AN926

Programming the Pocket PC OS for Embedded IR Applications

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INTRODUCTION

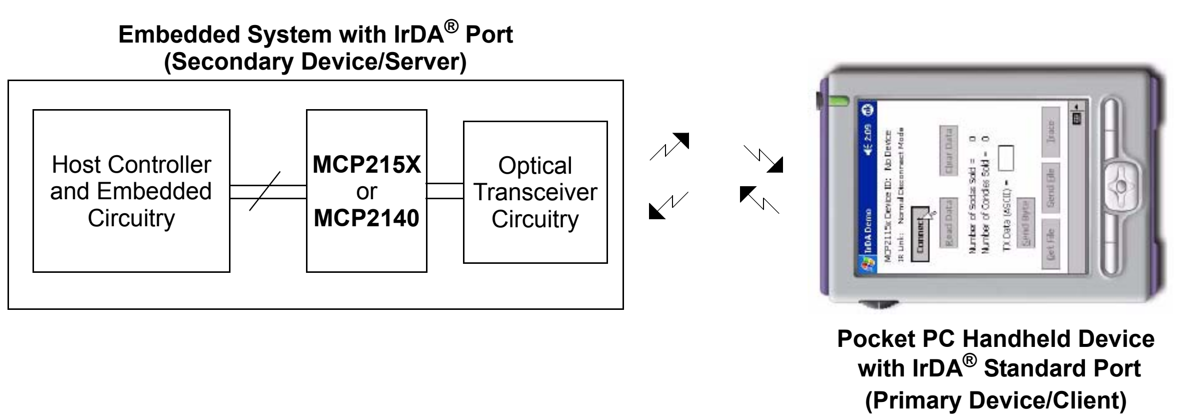
This application note details the tools, supporting technologies and procedures for the development of infrared applications on Windows Mobile™ based devices.

A Pocket PC (PPC) application that interfaces with an embedded system via IrCOMM is included in the Appendices of this application note. This source code demonstrates the use of the Windows® Application Programming Interface (API) required for IrDA® standard IR communication on Windows Mobile based platforms.

Appendix A: "Example Irda Standard System Description" describes the system and documents the tool used to create this Pocket PC application program, while **Appendix B: "PPC Source Code - IrDA DEMO.CPP"** through **Appendix C: "PPC Source Code - IrDA DemoDlg.cpp"** is the PPC Application Program source code.

Figure 1 shows an IrDA standard system, where a Pocket PC PDA device is communicating with an embedded system. In this system, the Pocket PC (PPC) PDA operates as the Primary Device (Client) and the embedded system operates as the Secondary Device (Server). The terms Client and Server are used in reference to Windows (PC and PPC) programming, while Primary Device and Secondary Device are terms used by the IrDA Standard.

FIGURE 1: POCKET PC PDA - EMBEDDED SYSTEM BLOCK DIAGRAM

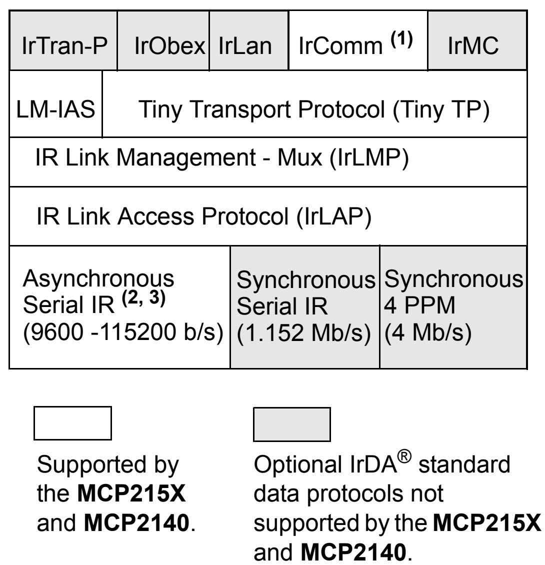


Terminology

Below is a list of useful terms and their definitions:

- **Pocket PC:** A Windows Mobile based handheld device.
- **Windows CE™:** Microsoft® operating system for handheld devices.
- **Microsoft ActiveSync®:** Application enabling the creation of a partnership between a desktop computer and a mobile device. This application allows desktop debugging of Windows Mobile based applications.
- **Host System:** The computer with which a PPC OS device performs an ActiveSync. The host system is also where development takes place. Host systems are typically based on Windows, Macintosh® or Linux® operating systems.
- **Microsoft Foundation Class (MFC):** Class library and framework for application development on Windows based platforms.
- **Microsoft eMbedded Visual C++®:** Development environment for the development of Windows Mobile based applications using C++. Available for free download from Microsoft's web site at www.microsoft.com.
- **Microsoft eMbedded Visual Basic®:** Development environment for the development of Windows Mobile based applications using Visual Basic. Available for free download from Microsoft's web site at www.microsoft.com.
- **Microsoft Visual Studio® .NET:** Development environment for the development of Windows desktop and Mobile based applications using C++, Visual Basic, Visual C#® and the .NET framework. Available for purchase from Microsoft's web site at www.microsoft.com.
- **Microsoft Software Development Kit (SDK):** Documentation, samples, header files, libraries and tools needed to develop applications that run on the Windows operating system. All Microsoft tools require the correct platform SDK to target Windows Mobile based devices.
- **Microsoft eMbedded Visual Tools 3.0:** Development environment for the development of Windows Mobile based applications, includes Microsoft eMbedded Visual C++ 3.0, eMbedded Visual Basic 3.0 and the required SDK for Pocket PC 2002.
- **Primary Device:** The IrDA standard device that queries for other devices.
- **Secondary Device:** The IrDA standard device that waits to detect IR communication before performing any IR communication.
- **Host Controller:** The controller in the embedded system that communicates to the MCP215X or MCP2140.
- **MCP215X:** An IrCOMM protocol handler IC that supports IR communication from 9600 baud to 115,200 baud.
- **MCP2140:** A low-cost IrCOMM protocol handler IC that supports IR communication at 9600 baud.
- **Protocol Stack:** A set of network protocol layers that work together. Figure 2 shows the IrDA standard protocol stack.
- **IrCOMM (9-wire "cooked" service class):** IrDA standard specification for the protocol to replace the serial cable (using flow control).

FIGURE 2: IrDA® STANDARD DATA - PROTOCOL STACKS



Note 1: The MCP215X and MCP2140 implement the 9-wire "cooked" service class serial replicator.

2: An optical transceiver is required.

3: The MCP2140 support 9600 baud IR communication only.

INFRARED COMMUNICATIONS

The application built and discussed in this application note uses a high-level, infrared protocol called IrCOMM. This protocol is designed to be a wirereplacement technology. Infrared technology is an excellent choice for data collection for many reasons, including:

- Availability: Virtually every late-model PDA and laptop contains an IrDA standard port.
- Cost: IrDA standard communications may be added to a custom design very economically, as demonstrated in this application note.
- Convenience and Compatibility: Working without wires means no cables, gender-changers or any other gadgets to allow two devices to communicate. This is vital to the frequent traveler or technician in the field.

For more information regarding the IrComm protocol, visit the IrDA organization's web site at: www.irda.org.

WINDOWS POCKET PC DEVELOPMENT

The Windows Mobile based Pocket PC is a handheld device utilizing the Windows Pocket PC 2000/2002/2003 platforms. The Pocket PC software platforms are built on the Windows CE 3.0/4.0 operating systems (see Table 1). Pocket PC allows development of applications using the familiar Windows development tools and APIs. These APIs include support for the development of applications that can communicate with other devices utilizing wireless transmission, such as Wi-Fi®, Bluetooth™ and infrared.

Pocket PC Tools

Microsoft offers a wide range of development choices, including the eMbedded Visual C++, eMbedded Visual Basic and Visual C# programming languages. There are currently three development environments available for Pocket PC development: eMbedded Visual C++, eMbedded Visual Basic and Visual Studio .NET. The platform and chosen API (Win32®, MFC, ATL, .NET Compact Framework) determines the application tools and languages available for development (see Table 2).

Both platforms, Pocket PC 2002 and Pocket PC 2003, can be targeted with one code base using eMbedded Visual C++ 3.0 if the application being developed uses the documented Microsoft APIs. This application note focuses on development of Pocket PC 2002 and 2003 applications using Microsoft's eMbedded Visual C++ and the Microsoft Foundation Library (MFC).

Note 1: The project files have been converted to embedded Visual C version 4.0.

2: The sample application created in this Application Note is a Microsoft Foundation Class (MFC) C++ application which relies heavily on the characteristics of object oriented programming. Therefore, to get the most out of this application note's examples requires an understanding of C++ programming. However, it is possible to employ "C#" to perform IrDA programming under the Windows environment. An example of C# IrDA programming under Pocket PC 2003 is available on the web site within this application note's zipped source code files.

POCKET PC 2002

The eMbedded Visual Tools 3.0 package, available for free from Microsoft (www.microsoft.com), includes eMbedded Visual C++ 3.0, eMbedded Visual Basic 3.0 and the required software development kit (SDK). This version supports the Pocket PC 2002 platform.

POCKET PC 2003

Development of Pocket PC 2003 applications requires eMbedded Visual C++ 4.0 or .NET tools. eMbedded Visual C++ 4.0 is also available as a free download from Microsoft's web site at www.microsoft.com.

TABLE 1: PLATFORM OPERATING SYSTEMS

Pocket PC Platform	Window CE Version
2000	2.0, 2.1, 2.11, 3.0
2002	3.0 and later
2003	4.0 and later

TABLE 2: PLATFORM DEVELOPMENT TOOLS

	Development Tools			
	eMbedded Visual Tools 3.0			
	eMbedded Visual C++ 3.0	eMbedded Visual Basic 3.0	eMbedded Visual C++ 4.0	Visual Studio .NET (C#, Visual Basic)
Pocket PC 2002	X	X	—	—
Pocket PC 2003	—	—	X	X
API	• MFC • ATL • Win32®	• eMbedded Visual Basic	• MFC • ATL • Win32®	• .NET Compact Framework

TOOL INSTALLATION

To insure inter operability between the development tools and the ability to target multiple platforms, the development tools and SDKs should be installed on the development system in the recommended order.

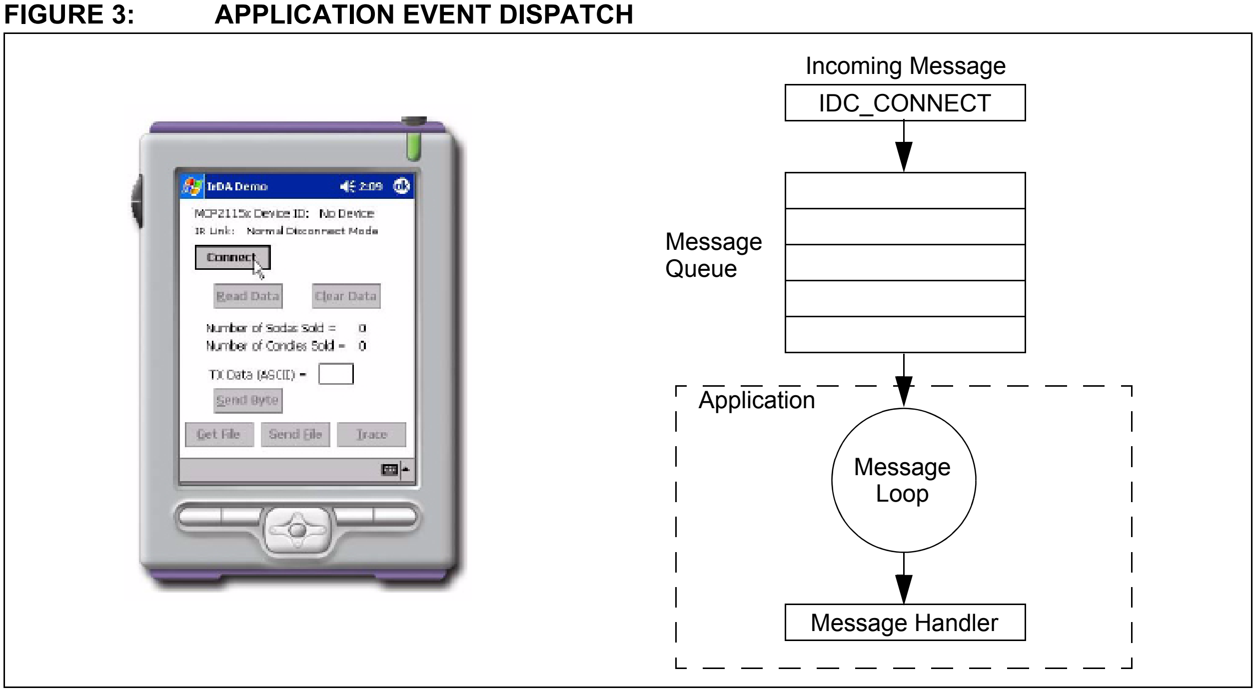
1. Uninstall all existing tools and SDKs.
2. Install Microsoft ActiveSync 3.7.
3. Install the eMbedded Visual Tools - 2002 Edition, Pocket PC 2002 SDK and Smartphone 2002 SDK.
4. Install eMbedded Visual C++ 4.0 and Service Pack 2.
5. Optionally install Visual Studio .NET 2003.
6. Install the Pocket PC 2003 SDK.
7. Optionally install the Smartphone 2003 SDK.

