
PIS	Protocol Integration Stack (SystemCorp)
SCL	System Configuration Language
DAID	Data Attribute ID

2   How to Run the DLL Example

1. Run SystemCORP Embedded Technology IEC 61850 DLL Demo Installation

2. Make sure the adapter is active, e.g. network cable is plug into a switch.

3. Configure the server and client CID files with the IP address and Mac Address of the machine(s) running the server and client. (See section 1.1)

4. Start the Server (`IEC61850_Example_Server.exe from the Dll folder`) and the CMD window appears:

5. Start the Client (`IEC61850_Example_Client.exe from the Dll folder`) and the CMD window appears:

This example contains 1 Double Position Switch, 1 Generic Output, 3 Phase Measurements, and 1 Curve Description Array.

3   How to Control the IEC61850 Server DLL Example

1. In Server window there are 6 options:

   1) `Update the Phase Measurement (PhsA$Mag$i) value`
   2) `Update the Phase Measurement (PhsB$Mag$i) value`
   3) `Update the Phase Measurement (PhsC$Mag$i) value`
   4) `Update the Cure Description Array in the x axis at a specified index`
   5) `Update the Cure Description Array in the y axis at a specified index`
   x) `Exit the Application`

2. Enter the number corresponding with the command you wish to execute and press enter

3. Depending on the Command you selected you will be prompted for more information:

   a) `Phase Measurement: you will be prompted for an integer value`
   b) `Cure Description Array You will be prompted for the index of the element you wish to update and then a value`

4. Once the value is updated the screen will be refreshed and in the IEC61850 Data section the new value will be displayed

5. The IEC61850 Stack will send a report back to the client to notify it of this change in value, and the IEC61850 Data section on the client will be changed to show the new value

Notes
- If a command is not successful an error will be displayed with a description of what has occurred, this error will be cleared after a new command has been preformed
- The client enables the control blocks of the server when it starts. A change in the values may be reported immediately back to the client.

4   How to Control the IEC61850 Client DLL Example

1. In Client window there are 3 options:

    1) `Select and Operate the Double Position Switch`
    2) `Direct Operate the Generic Output`
    x) `Exit the Application`

2. Enter the number corresponding with the command you wish to execute and press enter

3. Once the Command has been selected you will be prompted for a Boolean value True or False.

    a) `To enter True press either T, t or 1 and then press enter on the keyboard`
    b) `To enter False press either F, f or 0 and then press enter on the keyboard`

4. If the command is successful the corresponding CtlVal in the IEC61850 Data section will be updated

5. The IEC61850 Server will send a GOOSE message back to the IEC61850 Client to notify the client of the change in the corresponding StVal and the client will update the display with the new value for the StVal

Notes:
- If a command is not successful an error will be displayed with a description of what has occurred, this error will be cleared after a new command has been preformed
- The client enables the control blocks of the server when it starts. A change in the values may be reported immediately back to the client.
- The StVal attached to a control represents the hardware state, this StVal is being updated automatically by the server when an operate command is successful to simulate a change in the hardware state.

5   Installation Contents

Note – This does not include all files and directories installed just an overview of the important directories and files needed to get started with the example.

Installation Directory Structure:

```
ApiManual
        html
                index.html   ← The API Manual Home Page
CidFiles
        client.cid  ← The Client Configuration File
        server.cid  ← The Server Configuration File
Dll
        IEC61850_Example_Client.exe   ← The Client Example Executable
        IEC61850_Example_Server.exe   ← The Server Example Executable
        PIS10ED2.dll   ← The SystemCORP IEC61850 dll
        PIS10ED2.lib   ← The SystemCORP IEC61850 lib File
Documents
        Getting_Started_IEC61850_DLL_V2.pdf   ← This Document
        SW License Agreement.pdf       ← The SystemCORP Software License Agreement
Examples
        header    ← The C Header Files for the IEC61850 Example
        source    ← The C Source Code Files for the IEC61850 Example
        project   ← The Visual Studio Project Files for the IEC61850 Example
                IEC61850_Example.sln   ← The Visual Studio Solution File
header
        IEC61850API.h   ← The PIS10ED2.dll API Header file
        IEC61850Types.h    ← The PIS10ED2.dll Types Header File
        sysctype.h       ← The SystemCORP Types Header File
```

Please see the online API Manual for help understanding the API function calls and for writing your own applications:

http://www.systemcorp.com.au/support/iec61850-api-manual/

6 Troubleshooting

ID	Problem	Solution
1	"The program can't start because wpcap.dll is missing from your computer. Try reinstalling the program to fix this problem" message pops up when you run the example	1. Download the WinPcap installer from http://www.winpcap.org/ 2. Use the installer to install WinPcap on the computer. 3. Run the example after WinPcap has finished installing
2	"You must logged in as an administrator when installing this program." message pops up when you run the example	1. Right click on the example executable and select "Run as Administrator".
3	"Loading SCL File (../CidFiles/server.cid) has failed: Invalid IP Address Specified in ICD File (-56)"	1. Check the IP address, Subnet mask, IP gateway and MAC address in the server.cid file matches the computer running the example (see section 1.1) 2. If the ConnectedAP settings are correct run the example as an administrator by right clicking on the example executable and selecting "Run as Administrator".
4	"XXXXX failed: (-11) There is no ready connection to the given object ID"	1. Check the Example server is running 2. Check the Server and Client IP address, Subnet mask, IP gateway and MAC address in the client.cid file matches the computer(s) running the example (see section 1.1)
5	"Can't start server: GOOSE Service failed to perform the requested action (-73)"	1. Check the Server and Client MAC address in the server.cid and client.cid file 2. Ensure the MAC addresses matches the computer(s) running the example (see section 1.1)