WINDOWS PROGRAMMING

The Windows programming model is based on an event-driven architecture. Events can be generated through user interaction or some other event. Each time the user interacts with the interface, an event is generated and a message is placed in the operating system's message queue to be dispatched to the application. A message handler in the application handles the event by calling the appropriate function.

Selecting the **Connect** button in the application generates an `IDC_CONNECT` message (see Figure 3). That message is placed in the Windows message queue. The message is then retrieved, placed in the application's message loop and dispatched in the message map to the message handler, function `OnBnClickedConnect()` (see Example 1).

FIGURE 3: APPLICATION EVENT DISPATCH



EXAMPLE 1: MESSAGE HANDLER

```
BEGIN_MESSAGE_MAP(CIrDADemoDlg, CDialog)
    ON_BN_CLICKED(IDC_READ_DATA, OnBnClickedReadData)
    ON_BN_CLICKED(IDC_CLEAR_DATA, OnBnClickedClearData)
    ON_BN_CLICKED(IDC_CONNECT, OnBnClickedConnect)
    ON_BN_CLICKED(IDC_SEND_BYTE, OnBnClickedSendByte)
    ON_BN_CLICKED(IDC_SEND_FILE, OnBnClickedSendFile)
    ON_BN_CLICKED(IDC_RECEIVE_FILE, OnBnClickedReceiveFile)
    ON_BN_CLICKED(IDC_DISPLAY_DATA, OnBnClickedShowRawData)
    ON_MESSAGE(WM_CONNECTION_CLOSE, OnConnectionClose)
END_MESSAGE_MAP()

void CIrDADemoDlg::OnBnClickedConnect()
{
    //Connect to device
}
```

Microsoft Foundation Class Library

The Microsoft Foundation Class (MFC) library consists of a framework for developing applications for Windows based operating systems. The classes provide an object-oriented wrapper around the Windows API, simplifying the development of Windows programs. MFC includes classes for user interface objects, such as windows, dialog boxes and buttons. The common application tasks, such as dispatching messages, are provided by the classes and macros as shown in the message-map macro in Example 1.

PROJECT WIZARD

The creation of MFC based Pocket PC applications can be simplified using the Microsoft AppWizard. The Microsoft development tools provide application wizards that eliminate the need to create a project from scratch. eMbedded Visual C++ includes the MFC AppWizard. The MFC AppWizard guides you through the creation of a MFC project for a Pocket PC application. The AppWizard generates source, header and resource files that contain the required classes and macros for a skeleton application and guides you through the configuration of the project. For a dialog-based application, the AppWizard creates the message maps and two classes. The first class is derived from `CWinApp`, which handles the initialization, termination and running of the program. The second class is derived from `CDialog`, which handles the creation of a dialog box.

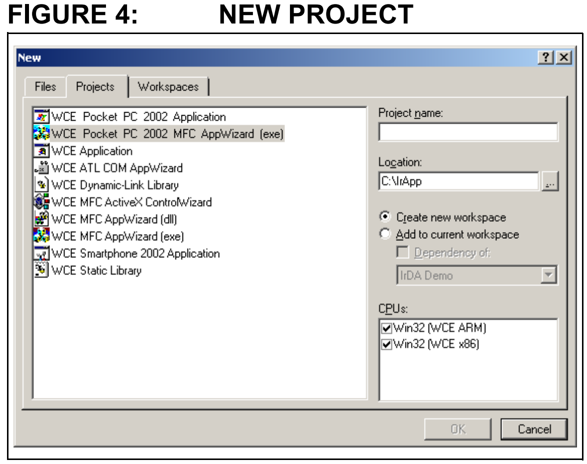
CREATING A PROJECT

1. The first step in creating a MFC based Pocket PC application is to create a project using the project wizard. From the **File** menu of eMbedded Visual C++, select **New**. In the dialog box, select the **Project** tab. Microsoft provides several different project options (see Figure 4). The Pocket PC MFC AppWizard (exe) option creates a skeleton application with the required classes for either a dialog or window-based Pocket PC application.

   The available target CPUs are shown in the lower right-hand corner of the dialog box. If the CPU you are targeting is not shown, verify that the correct SDKs are installed for your device. Select the **CPU x86** option to debug applications on the development computer using the Pocket PC emulator.

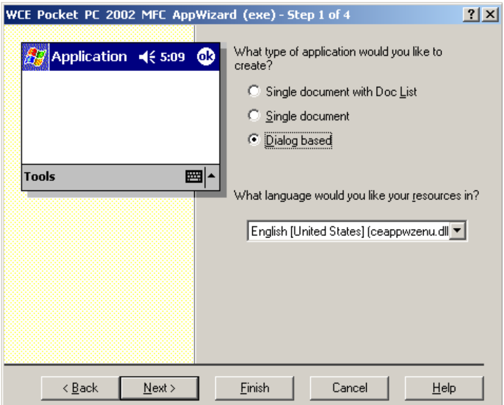
   After entering the project name, select **OK**.

FIGURE 4: NEW PROJECT



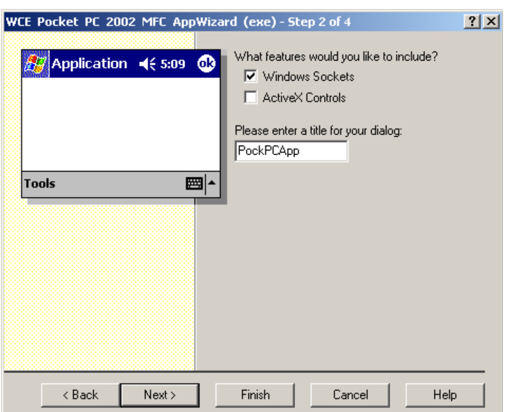
2. Select **Dialog based** in the AppWizard's Step 1 of 4 dialog (see Figure 5).

FIGURE 5: MFC APPWIZARD STEP 1



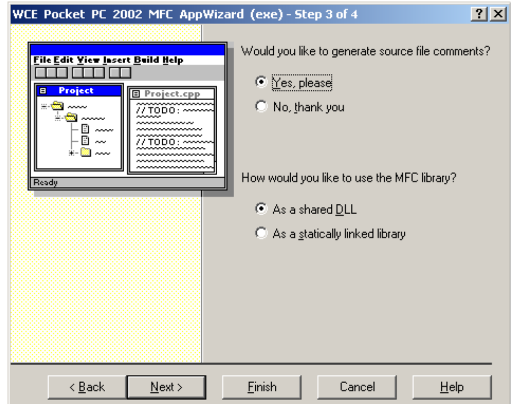
3. Select **Windows Sockets** in the AppWizard's Step 2 of 4 dialog box (see Figure 6). **Windows Sockets** must be selected to support IrDA standard communications. Please see "Infrared Communications on Windows Platforms" for more information.

FIGURE 6: MFC APPWIZARD STEP 2



4. Use the default setting in the AppWizard's Step 3 of 4 dialog box (see Figure 7).

FIGURE 7: MFC APPWIZARD STEP 3



5. The AppWizard's Step 4 of 4 dialog box shows the class names for the classes created by AppWizard, as well as the source files that will be created for each class object (see Figure 8 and Figure 9).

FIGURE 8: MFC APPWIZARD STEP 4 - APPLICATION CLASS

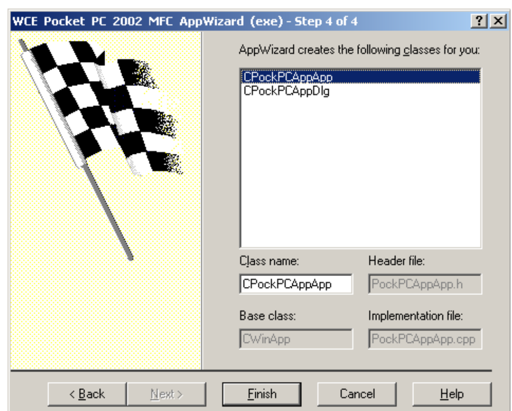
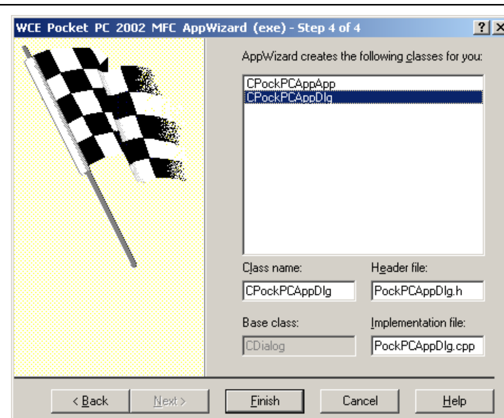
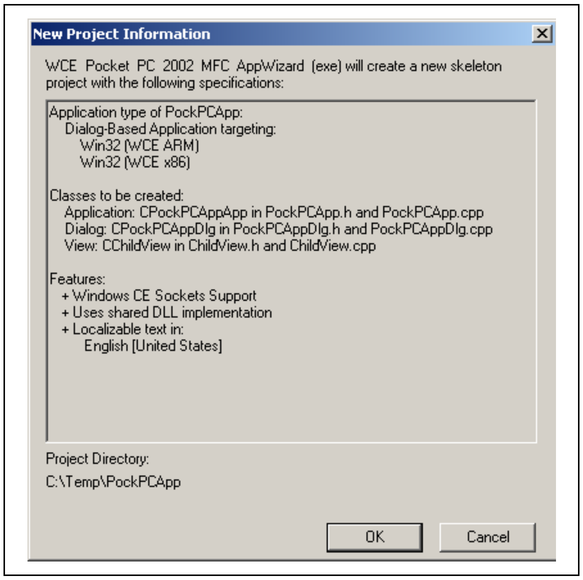


FIGURE 9: MFC APPWIZARD STEP 4 - DIALOG CLASS



6. After selecting **Finish**, a summary will be displayed (see Figure 10) and the AppWizard will create the source files for the skeleton application.

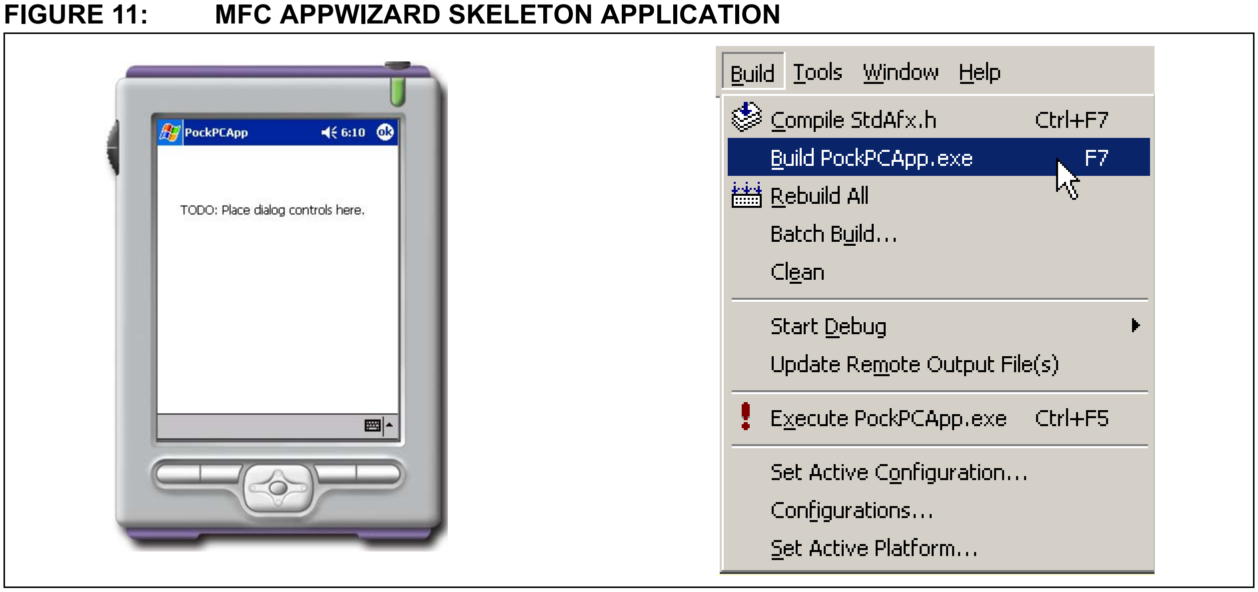
FIGURE 10: MFC APPWIZARD SUMMARY



The above steps create the skeleton application in Figure 11 after selecting **Build PocketPCApp.exe** from the **Build** menu.

After creating the skeleton program with AppWizard, only the dialog box controls and event handlers need to be added to the application.

FIGURE 11: MFC APPWIZARD SKELETON APPLICATION



Configuration

There are several options when building an application with eMbedded Visual C++. eMbedded Visual C++ provides an emulator that allows the emulation of a Pocket PC application on the development desktop (as well as the debugging of the application on the Pocket PC device) when it is connected to the PC using Microsoft's ActiveSync. The debugging target and type of executable file built is determined by the settings in the combo boxes in the toolbar of eMbedded Visual C++ (see Figure 12). The debugger allows setting breakpoints, stepping through the source code, inspecting variables and inspecting the stack.

The target operating system is selected from the toolbar's Active Configuration Combo Box (see Figure 13).

The target device is selected from the Target Device Combo Box (see Figure 14).

Alternatively, the target can be changed using the Set Active Configuration dialog box (see Figure 16), which is accessed by selecting **Set Active Configuration** from the **Build** menu (see Figure 15).

FIGURE 12: eMbedded VISUAL C++ TOOLBAR

FIGURE 13: ACTIVE CONFIGURATION COMBO BOX

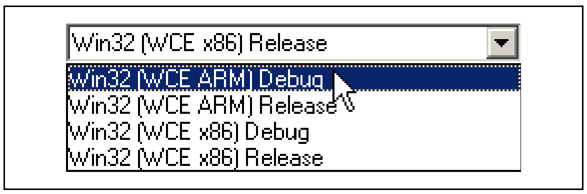


FIGURE 14: TARGET DEVICE COMBO BOX

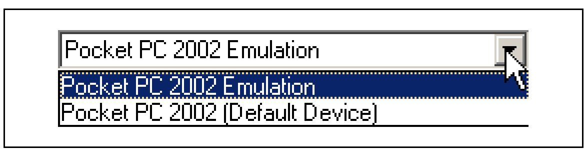


FIGURE 15: ACTIVE CONFIGURATION MENU ITEM

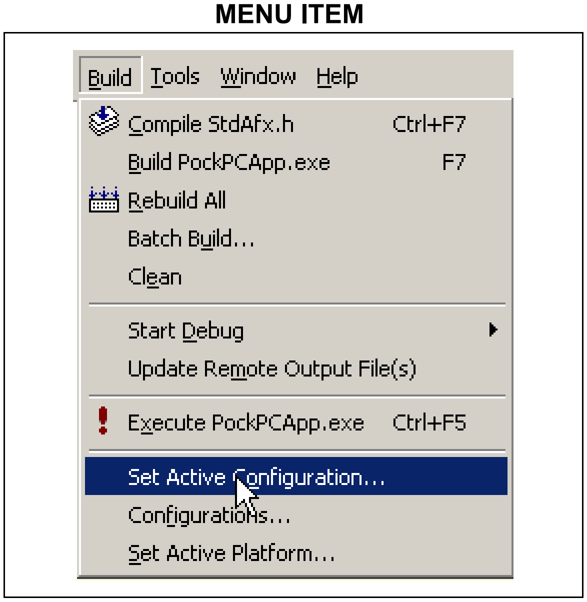
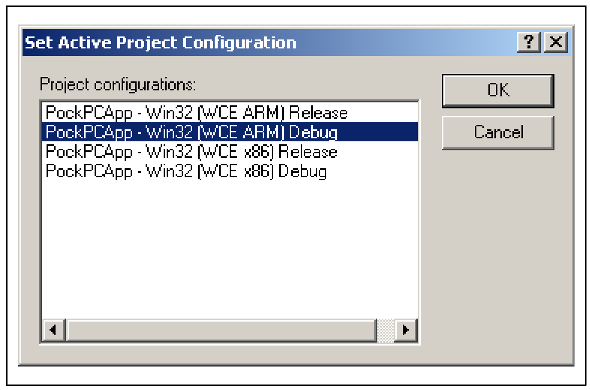


FIGURE 16: ACTIVE CONFIGURATION DIALOG BOX



Debugging an Application with the Emulator

To debug an application on the emulator, select **Pocket PC 200x Emulation** from the Target Device Combo Box (see Figure 17) and **Win32 (WCE x86) Debug** from the Active Configuration combo box (see Figure 18). **x86** must be chosen when using the emulator because the emulator is running on the PC which in most cases is a x86 machine.

FIGURE 17: TARGET DEVICE COMBO BOX

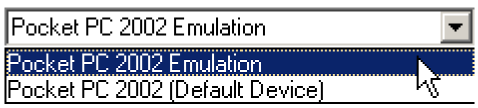


FIGURE 18: ACTIVE CONFIGURATION COMBO BOX

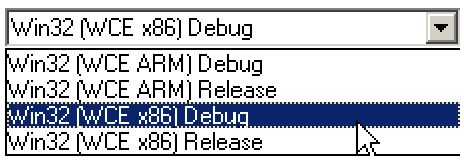
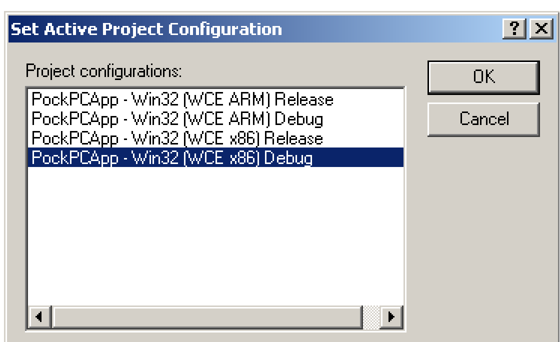


FIGURE 19: ACTIVE CONFIGURATION DIALOG



Select **Execute PockPCApp.exe** from the **Build** menu (see Figure 20) to build and start debugging the application. Visual C++ automatically starts, connects to the emulator and launches the application (see Figure 21 and Figure 22).

FIGURE 20: EXECUTE APPLICATION

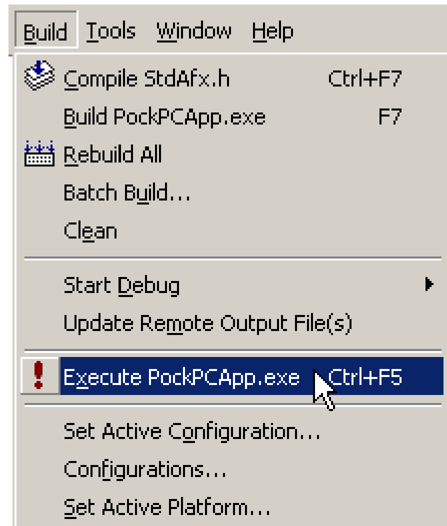


FIGURE 21: CONNECTING TO EMULATOR

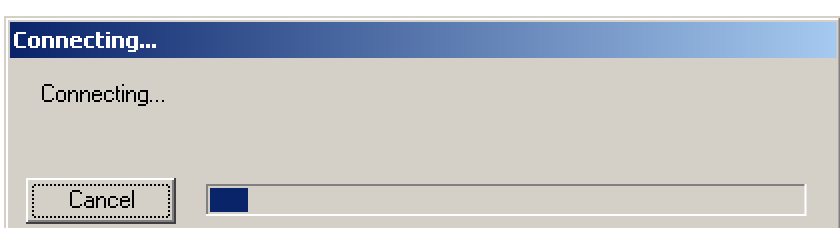


FIGURE 22: POCKET PC EMULATOR

Debugging an Application on the Device

To debug an application on the Pocket PC, connect the device to the computer, then select **Pocket PC 200x (Default Device)** from the Target Device Combo Box (see Figure 23), as well as **Win32 (WCE ARM) Debug** from the Active Configuration Combo Box (see Figure 24). When the application is built, Visual C++ automatically connects to the device, downloads the application and runs the application on the device.

FIGURE 23: TARGET DEVICE COMBO BOX

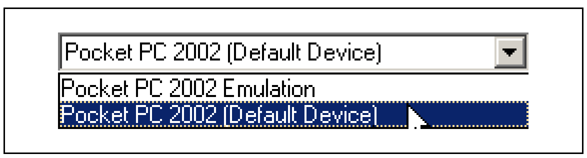


FIGURE 24: ACTIVE CONFIGURATION COMBO BOX

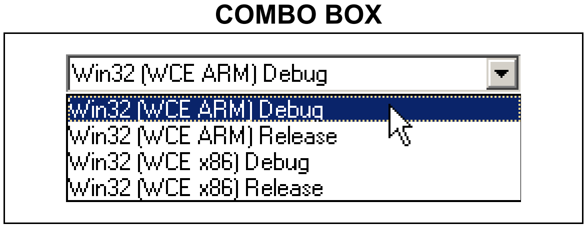
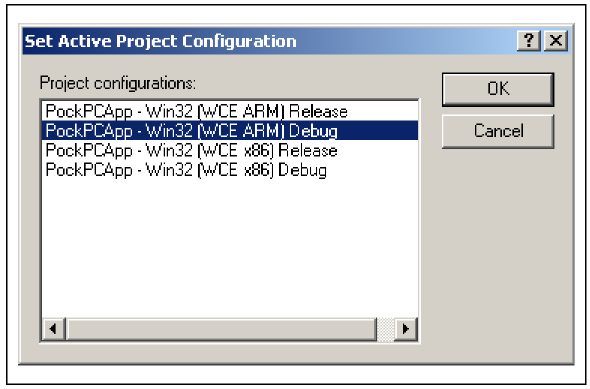


FIGURE 25: ACTIVE CONFIGURATION DIALOG BOX



INFRARED COMMUNICATIONS ON WINDOWS PLATFORMS

Microchip's infrared wireless communication devices support the IrCOMM standard protocol layer. IrCOMM allows the emulation of serial or parallel connections. IrCOMM was intended to support IrDA modems and legacy applications built on the Serial API. Therefore, Windows originally supported IrCOMM using virtual serial ports. The virtual serial port implementation of IrCOMM had inherent limitations, including the inability of multiple applications sharing virtual ports and full error-correction in the IrDA standard stack. Starting with Windows 2000, virtual serial ports, as well as the general implementation of IrCOMM to map the ports, were discontinued. The IrCOMM protocol is now exposed through the Windows WinSock API rather than through the Serial API. This application note focuses on implementing IrCOMM using the WinSock API.

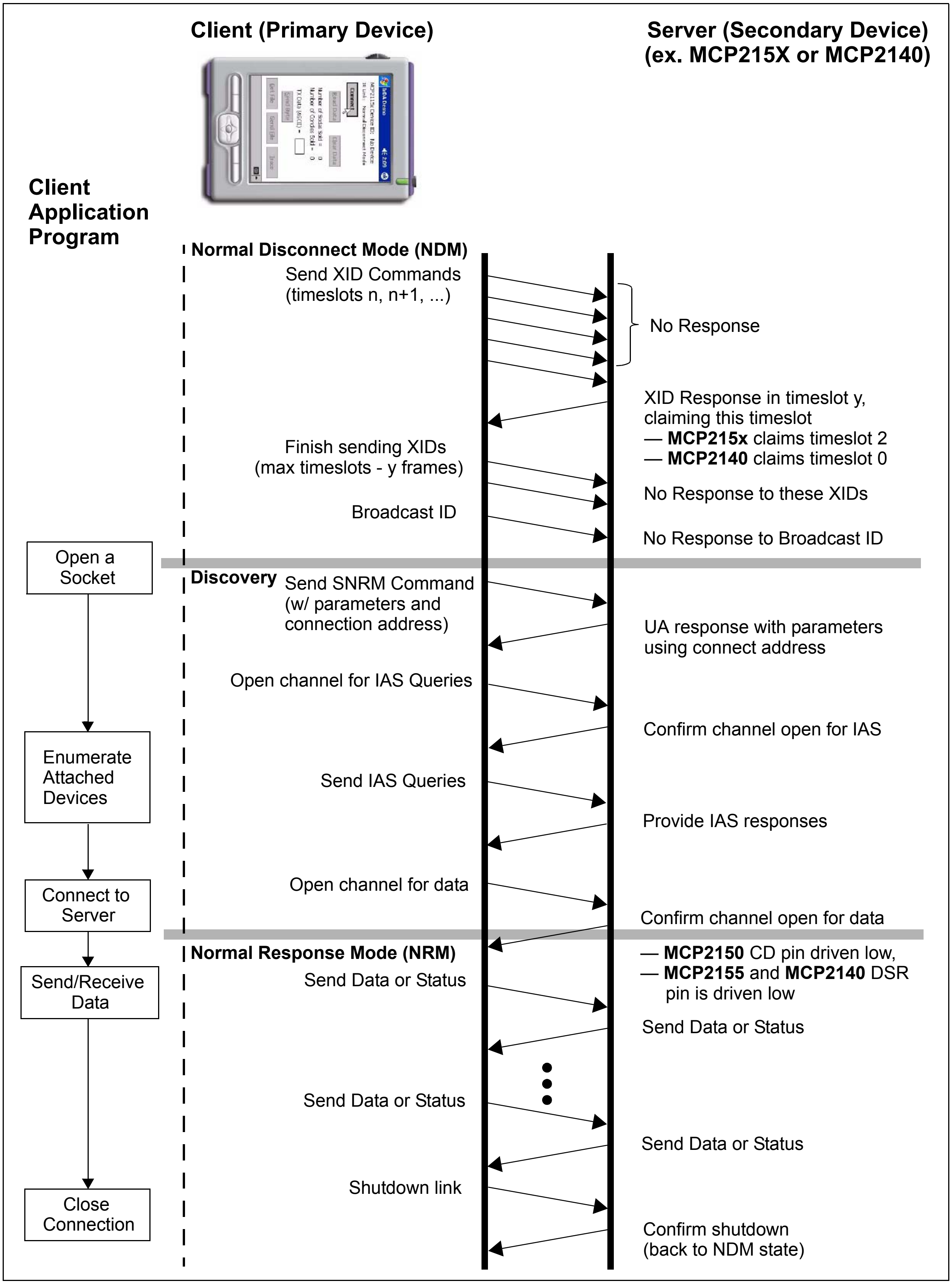
WinSock Applications

WinSock is Microsoft's implementation of the widely-used Sockets API. It allows the use of sockets with Windows based applications. A socket enables communication between two endpoints on a network. These endpoints are usually referred to as a client and a server. The client initiates the connection with the server, while the server waits for a connection request from a client. After a connection has been established, either the client or the server can initiate the exchange of data. This application note focuses on using the Pocket PC as the client, which then initiates the connection to the DSTEMP device, which acts as the server.

CONNECTING TO A SERVER

A client application using WinSock should execute the following steps to connect to a server (see Figure 26).

FIGURE 26: CONNECTION SEQUENCE



Steps:

1. Initialize the `WSADATA` structure by calling `WSAStartup` (see Example 2).
2. Open a stream socket (see Example 3).
3. Search for the device by enumerating all the devices connected to the system (see Example 4).
4. Query the device's IAS database to verify the type of features supported by the device (see Example 5).
5. Enable the 9-Wire mode before connecting (see Example 6).
6. Connect to the device (see Example 7).
7. Send/Receive data (see Example 8).
8. Disconnect and close socket (see Example 9).

In the code snippets demonstrated in Example 2 through Example 9, the WinSock API is used directly. The functions `getsockopt` and `setsockopt` are used extensively to perform IrDA specific functions not normally associated with traditional TCP/IP sockets programming. These functions are handy for accessing network-specific features.

EXAMPLE 2: INITIALIZE THE WSDATA STRUCTURE

```
WORD      WSAVerReq = MAKEWORD( 1, 1 );
WSADATA   WSAData;

if ( WSAStartup( WSAVerReq, &WSAData ) != 0 )
{
    // wrong winsock dlls?
}
```

EXAMPLE 3: OPEN A STREAM SOCKET

```
if (( sock = socket( AF_IRDA, SOCK_STREAM, 0 )) == INVALID_SOCKET )
{
    // WSAGetLastError
}
```

EXAMPLE 4: SEARCH FOR THE SECONDARY DEVICE

```
if ( getsockopt( sock, SOL_IRLMP, IRLMP_ENUMDEVICES,
     (CHAR *) pDevList, &DevListLen ) == SOCKET_ERROR )
{
    // WSAGetLastError
}
```

EXAMPLE 5: QUERY THE IAS DATABASE

```
if ( getsockopt( sock , SOL_IRLMP, IRLMP_IAS_QUERY,
     (char *) pIASQuery, &IASQueryLen ) == SOCKET_ERROR )
{
    // WSAGetLastError
}

if ( pIASQuery->irdaAttribType != IAS_ATTRIB_OCTETSEQ )
{
    // Peer's IAS database entry for IrCOMM is bad.
}

if ( pIASQuery->irdaAttribute.irdaAttribOctetSeq.Len < 3 )
{
    // Peer's IAS database entry for IrCOMM is bad.
}
```

EXAMPLE 6: ENABLING 9-WIRE MODE

```
if ( setsockopt( sock, SOL_IRLMP, IRLMP_9WIRE_MODE,
     (const char *) &Enable9WireMode, sizeof(int) )  == SOCKET_ERROR )
{
    // WSAGetLastError
}
```

EXAMPLE 7: CONNECTING TO THE DEVICE

```
if ( connect( sock, (const struct sockaddr *) &DstAddrIR,
     sizeof(SOCKADDR_IRDA) ) == SOCKET_ERROR )
{
    // WSAGetLastError
}
```

EXAMPLE 8: SENDING AND RECEIVING DATA

```
if (( BytesRead = recv( sock, buffer, sizeof(buffer), 0 )) ==  SOCKET_ERROR )
{
    // WSAGetLastError
}

if (( BytesSent = send( sock, buffer, sizeof(buffer), 0 )) == SOCKET_ERROR )
{
    // WSAGetLastError
}
```

EXAMPLE 9: DISCONNECTING AND CLOSING THE SOCKET

```
if ( shutdown( sock, 0 ) == SOCKET_ERROR )
{
    // WSAGetLastError
}

if ( closesocket( sock ) == SOCKET_ERROR )
{
    // WSAGetLastError
}

if ( WSACleanup() == SOCKET_ERROR )
{
    // WSAGetLastError
}
```

Sockets with MFC

Just as MFC simplifies Graphical User interface (GUI) development over the base Windows SDK, MFC also encapsulates socket communications with two classes (CASyncSocket and CSocket) that encapsulate the Windows Socket API. These classes simplify the development of applications that communicate over a network using sockets. CASyncSocket provides more flexibility than CSocket, with the benefits of network event notification. The event notification eliminates the need to continually poll the socket for incoming data. When data is received from a client, server or peer, the system automatically calls the CASyncSocket member function Receive(). The developer adds the necessary code that processes the data in the Receive() callback function.

An application that utilizes the CASyncSocket class must follow the same steps with the CASyncSocket class object as an application utilizing the WinSock API. However, the CASyncSocket member function CASyncSocket::setsockopt() does not support the parameters required for IrDA standard communications. Therefore, the first five steps are executed using a handle to a socket. After the devices are enumerated and 9-Wire mode has been set with setsockopt() (see Example 13), a CASyncSocket socket object is created and the socket handle is attached to the socket object using CASyncSocket::Attach().

Steps:

1. Initialize the WSADATA structure (see Example 10).
2. Create a handle to a socket (see Example 11).
3. Search for the device by enumerating all the devices (see Example 12).
4. Set 9-Wire mode (see Example 13).
5. Create an CASyncSocket object (see Example 14).
6. Attach the handle to the CASyncSocket object (see Example 15).
7. Connect to the device (see Example 16).
8. Send/Receive data (see Example 17).
9. Close the socket (see Example 18).

EXAMPLE 10: INITIALIZING THE WSDATA STRUCTURE

```
WORD      WSAVerReq = MAKEWORD(1,1);
WSADATA   WSAData;

if ( WSAStartup( WSAVerReq, &WSAData ) != 0 )
{
    // wrong winsock dlls?
    AfxMessageBox( IDS_WINSOCK_DLLS, MB_OK | MB_ICONEXCLAMATION );
}
```

EXAMPLE 11: CREATING A HANDLE TO A SOCKET

```
m_hSocket = socket( AF_IRDA, SOCK_STREAM, 0 );

if ( INVALID_SOCKET == m_hSocket )
{
    // WSAGetLastError
}
```

EXAMPLE 12: SEARCHING FOR THE SECONDARY DEVICE

```
if ( getsockopt( m_hSocket, SOL_IRLMP, IRLMP_ENUMDEVICES,
     (char *) pDevList, &nDevListLen ) == SOCKET_ERROR )
{
    // WSAGetLastError
}
```

EXAMPLE 13: SETTING 9-WIRE MODE

```
if ( setsockopt( m_hSocket, SOL_IRLMP, IRLMP_9WIRE_MODE,
     (const char *) &Enable9WireMode, sizeof(int) ) == SOCKET_ERROR )
{
    // WSAGetLastError
}
```

EXAMPLE 14: CREATING AN CASYNCSOCKET OBJECT

```
CASyncSocket m_socket;

if ( m_socket.Create() )
{
    // WSAGetLastError
}
```

EXAMPLE 15: ATTACHING THE HANDLE TO THE CASYNCSOCKET OBJECT

```
if ( m_socket.Attach( m_hSocket ) != 0 )
{
    // WSAGetLastError
}
```

EXAMPLE 16: CONNECTING TO THE DEVICE

```
if ( m_socket.Connect((const struct sockaddr *) &m_DestSockAddr,
    sizeof(SOCKADDR_IRDA)) == SOCKET_ERROR )
{
    // WSAGetLastError
}
```

EXAMPLE 17: SENDING AND RECEIVING DATA

```
if (( m_socket.Send( (LPCTSTR)m_sendBuff, m_nSendDataLen )) == SOCKET_ERROR )
{
    // WSAGetLastError
}

void CMCPSocket::OnReceive(int nErrorCode)
{
    // Process received data.
}
```

EXAMPLE 18: CLOSING THE SOCKET

```
if ( m_socket.m_fConnected )
{
    m_socket.m_fConnected = FALSE;
    m_socket.ShutDown();
    m_socket.Close();
}
```

Using Threads

The user interface will not respond to messages during network interaction (such as sending or receiving large amounts of data or connecting to a network endpoint). Processing data or completing other tasks in a separate thread frees the user interface thread to process user interface event messages while the data processing on the network is taking place. The `CWinThread` class object allows the creation of additional threads to handle these background tasks in order to eliminate interference with messages generated by the user. The dialog box object creates and spawns a second thread that contains the socket object. The two threads communicate with messages using the functions `PostMessage()` and `SendMessage()`. In the IrDA standard application, when the user selects a button to send data, the user interface thread posts a message to the background thread to send to the server. The user interface thread is then free to process any other user events while the background thread attempts to connect to the server. When the server sends data to the client, the background thread receives the data, then sends a message to the user interface thread, informing it that data was received.

PPC Application Testing

Table 3 shows the different versions of the platform products (Pocket PC OS PDAs) that were used in the development and validation of the Pocket PC application program.

TABLE 3: POCKET PC PDAs USED

PDA Model	O.S. Version	Comment
Compaq® iPAQ™ 3650	PPC (WinCE) 3.0.9348 (Build 9616)	ARM SA1110 Processor
Compaq iPAQ h3835	PPC 2002 3.0.11171 (Build (11178)	ARM SA1110 Processor
HP™ iPAQ h1945 **(Note 1)**	PPC 2003 V4.20.1081 (Build 13100)	Samsung® S3C2410 Processor
Toshiba® e755	PPC 2003 V4.20.1081 (Build 13100)	Intel® PXA255 Processor

Note 1: It has been determined that this device operates outside the IrDA Physical Layer Specifications (V1.3) after switching from 9600 to 115200 baud. As a result of this, the h1945 fails to connect to the **MCP215X** device. If the application software can be configured to force the h1945 IR port to operate at 9600 baud, the h1945 should connect to the **MCP215X** device. Also, please check with Hewlett Packard® for a possible operating system to address this issue.

PPC Application Code Descriptions

The PocketPC application program, called MCP215XDemo, is shown in **Appendix B: "PPC Source Code - IrDA DEMO.CPP"** through **Appendix G: "PPC Source Code - Include Files"**.

Table 4 briefly describes the role of each source file and has a link to the appendix that contains that source file.

The non-MFC socket operations rely on values defined in the Microsoft-supplied header file #include `<af_irda.h>`. See `MCPSocket.cpp` for its inclusion.

For more information about the operation of the system (embedded system and PPC application program), please refer to **Appendix A: "Example Irda Standard System Description"**.

TABLE 4: MCP215XDEMO SOURCE FILES

File Name	Description	Appendix
IrDA Demo.cpp	Application entry and exit. Creates the dialog box object and handles initialization and running of the application.	**Appendix B**
IrDA DemoDlg.cpp	Dialog box object. Handles all events generated by the user. Creates the socket and thread objects. Controls connecting and writing to the device by posting messages to the thread object.	**Appendix C**
ClientThread.cpp	Secondary thread created by the dialog box object. Controls communications with the server freeing the dialog box object to process user events. Posts messages to dialog box object on receipt of data from the server.	**Appendix D**
MCPSocket.cpp	Socket object connection to the DSTEMP server.	**Appendix E**
TransparentBitmap.cpp	Bitmap object that displays the connection state of the client with the server.	**Appendix F**
IrDA Demo.h, IrDA DemoDlg.h, ClientThread.h, MCPSocket.h, TransparentBitmap.h, stdafx.h	Include Files.	**Appendix G**

Resources

For additional information on the Pocket PC operating system development, visit:

http://msdn.microsoft.com/

Recommended Reading

Table 5 gives a list of additional documentation for Windows operating system development, while Table 6 shows some of the documentation available from Microsoft®.

SUMMARY

This application note has shown some of the fundamental programming concepts and design considerations for the development of Pocket PC OS application programs. Attention was given to the WinSock API calls for IrCOMM communications.

Using the source code from the example Pocket PC application program should allow you to get your custom application to connect to an embedded IrDA standard system using either the MCP215X or MCP2140 device.

Biography

Frank Ableson is a consultant specializing in the development of IrDA application programs for Palm OS, PocketPC OS, Symbian® OS and Windows OS systems.

For inquiries into consulting services, please contact Frank via e-mail at fableson@UnwiredTools.com.

TABLE 5: ADDITIONAL WINDOWS DEVELOPMENT READING

Title	Author	ISBN
Programming Windows® 95 with MFC	Jeff Prosise	1556159021
Network Programming in Windows NT®	Alok K. Sinha	0201590565
The MFC Answer Book	Eugene Kain	0201185377
The C Programming Language	Brian W. Kernighan, Dennis M. Ritchie	0131103628

TABLE 6: WINDOWS DOCUMENTATION (AVAILABLE AT HTTP://MSDN.MICROSOFT.COM/)

Title	Date	Description
Choosing a Windows eMbedded API: Win32 vs. the .NET Compact Framework	September 2002	Discusses the various Pocket PC platforms, development tools and APIs
Development Tools for Mobile and eMbedded Applications	2002	Discussion of current and future mobile application development tools.
Creating an Infrared WinSock Application	May 2002	Describes the creation of an infrared application using windows sockets.
Windows® Sockets in MFC	—	Describes the two MFC classes that support sockets.

APPENDIX A: EXAMPLE IrDA STANDARD SYSTEM DESCRIPTION

A description of the example IrDA standard system is provided to facilitate a better understanding of the Pocket PC (PPC) application program functions. This PPC OS application program communicates with an embedded system to transfer data and control operation/status. The embedded system acts as an IrDA standard Secondary Device. Figure A-1 shows this example IrDA standard system with a Primary Device (PPC PDA) and a Secondary Device (embedded system). Figure A-2 shows a detailed block diagram of the embedded system (Secondary Device). For additional information on the implementation of an embedded system, please refer to AN858, "Interfacing the MCP215X to a Host Controller", DS00858.

The embedded system uses a 40-pin PIC MCU and a MCP215X device and is available as a demo board.

This demo board is available and is called the DSTEMP Data Logger Demo Board (MCP215XDM).

FIGURE A-1: PPC PDA - EMBEDDED SYSTEM BLOCK DIAGRAM

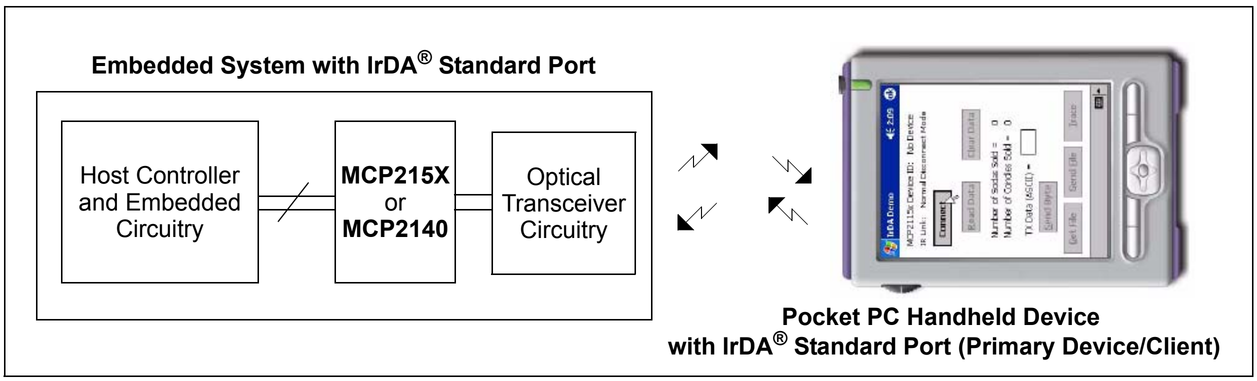
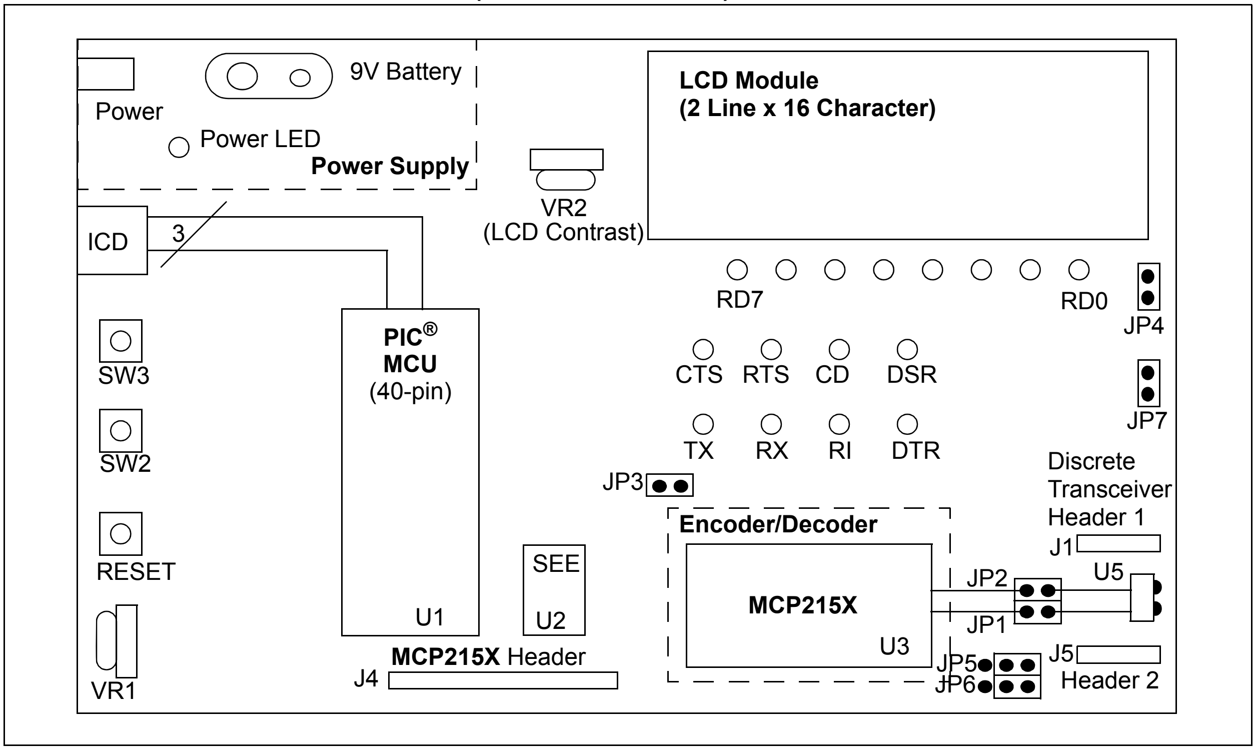


FIGURE A-2: EMBEDDED SYSTEM (IR DEMO BOARD 1) BLOCK DIAGRAM



Embedded System Firmware Operation

The embedded system has two programs that can be selected to run. The first is a vending machine, while the second is a 240-byte data transfer.

VENDING MACHINE

This demo emulates a “Vending Machine” by counting the number of each item (soda and candy) dispensed.

Each time the SW2 button is depressed, the counter for the number of sodas is incremented. Each time the SW3 button is depressed, the counter for the number of candies is incremented. Each counter is an 8-bit value and can display a value from 0 to 255 (decimal).

The program monitors for data being received from the IR port (received on the Host UART) and will then respond with the appropriate data. Table A-1 shows the two commands of the Vending Machine program.

TABLE A-1: VENDING MACHINE COMMANDS

Command Value (ASCII)	Hex Value	Demo Program
5	0x35	Transfer the current soda and candy counter values to the Primary Device.
6	0x36	Clears the current soda and candy counters.

Note: All other values are ignored.

240 BYTE DATA TRANSFER

Depressing SW2 and SW3 will cause the program in the PICmicro® microcontroller to execute the Tranfer 240 Bytes routine. In this demo, the PIC16F877 receives a single byte from the IrDA standard Primary Device. This received byte is moved to PORTD (displayed on the LEDs) and then a 240-byte table is transmitted back to the Primary Device.

> **Note:** The byte sent by the Primary Device is expected, since most PDAs will not establish a link until data is sent. This application program forces the link open when the **Connect** button is depressed by transmitting a null data packet (a packet with 0 data bytes).

PPC Application Program User Interface

In this case, the main User Interface (UI) form (Figure A-3) either displays all the information required, has a button to do the requested action or has a button to display the information (trace buffer).

The **Connect** button causes the application to attempt a connection with the Secondary Device. Once this command is completed, the **Device ID** of the Secondary Device is displayed and the **IR Link** shows the state of the link. If the link states Normal Response Mode, the link is ready for data transfer. The DSTEMP CD signal (or DSTEMP DSR signal) will turn on.

> **Note:** Once the IR Link indicates Normal Response Mode, the other buttons of the application can be tapped for their desired operation.

FIGURE A-3: IrDA® STANDARD DEMO MAIN FORM

VENDING MACHINE

To interface to the embedded system running the Vending Machine program, the main UI form displays all the user information (Figure A-3).

The **Read Data** button can then be tapped, prompting the read data command to be sent to the embedded system. The embedded system will respond with strings that include the following information:

- number of sodas sold, and
- number of candies sold.

Tapping the **Clear Data** button will send the clear data command and clear the counters on the embedded system's application.

240 BYTE DATA TRANSFER

To interface to the embedded system running the Vending Machine program, the main UI form displays some of the information the user needs (Figure A-3).

Once the PPC has connected to the embedded system (Secondary Device), tap on the **Get File** button to transfer 240 bytes from the embedded system to the PPC. To view the trace buffer, tap on the **Trace** button. To clear the trace buffer, tap on the **Clear** button in the trace buffer dialog box.

Description of Graphical User Interface (GUI)

The GUI consists of a number of user interface elements, including command buttons, text labels and a text entry field.

- The **Connect** button attempts to establish a connection to the IR demo board. The PPC device is acting as the Primary Device and the demo board acts as the Secondary Device.
- The **Read Data** button causes a query to be sent to the demo board requesting a tally of the number of sodas and candies dispensed. Data received from the demo board is parsed and displayed in text labels.
- The **Clear Data** button sends a command to the demo board instructing it to reset the application level counters.
- The **Send Byte** button transfers the byte entered into the TX Data (ASCII) text box. Any byte may be entered and transferred to the embedded system. If the byte corresponds to one of the commands to read data, clear data or transfer a buffer, the board will respond depending on its mode (Vending Machine or 240-Byte Transfer).
- The **Get File** button initiates the 240-byte data transfer from the embedded system by sending the embedded system the command byte for the transfer.
- The **Send File** button allows the user to select a file on the PPC and transfer it to the embedded system.
- The **Trace** button causes the information in the trace buffer to be displayed. Within this window is the capability to clear the trace buffer.

Code Module Description

Table A-2 briefly describes the role of each source code module.

TABLE A-2: PPC APPLICATION PROGRAM FUNCTIONS

File Name	Description	Appendix
IrDA Demo.cpp	Application entry and exit. Creates the dialog box object and handles initialization and execution of the application.	Appendix B
IrDA DemoDlg.cpp	Dialog box object. Handles all events generated by the user. Creates the socket and thread objects. Controls connecting and writing to the device by posting messages to the thread object.	Appendix C
ClientThread.cpp	Secondary thread created by the dialog box object. Controls communications with the server, freeing the dialog box object to process user events. Posts messages to dialog box object to receipt of data from the server.	Appendix D
MCPSocket.cpp	Socket object connection to the MCP21XX server.	Appendix E
TransparentBitmap.cpp	Bitmap object that displays the connection state of the client with the server.	Appendix F
IrDA Demo.h, IrDA DemoDlg.h, ClientThread.h, MCPSocket.h, TransparentBitmap.h, stdafx.h	Include Files.	Appendix G

NOTES:

APPENDIX B: PPC SOURCE CODE - IRDA DEMO.CPP

FIGURE B-1: IrDA DEMO.SPP - PAGE 1

```
// IrDA Demo.cpp : Defines the class behaviors for the application.
//

#include "stdafx.h"
#include "IrDA Demo.h"
#include "IrDA DemoDlg.h"

#ifdef _DEBUG
#define new DEBUG_NEW
#endif


// CIrDADemoApp

BEGIN_MESSAGE_MAP(CIrDADemoApp, CWinApp)
    ON_COMMAND(ID_HELP, CWinApp::OnHelp)
END_MESSAGE_MAP()

// CIrDADemoApp construction

CIrDADemoApp::CIrDADemoApp()
{
    // TODO: add construction code here,
    // Place all significant initialization in InitInstance
}

// The one and only CIrDADemoApp object

CIrDADemoApp theApp;

// CIrDADemoApp initialization
```

FIGURE B-2: IrDA DEMO.CPP - PAGE 2

```
BOOL CIrDADemoApp::InitInstance()
{
    // InitCommonControls() is required on Windows XP(r) if an application
    // manifest specifies use of ComCtl32.dll version 6 or later to enable
    // visual styles.  Otherwise, any window creation will fail.
    InitCommonControls();

    CWinApp::InitInstance();

    if (!AfxSocketInit())
    {
        AfxMessageBox(IDP_SOCKETS_INIT_FAILED);
        return FALSE;
    }

    AfxEnableControlContainer();

    CIrDADemoDlg dlg;

    // Connect to the simulator or to the board on the ir port.
    // m_bSimulate is set with the command line flag /s.  For debugging,
    // the flag is set under Project->Properties->Debugging
    CString strSimFlag( (LPCTSTR)IDS_SIMULATE_FLAG );

    if ( m_lpCmdLine == strSimFlag )
        dlg.m_bSimulate = TRUE;
    else
        dlg.m_bSimulate = FALSE;

    m_pMainWnd = &dlg;
    INT_PTR nResponse = dlg.DoModal();
    if (nResponse == IDOK)
    {
        // TODO: Place code here to handle when the dialog is
        //  dismissed with OK
    }
    else if (nResponse == IDCANCEL)
    {
        // TODO: Place code here to handle when the dialog is
        //  dismissed with Cancel
    }

    // Since the dialog has been closed, return FALSE so that we exit the
    //  application, rather than start the application's message pump.
    return FALSE;
}
```

APPENDIX C: PPC SOURCE CODE - IRDA DEMODLG.CPP

FIGURE C-1: IrDA DEMODLG.CPP - PAGE 1

```
// IrDA DemoDlg.cpp : implementation file
//
#include "stdafx.h"
#include "IrDA Demo.h"
#include "IrDA DemoDlg.h"
#include "MCPSocket.h"// class CMCPSocket
#include "ClientThread.h"
#include "TransparentBitmap.h"
#include <af_irda.h>
#include ".\irda demodlg.h"

#ifdef _DEBUG
#define new DEBUG_NEW
#endif

#define STATE_NDM              0       // Program states
#define STATE_DISCOVERY        1       // Program states
#define STATE_CONNECTING       2       // Program states
#define STATE_NRM              3       // Program states
#define COMMAND_SEND_DATA_NUM_CHARS    24
#define COMMAND_ASCII_HEX       0x34      // Prompts server to toggle between ASCII/HEX
#define COMMAND_SEND_DATA       0x35      // Prompts server to send client counter data
#define COMMAND_CLEAR_DATA      0x36      // Clears counters on server
#define COMMAND_READ_DATA       0x37      // Reads A/D value from server
#define COMMAND_TX_BYTES        0x56      // Transfers file to the embedded system.
#define COMMAND_RX_BYTES        0x57      // Receives file from the embedded system.
#define TIMER_3SEC              3000

CEvent termEvent(TRUE); // event to communicate termination of all threads,
                        // initally TRUE in case no threads are started
long nThreadCount = 0;  // count of all active threads

// CAboutDlg dialog used for App About

class CAboutDlg : public CDialog
{
public:
    CAboutDlg();
```

FIGURE C-2: IrDA DEMODLG.CPP - PAGE 2

```
// Dialog Data
    enum { IDD = IDD_ABOUTBOX };

    protected:
    virtual void DoDataExchange(CDataExchange* pDX);    // DDX/DDV support

// Implementation
protected:
    DECLARE_MESSAGE_MAP()
};

CAboutDlg::CAboutDlg() : CDialog(CAboutDlg::IDD)
{
}

void CAboutDlg::DoDataExchange(CDataExchange* pDX)
{
    CDialog::DoDataExchange(pDX);
}

BEGIN_MESSAGE_MAP(CAboutDlg, CDialog)
END_MESSAGE_MAP()

// CIrDADemoDlg dialog

CIrDADemoDlg::CIrDADemoDlg(CWnd* pParent /*=NULL*/)
    : CDialog(CIrDADemoDlg::IDD, pParent), m_pClientThread(NULL),
                                m_bSimulate(FALSE), m_bProgramState(STATE_NDM)
{
    m_pConnectedBitmap = m_pConnectNotBitmap = NULL;
    m_pConnectedBitmap = new CTransparentBitmap( IDB_CONNECTED, RGB( 0, 128, 128 ));
    m_pConnectNotBitmap = new CTransparentBitmap( IDB_CONNECTEDNOT, RGB( 0, 128, 128 ));
    m_pCurrentStateBitmap = m_pConnectNotBitmap;
    m_hIcon = AfxGetApp()->LoadIcon(IDR_CONNECTION);
}

void CIrDADemoDlg::DoDataExchange(CDataExchange* pDX)
{
    CDialog::DoDataExchange(pDX);
}
BEGIN_MESSAGE_MAP(CIrDADemoDlg, CDialog)
    ON_WM_SYSCOMMAND()
    ON_WM_PAINT()
    ON_WM_QUERYDRAGICON()
    //}}AFX_MSG_MAP
    ON_WM_CLOSE()
    ON_BN_CLICKED(IDC_READ_DATA, OnBnClickedReadData)
    ON_BN_CLICKED(IDC_CLEAR_DATA, OnBnClickedClearData)
    ON_BN_CLICKED(IDC_CONNECT, OnBnClickedConnect)
    ON_BN_CLICKED(IDC_ASCII_HEX, OnBnClickedAsciiHex)
    ON_BN_CLICKED(IDC_SEND_BYTE, OnBnClickedSendByte)
    ON_BN_CLICKED(IDC_SEND_FILE, OnBnClickedSendFile)
    ON_BN_CLICKED(IDC_RECEIVE_FILE, OnBnClickedReceiveFile)
    ON_BN_CLICKED(IDC_DISPLAY_DATA, OnBnClickedShowRawData)
    ON_MESSAGE(WM_CONNECTION_CLOSE, OnConnectionClose)
    ON_MESSAGE(WM_NEWMESSAGE, OnNewMessage)
    ON_MESSAGE(WM_CONNECTION_DONE, OnConnectionDone)
    ON_MESSAGE(WM_DEVICE_ATTACHED, OnDeviceAttached)
    ON_MESSAGE(WM_DEVICE_NOTATTACHED, OnDeviceNotAttached)
    ON_MESSAGE(WM_SEND_COMPLETE, OnSendDataComplete)
    ON_WM_TIMER()
END_MESSAGE_MAP()
```

FIGURE C-3: IrDA DEMODLG.CPP - PAGE 3

```
void CIrDADemoDlg::CleanupThread()
{
    TRACE( _T( "CIrDADemoDlg::CleanupThread()\n" ));

    if ( m_pClientThread )
    {
        // ask the client thread to terminate
        if ( ::PostThreadMessage( m_pClientThread->m_nThreadID, WM_TERM_THREAD, 0, 0 ) == 0 )
            TRACE( _T( "Thread 0x%02x possibly already terminated\n" ),
                       m_pClientThread->m_nThreadID );

        // wait up to 1s for secondary threads to terminate
        // termEvent will be signaled when thread count reaches 0
        if ( termEvent.Lock( 1000 ))
            TRACE( _T( "Threads terminated gracefully\n" ));
        else
            TRACE( _T( "WARNING: All secondary thread(s) not gracefully terminated.\n" ));
    }
}
// CIrDADemoDlg message handlers

BOOL CIrDADemoDlg::OnInitDialog()
{
    CDialog::OnInitDialog();

    // m_bSimulate is set with the command line flag /s.  For debugging,
    // the flag is set under Project->Properties->Debugging
    // Move dialog to the right so it doesn't cover up the simulation server dialog.
    if ( m_bSimulate )
    {
        CPoint   Point;
        CRect    DialogRect;
        CRect    ParentRect;
        CWnd     *DesktopWindow = NULL;
        int      nWidth;
        int      nHeight;

        GetWindowRect( DialogRect );
        DesktopWindow = GetDesktopWindow();

        if ( DesktopWindow )
        {
            DesktopWindow->GetWindowRect( ParentRect );
            Point.x = ParentRect.Width() / 2;
            Point.y = ParentRect.Height() / 2;
            DesktopWindow->ClientToScreen( &Point );
            nWidth = DialogRect.Width();
            nHeight = DialogRect.Height();
            Point.x += nWidth / 2;
            Point.y -= nHeight / 2;
            MoveWindow( Point.x, Point.y, nWidth, nHeight, FALSE );
        }
    }

    // Add "About..." menu item to system menu.

    // IDM_ABOUTBOX must be in the system command range.
    ASSERT((IDM_ABOUTBOX & 0xFFF0) == IDM_ABOUTBOX);
    ASSERT(IDM_ABOUTBOX < 0xF000);
```

FIGURE C-4: IrDA DEMODLG.CPP - PAGE 4

```
#ifndef _WIN32_WCE
    CMenu* pSysMenu = GetSystemMenu(FALSE);
    if (pSysMenu != NULL)
    {
        CString strAboutMenu;
        strAboutMenu.LoadString(IDS_ABOUTBOX);
        if (!strAboutMenu.IsEmpty())
        {
            pSysMenu->AppendMenu(MF_SEPARATOR);
            pSysMenu->AppendMenu(MF_STRING, IDM_ABOUTBOX, strAboutMenu);
        }
    }
#endif
    // Limit the text for the transmit edit control to one character.
    ((CEdit*)GetDlgItem( IDC_BYTE ))->SetLimitText( 1 );

    // Set the counters to zero or else there will just be a blank space where the numbers go.
    SetDlgItemInt( IDC_SODAS_SOLD, 0 );
    SetDlgItemInt( IDC_CANDIES_SOLD, 0 );
    SetDlgItemInt( IDC_CHANGEBOX, 0 );

    // Set the icon for this dialog.  The framework does this automatically
    //  when the application's main window is not a dialog
    SetIcon(m_hIcon, TRUE);     // Set big icon
    SetIcon(m_hIcon, FALSE);    // Set small icon
    WCE_DEL CreateDeviceAnimation();
    WCE_INS CenterWindow(GetDesktopWindow());    // center to the hpc screen
    InitializeSocketThread();    // Create and initialize the thread.  Creates the socket.

    SetProgramState( STATE_NDM );// Starts the search for devices => must come after thread is
initialized.
    return TRUE;  // return TRUE  unless you set the focus to a control
}

void CIrDADemoDlg::OnSysCommand(UINT nID, LPARAM lParam)
{
    if ((nID & 0xFFF0) == IDM_ABOUTBOX)
    {
        CAboutDlg dlgAbout;
        dlgAbout.DoModal();
    }
    else
    {
        CDialog::OnSysCommand(nID, lParam);
    }
}
```


FIGURE C-5: IrDA DEMODLG.CPP - PAGE 5

```
#ifndef _WIN32_WCE
void CIrDADemoDlg::OnPaint()
{
    if (IsIconic())
    {
        CPaintDC dc(this); // device context for painting

        SendMessage(WM_ICONERASEBKGND, reinterpret_cast<WPARAM>(dc.GetSafeHdc()), 0);

        // Center icon in client rectangle
        int cxIcon = GetSystemMetrics(SM_CXICON);
        int cyIcon = GetSystemMetrics(SM_CYICON);
        CRect rect;
        GetClientRect(&rect);
        int x = (rect.Width() - cxIcon + 1) / 2;
        int y = (rect.Height() - cyIcon + 1) / 2;

        // Draw the icon
        dc.DrawIcon(x, y, m_hIcon);
    }
    else
    {
        DrawConnectionImage();
        CDialog::OnPaint();
    }
}
#endif
// The system calls this function to obtain the cursor to display while the user drags
//  the minimized window.
HCURSOR CIrDADemoDlg::OnQueryDragIcon()
{
    return static_cast<HCURSOR>(m_hIcon);
}

// This function is separate from OnBnClickedConnect() so that it
// can be repeatedly called if user wants to try to connect again.
BOOL CIrDADemoDlg::ConnectWithServer()
{
    TRACE( _T( "CIrDADemoDlg::ConnectWithServer()\n" ));

    if ( m_pClientThread )
    {
        // ask the client thread to terminate
        if ( ::PostThreadMessage( m_pClientThread->m_nThreadID, WM_DEVICE_CONNECT, 0, 0 ) == 0 )
        {
            AfxMessageBox( IDS_THREAD_TERMINATED, MB_OK | MB_ICONEXCLAMATION );
            TRACE( _T( "Thread 0x%02x possibly already terminated\n" ),
                       m_pClientThread->m_nThreadID );
        }
    }
    return TRUE;
}

void CIrDADemoDlg::DisconnectWithServer()
{
    // Post message to thread to close connection with socket.
    if ( m_pClientThread )
    {
        if ( ::PostThreadMessage( m_pClientThread->m_nThreadID,
                                  WM_DEVICE_DISCONNECT, 0, 0 ) == 0 )
            TRACE( _T( "Thread 0x%02x possibly already terminated\n" ),
                       m_pClientThread->m_nThreadID );
    }
}
```

FIGURE C-6: IrDA DEMODLG.CPP - PAGE 6

```
// Callback from the client socket thread to signify a connection has been established.
LRESULT CIrDADemoDlg::OnConnectionDone(WPARAM, LPARAM)
{
    SetProgramState( STATE_NRM );
    return 0;
}

// Callback from the client socket thread to signify a connection has been disestablished.
LRESULT CIrDADemoDlg::OnConnectionClose(WPARAM, LPARAM)
{
    if ( STATE_CONNECTING == m_bProgramState )// We were trying to connect and failed.
    {
        if ( AfxMessageBox( IDS_RETRYCONNECT, MB_YESNO ) == IDYES )
        {
            ConnectWithServer();
            return 0;
        }
    }

    SetProgramState( STATE_NDM );
    return 0;
}
LRESULT CIrDADemoDlg::OnSendDataComplete(WPARAM wParam, LPARAM lParam)
{
    switch ( m_nLastCommand )
    {
        case COMMAND_SEND_DATA:
        case COMMAND_TX_BYTES:
            // Do nothing
            break;
        default:
            // This will reenable the buttons if the connection did not close after command
           // was sent.
            SetProgramState( m_bProgramState );
    }
    return 0;
}

// The Connect button serves as both a connection and disconnection button. The
// button text is changed in the OnConnectionClose and OnConnectionDone.
void CIrDADemoDlg::OnBnClickedConnect()
{
    // If disconnected, then connect, else disconnect.
    if ( STATE_DISCOVERY == m_bProgramState )
    {
        SetProgramState( STATE_CONNECTING );
        ConnectWithServer();
    }
    else //( STATE_NRM == m_bProgramState )
    {
        // Program state will change when the disconnected message from the socket is received.
        //SetProgramState( STATE_DISCOVERY );
        DisconnectWithServer();
    }
}
```


FIGURE C-7: IrDA DEMODLG.CPP - PAGE 7

```
// Prompts embedded system to send the vending machine data to this server.
void CIrDADemoDlg::OnBnClickedReadData()
{
    ClearTraceBuffer();

    // Disable buttons until command completes so the user does not send command
    // more than once at a time. AsyncSendBuff( ) posts a message when complete.
    EnableButtons( FALSE );

    // Start a timer to trigger a time-out if the system
    // does not respond (handled in OnTimer()).
    m_pTimer = SetTimer( WM_TIMER_SEND_DATA, TIMER_3SEC, 0 );

    m_nLastCommand = COMMAND_SEND_DATA;
    SendData( m_nLastCommand );
}

void CIrDADemoDlg::OnBnClickedClearData()
{
    ClearTraceBuffer();
    m_nLastCommand = COMMAND_CLEAR_DATA;
    SendData( m_nLastCommand );
}
void CIrDADemoDlg::OnBnClickedAsciiHex()
{
    m_nLastCommand = COMMAND_ASCII_HEX;
    SendData( m_nLastCommand );
}
void CIrDADemoDlg::OnBnClickedSendByte()
{
    CString str;
    GetDlgItemText( IDC_BYTE, str );

    ClearTraceBuffer();

    if ( str.GetLength() < 1 )
    {
        AfxMessageBox( IDS_ENTER_DATA );
        return;
    }
```

FIGURE C-8: IrDA DEMODLG.CPP - PAGE 8

```
    // Save the byte because user may be trying
    // to send a read, clear, transfer... command.
    switch( *str.GetBuffer(0) )
    {                                            //   HEX    DEC    ASCII
        case '4':                                // -----------------------
            m_nLastCommand = COMMAND_ASCII_HEX;   //   0x34    52    4
            break;
        case '5':
            m_nLastCommand = COMMAND_SEND_DATA;    //  0x35    53    5
            break;
        case '6':
            m_nLastCommand = COMMAND_CLEAR_DATA;   //  0x36    54    6
            break;
        case '7':
            m_nLastCommand = COMMAND_READ_DATA;    //  0x37    57    7
            break;
        case 'V':
            m_nLastCommand = COMMAND_TX_BYTES;     //  0x56    86    V
            break;
        case 'W':
            m_nLastCommand = COMMAND_RX_BYTES;     //  0x57    87    W
            break;
        default:
            m_nLastCommand = -1;
            break;
    }

    SendData( str );
}

void CIrDADemoDlg::SendData(int nData)
{
    CString str;
    str.Format( _T( "%c" ), nData );
    SendData( str );
}
void CIrDADemoDlg::SendData(CString strData)
{
    if ( m_pClientThread && ( m_pClientThread->m_socket ).m_fConnected )
    {
        (m_pClientThread->m_socket).AsyncSendBuff( ( void* )( LPCTSTR )strData,
                                                   strData.GetLength() );
    }
    else
    {
        // we are not connected to peer, reset state
        SetProgramState( STATE_NDM );
        m_pClientThread = NULL;
    }
```

FIGURE C-9: IrDA DEMODLG.CPP - PAGE 9

```
    TRACE( _T( "CIrDADemoDlg::SendData()\n" ));
}

// Sends a file to the embedded system.
// Sequence:
// 1. Prompt user to select the file.
// 2. Send the number of bytes.
// 3. Wait for OK.
// 4. Send the file.
void CIrDADemoDlg::OnBnClickedSendFile()
{
    ClearTraceBuffer();

    // Get file to send.
    CFileDialog dlg( TRUE );

    if ( dlg.DoModal() )
    {
        CFile sourceTxFile;
        CFileException ex;
        m_strTxFileName = dlg.GetFileName();

        if ( ! sourceTxFile.Open( m_strTxFileName, CFile::modeRead, &ex ))
        {
            TCHAR szError[1024];
            ex.GetErrorMessage( szError, 1024 );
            MessageBox( szError, _T( "Error" ), MB_OK | MB_ICONEXCLAMATION );
        }
        else
        {
            // Disable buttons until command completes so the user
            // does not send command more than once at a time.
            EnableButtons( FALSE );
            DWORD nFileLength = (DWORD)sourceTxFile.GetLength();
            sourceTxFile.Close();
            m_nLastCommand = COMMAND_TX_BYTES;

            // Start a timer to trigger a time-out if the system
            // does not respond (handled in OnTimer()).
            m_pTimer = SetTimer( WM_TIMER_TX_BYTES, TIMER_3SEC, 0 );

            SendData( (DWORD)nFileLength );
        }
    }
}
// Get a file from the embedded system.
// Sequence:
// 1. Send command COMMAND_RX_BYTES
// 2. Receive data from system.
void CIrDADemoDlg::OnBnClickedReceiveFile()
{
    ClearTraceBuffer();
    m_nLastCommand = COMMAND_RX_BYTES;

    // Disable buttons until command completes so the user
    // does not send command more than once at a time.
    EnableButtons( FALSE );

    // Start a timer to trigger a time-out if the system
    // does not respond (handled in OnTimer()).
    m_pTimer = SetTimer( WM_TIMER_TX_BYTES, TIMER_3SEC, 0 );

    SendData( m_nLastCommand );
}
```

FIGURE C-10: IrDA DEMODLG.CPP - PAGE 10

```
// This button is only on the Pocket PC(tm).  The laptop
// application displays the data in the dialog.
void CIrDADemoDlg::OnBnClickedShowRawData()
{
    MessageBox( (LPCTSTR)m_strTraceBuffer, _T( "Raw Data" ), MB_OK );
}

// This is a message from the socket.  The socket posts this message when it has received
// something from client to the client.  m_nLastCommand is the last command sent to the
// client.  I use the same mesage (WM_NEWMESSAGE) because the socket does not know what
// the last command was. It only knows that it received some data from the client.
LRESULT CIrDADemoDlg::OnNewMessage(WPARAM wParam, LPARAM lParam)
{
    int nCharPos;
    int nRead = (int)lParam;

    // Kill the timer so we don't get a time-out error.
    KillTimer( m_pTimer );

    // We always show the raw data received in the raw data textbox.
    m_strRawRecvData = CString((TCHAR *)wParam);

    // Remove any extra line feeds.  They will be displayed as characters if they are not removed.
    while (( nCharPos = m_strRawRecvData.Find( _T( "\n\n" ))) != -1 )
        m_strRawRecvData.Delete( nCharPos, 1 );

    m_strTraceBuffer = m_strTraceBuffer + m_strRawRecvData;
    WCE_DEL SetDlgItemText( IDC_RECEIVEDDATA_RAW, (LPCTSTR)m_strTraceBuffer );

    switch ( m_nLastCommand )
    {
        case COMMAND_ASCII_HEX:
            // Do nothing
            break;
```

FIGURE C-11: IrDA DEMODLG.CPP - PAGE 11

```
        case COMMAND_SEND_DATA:
            // The firmware must send both \r\n.
            // The string received will be as shown below:
            // SODA  = 000\r\nCANDY = 000
            // 12345678901234567890123456789
            // The word soda, two spaces, "=", three characters,
            // one space, the word candie, one space, "=" one space,
            // three characters representing three digit number.

            if ( m_strRawRecvData.GetLength() < COMMAND_SEND_DATA_NUM_CHARS )
            {
                AfxMessageBox( IDS_DATARECVERROR, MB_OK );
            }
            else
            {
                int nNumDigits = 3;

                // Find the value for soda by searching for '='
                nCharPos = m_strRawRecvData.Find( _T( '=' )) + 2;

                // Remove the leading zeros.
                while (( m_strRawRecvData.GetAt( nCharPos ) == '0' ) && ( nNumDigits > 1 ))
                {
                    nCharPos++;
                    nNumDigits--;
                }

                SetDlgItemText( IDC_SODAS_SOLD, m_strRawRecvData.Mid( nCharPos, nNumDigits ));

                // Find the value for candies by searching for the next '='
                nCharPos = m_strRawRecvData.Find( _T( '=' ), nCharPos ) + 2;
                nNumDigits = 3;

                // Remove the leading zeros.
                while (( m_strRawRecvData.GetAt( nCharPos ) == '0' ) && ( nNumDigits > 1 ))
                {
                    nCharPos++;
                    nNumDigits--;
                }

                SetDlgItemText( IDC_CANDIES_SOLD, m_strRawRecvData.Mid( nCharPos, nNumDigits ));

                // This will reenable the buttons if the connection did not close.
                SetProgramState( m_bProgramState );

                //SetDlgItemText( IDC_CHANGEBOX, m_strRawRecvData.Mid( 4, 2 );
            }
            break;
        case COMMAND_CLEAR_DATA:
            // Do nothing
            break;
        case COMMAND_READ_DATA:
            // Do nothing
            break;
```

FIGURE C-12: IrDA DEMODLG.CPP - PAGE 12

```
        case COMMAND_TX_BYTES:
            // Sequence:
            // 1. Send the number of bytes (done in OnBnClickedSendFile()).
            // 2. Wait for OK.
            // 3. Send the file.

            // If received OK send file.
            if ( m_strRawRecvData == "255" )
            {
                CFile sourceTxFile;
                CFileException ex;

                if ( ! sourceTxFile.Open( m_strTxFileName, CFile::modeRead, &ex ))
                {
                    TCHAR szError[1024];
                    ex.GetErrorMessage( szError, 1024 );
                    MessageBox( szError, _T( "Error" ), MB_OK | MB_ICONEXCLAMATION );
                    //AfxMessageBox( IDS_ERROR_FILE_OPEN, MB_OK | MB_ICONEXCLAMATION );
                }
                else
                {
                    CString strData;
                    DWORD nFileLength = (DWORD)sourceTxFile.GetLength();
                    BYTE *lpBuf = new BYTE[nFileLength];
                    sourceTxFile.Read( lpBuf, nFileLength );
                    strData.Format( _T( "%s" ), lpBuf );

                    // Clear the last command so we don't end up in a loop.
                    // It also needs to be reset or else the buttons will not
                    // be reenabled when it is done sending data.
                    m_nLastCommand = -1;

                    SendData( strData );
                    delete[] lpBuf;
                    sourceTxFile.Close();
                }
            }

            break;
        case COMMAND_RX_BYTES:
            // Receive the 240 byte buffer from the client.
            // Do nothing.  It is already displayed in the raw data window.
            // m_nLastCommand = -1;
            break;

        default:
            AfxMessageBox( IDS_UNRECOGNIZED_RESPONSE, MB_OK | MB_ICONEXCLAMATION );
            break;
    }

    return 0L;
}
```

FIGURE C-13: IrDA DEMODLG.CPP - PAGE 13

```
void CIrDADemoDlg::OnOK()
{
    CleanupThread();

    if ( m_pConnectedBitmap != NULL )
        delete m_pConnectedBitmap;

    if ( m_pConnectNotBitmap != NULL )
        delete m_pConnectNotBitmap;

    //SendMessage(WM_CLOSE, 0 ,0);
    CDialog::OnOK();
}

// Callback from the thread indicating that a device has been moved within range of the IR port.
LRESULT CIrDADemoDlg::OnDeviceAttached(WPARAM wParam, LPARAM lParam)
{
    SetProgramState( STATE_DISCOVERY );
    SetDlgItemText( IDC_MCP_DEVICEID, (LPCTSTR)lParam );
    return 0L;
}

// Callback from the thread indicating that no devices are within the range of the IR port.
LRESULT CIrDADemoDlg::OnDeviceNotAttached(WPARAM, LPARAM)
{
    SetProgramState( STATE_NDM );
    SetDlgItemText( IDC_MCP_DEVICEID, _T("") );
    return 0L;
}
```

FIGURE C-14: IrDA DEMODLG.CPP - PAGE 14

```
// Sets state to one of the four program states:
//    NDM (Normal Disconnect Mode) - no devices attached.
//    Discovery - Device is attached but no connection has been initiated.
//    Connecting - User initiated a connection with device.
//    NRM (Normal Response Mode) - Successful connection to a device.
void CIrDADemoDlg::SetProgramState(int nState)
{
    if ( STATE_NDM == nState )
    {
//        if ( m_bSimulate )
//        {
//            SetProgramState( STATE_DISCOVERY );   // Straight to discovery if simulating.
//            return;
//        }

        m_bProgramState = nState;

    // Search for devices connected to IR port when we are in Disconnect mode.
    // Ignored if simulating.
        SearchForDevices();

        // Only play part of the animation because we don't want the folder in the
        // last half displayed.
        WCE_DEL    m_DeviceAnimation.Play( 0, 13, -1);
        WCE_DEL    m_DeviceAnimation.ShowWindow( SW_SHOW );
        SetDlgItemText( IDC_LINK_STATUS, CString( (LPCTSTR)IDS_NDM ));
        SetDlgItemText( IDC_MCP_DEVICEID, CString( (LPCTSTR)IDS_NODEVICE ));
        GetDlgItem( IDC_CONNECT )->SetWindowText( _T("Connect") );
        EnableButtons( FALSE );
    }
    else if ( STATE_DISCOVERY == nState )
    {
        WCE_DELm_DeviceAnimation.Stop();
        WCE_DEL m_DeviceAnimation.ShowWindow( SW_HIDE );
        m_bProgramState = nState;
        m_pCurrentStateBitmap = m_pConnectNotBitmap;
        RedrawConnectionBitmap();
        SetDlgItemText( IDC_LINK_STATUS, CString( (LPCTSTR)IDS_DISCOVERY ));
        GetDlgItem( IDC_CONNECT )->SetWindowText( _T("Connect") );
        GetDlgItem( IDC_CONNECT )->EnableWindow( TRUE );
        EnableButtons( FALSE );
    }
    else if ( STATE_CONNECTING == nState )
    {
        m_bProgramState = nState;
        SetDlgItemText( IDC_LINK_STATUS, CString( (LPCTSTR)IDS_CONNECTING ));
    }
    else if ( STATE_NRM == nState )
    {
        m_bProgramState = nState;
        m_pCurrentStateBitmap = m_pConnectedBitmap;
        RedrawConnectionBitmap();
        SetDlgItemText( IDC_LINK_STATUS, CString( (LPCTSTR)IDS_NRM ));
        GetDlgItem( IDC_CONNECT )->SetWindowText( _T("Disconnect") );
        GetDlgItem( IDC_CONNECT )->EnableWindow();
        EnableButtons( TRUE );
    }
    else
    {
        m_bProgramState = -1;
    }
}
```

FIGURE C-15: IrDA DEMODLG.CPP - PAGE 15

```
void CIrDADemoDlg::InitializeSocketThread()
{
#ifndef _WIN32_WCE
    // Connect to the simulator or to the board on the ir port.
    // m_bSimulate is set with the command line flag /s.  For debugging
    // the flag is set under Project->Properties->Debugging
    if ( m_bSimulate )
    {
        DWORD    MaxNameLength = MAX_COMPUTERNAME_LENGTH + 1;
        char     lpszHostName[MAX_COMPUTERNAME_LENGTH + 1];

        if ( GetComputerName( (LPTSTR)lpszHostName, (LPDWORD) &MaxNameLength ) != 0 )
        {
            m_strServerName = lpszHostName;
        }
        else
        {
            AfxMessageBox( IDS_COMPUTER_NAME_ERROR, MB_OK | MB_ICONEXCLAMATION  );
            return;
        }
    }
#endif

    // Create a thread to handle the connection. The thread created is suspended so
    // that we can set variables in CClientThread before it starts executing.
    CClientThread* pThread = (CClientThread*)AfxBeginThread( RUNTIME_CLASS( CClientThread ),
THREAD_PRIORITY_NORMAL, 0, CREATE_SUSPENDED );

    if ( ! pThread )
    {
        TRACE( _T( "Could not create thread\n" ));
        AfxMessageBox( IDS_THREAD_CREATION, MB_OK | MB_ICONEXCLAMATION );
        return;
    }

    pThread->m_strServerName = m_strServerName;    // server machine name
    pThread->m_bSimulate = m_bSimulate;            // server machine name
    pThread->m_socket.m_pThread = pThread;         // the thread that m_socket lives
    m_pClientThread = pThread;        // keep a pointer to the connect socket thread

    // Now start the thread.
    pThread->ResumeThread();
}

void CIrDADemoDlg::SearchForDevices()
{
    if ( m_pClientThread )    // Look for devices connected to IR port.  Ignored if simulating.
    {
        // Ask the client thread to start looking for devices.
        // The TRUE parameters tell the client to search.  Thread does nothing if simulating.
       if ( ::PostThreadMessage( m_pClientThread->m_nThreadID, WM_DEVICE_SEARCH, TRUE, 0 ) == 0 )
        {
            AfxMessageBox( IDS_THREAD_TERMINATED, MB_OK | MB_ICONEXCLAMATION );
            TRACE( _T( "Thread 0x%02x possibly already terminated\n" ),
                        m_pClientThread->m_nThreadID );
        }
    }
}
```

FIGURE C-16: IrDA DEMODLG.CPP - PAGE 16

```
void CIrDADemoDlg::RedrawConnectionBitmap()
{
#ifndef _WIN32_WCE
    CRect rect;
    GetDlgItem( IDC_DRAW_AREA )->GetWindowRect( &rect );
    ScreenToClient( &rect );
    InvalidateRect( rect );
    Invalidate();
    UpdateWindow();
#endif
}

void CIrDADemoDlg::DrawConnectionImage()
{
#ifndef _WIN32_WCE
    CPaintDC dc( this ); // Device context for painting
    CRect rect;
    GetDlgItem( IDC_DRAW_AREA )->GetWindowRect( &rect );
    ScreenToClient( &rect );

    m_pCurrentStateBitmap->DrawTransparentBitmap(&dc,           // The destination DC.
                                                 rect.left,     // X coordinate.
                                                 rect.top );    // Y coordinate.
#endif
}

void CIrDADemoDlg::CreateDeviceAnimation()
{
#ifndef _WIN32_WCE
        CRect rect;
        GetDlgItem( IDC_DRAW_AREA )->GetWindowRect( &rect );
        ScreenToClient( &rect );

        rect.top = rect.top - 10;
        rect.left = rect.left - 10;
        rect.right = rect.right + 10;
        rect.bottom = rect.bottom + 10;

       if ( m_DeviceAnimation.Create( WS_CHILD | WS_VISIBLE | ACS_CENTER | ACS_TRANSPARENT, rect,
                                      this, IDR_DEVICE_SEARCH ) == FALSE )
            AfxMessageBox( IDS_DEVICE_ANIMATION, MB_OK | MB_ICONEXCLAMATION );

        // Open displays the clip's first frame.
        if ( m_DeviceAnimation.Open( IDR_DEVICE_SEARCH ) == FALSE )
            AfxMessageBox( IDS_DEVICE_ANIMATION, MB_OK | MB_ICONEXCLAMATION );
#endif
}
```

FIGURE C-17: IrDA DEMODLG.CPP - PAGE 17

```
void CIrDADemoDlg::EnableButtons(BOOL nEnable)
{
    if ( nEnable == TRUE )
    {
        GetDlgItem( IDC_READ_DATA )->EnableWindow();
        GetDlgItem( IDC_CLEAR_DATA )->EnableWindow();
        //GetDlgItem( IDC_ASCII_HEX )->EnableWindow();
        GetDlgItem( IDC_BYTE )->EnableWindow();
        GetDlgItem( IDC_SEND_BYTE )->EnableWindow();
        GetDlgItem( IDC_RECEIVE_FILE )->EnableWindow();
        GetDlgItem( IDC_SEND_FILE )->EnableWindow();
        WCE_INS GetDlgItem( IDC_DISPLAY_DATA )->EnableWindow();
    }
    else
    {
        GetDlgItem( IDC_READ_DATA )->EnableWindow( FALSE );
        GetDlgItem( IDC_CLEAR_DATA )->EnableWindow( FALSE );
        //GetDlgItem( IDC_ASCII_HEX )->EnableWindow( FALSE );
        GetDlgItem( IDC_BYTE )->EnableWindow( FALSE );
        GetDlgItem( IDC_SEND_BYTE )->EnableWindow( FALSE );
        GetDlgItem( IDC_RECEIVE_FILE )->EnableWindow( FALSE );
        GetDlgItem( IDC_SEND_FILE )->EnableWindow( FALSE );
        WCE_INS GetDlgItem( IDC_DISPLAY_DATA )->EnableWindow( FALSE );
    }
}

void CIrDADemoDlg::OnTimer(UINT nIDEvent)
{
    switch ( nIDEvent )
    {
        case WM_TIMER_SEND_DATA:
        case WM_TIMER_TX_BYTES:
        case WM_TIMER_RX_BYTES:
            // Stop the timer so that no more than one of these error messages
            // is displayed.  Restart if the user wants to continue waiting.
            KillTimer( m_pTimer );

            if ( AfxMessageBox( IDS_NORESPONSE, MB_YESNO ) == IDYES )
            {
                m_nLastCommand = -1;// Reset the command.
                SetProgramState( m_bProgramState );// Reenable the buttons.
            }
            else
            {
                m_pTimer = SetTimer( nIDEvent, TIMER_3SEC, 0 );
            }
            break;
    }

    CDialog::OnTimer(nIDEvent);
}

void CIrDADemoDlg::ClearTraceBuffer()
{
    m_strTraceBuffer.Empty();
}
```

NOTES:

APPENDIX D: PPC SOURCE CODE - CLIENTTHREAD.CPP

FIGURE D-1: CLIENTTHREAD.CPP - PAGE 1

```
// ClientThread.cpp : implementation file
//

#include "stdafx.h"
#include "IrDA Demo.h"
#include "ClientThread.h"
#include ".\clientthread.h"

extern CEvent termEvent; // event to communicate termination of all threads
extern long nThreadCount; // count of all active threads

#define DEVICE_LIST_LEN    10

// CClientThread

IMPLEMENT_DYNCREATE(CClientThread, CWinThread)

CClientThread::CClientThread():m_bDeviceAttached(FALSE)
{
    // count of all threads running
    if ( InterlockedIncrement( &nThreadCount ) == 1 )
        termEvent.ResetEvent();// only one reset needed

    m_hSocket = NULL;
    m_pDevListBuff = NULL;
    m_nDevListLen = sizeof(DEVICELIST) - sizeof(IRDA_DEVICE_INFO) +
                    (sizeof(IRDA_DEVICE_INFO) * DEVICE_LIST_LEN);
    m_pDevListBuff = new unsigned char[m_nDevListLen];
    m_DestSockAddr.irdaAddressFamily = AF_IRDA;
    m_DestSockAddr.irdaDeviceID[0] = 0;
    m_DestSockAddr.irdaDeviceID[1] = 0;
    m_DestSockAddr.irdaDeviceID[2] = 0;
    m_DestSockAddr.irdaDeviceID[3] = 0;
    memcpy( m_DestSockAddr.irdaServiceName, "IrDA:IrCOMM", 25 );
}
```

FIGURE D-2: CLIENTTHREAD.CPP - PAGE 2

```
CClientThread::~CClientThread()
{
    // this notifies parent thread when all threads have been deleted
    // note that it's still not terminated at this point, but it's close enough
    if (InterlockedDecrement(&nThreadCount) == 0)
        termEvent.SetEvent(); // possibly called twice, but no harm done

    if ( m_pDevListBuff )
        delete [] m_pDevListBuff;
}

BOOL CClientThread::InitInstance()
{
    TRACE( _T( "CClientThread::InitInstance()\n" ));

    if ( m_bSimulate == FALSE )
    {
        // The sequence to connect to a device is: create a socket,  scan the immediate vicinity
        // for IrDA standard devices with the IRLMP_ENUMDEVICES socket option,  choose a device
        // from the returned list, form an address and call connect.

        // Need to use AF_IRDA, which is an int, as the address family, but the class takes
        // a string as the address.  So use the non-MFC functions to create the socket, then
        // attach it to my MFC derived class.
        //    SOCKET socket(BOOL Create( UINT nSocketPort = 0,
        //    int af, int nSocketType = SOCK_STREAM,
        //    int type, long lEvent,
        //    int protocol;     LPCTSTR lpszSocketAddress = NULL );

        WORD       WSAVerReq = MAKEWORD(1,1);
        WSADATA    WSAData;

        if ( WSAStartup( WSAVerReq, &WSAData ) != 0 )
        {
            // wrong winsock dlls?
            AfxMessageBox( IDS_WINSOCK_DLLS, MB_OK | MB_ICONEXCLAMATION );
        }
    }

    return TRUE;
}

int CClientThread::ExitInstance()
{
    // Send message to the main thread indicating that this socket connection has closed
    AfxGetMainWnd()->SendMessage( WM_CONNECTION_CLOSE );
    return CWinThread::ExitInstance();
}

BEGIN_MESSAGE_MAP(CClientThread, CWinThread)
    ON_THREAD_MESSAGE(WM_TERM_THREAD, OnTermThread)
    ON_THREAD_MESSAGE(WM_DEVICE_SEARCH, OnDeviceSearch)
    ON_THREAD_MESSAGE(WM_DEVICE_CONNECT, OnDeviceConnect)
    ON_THREAD_MESSAGE(WM_DEVICE_DISCONNECT, OnDeviceDisconnect)
END_MESSAGE_MAP()
```

FIGURE D-3: CLIENTTHREAD.CPP - PAGE 3

```
// CClientThread message handlers

// User-defined message will be posted by parent thread when parent thread's
// main window is going to close.
void CClientThread::OnTermThread(UINT, LONG)
{
    TRACE( _T( "CClientThread::OnTermThread()\n" ));

    // active close
    if ( m_socket.m_fConnected )
    {
        m_socket.m_fConnected = FALSE;
        m_socket.ShutDown();
        m_socket.Close();
    }

    ::PostQuitMessage( 0 );
}

// Continuously searches for devices connected to the IR port.
// Called by CIrDADemoDlg when in Normal Disconnect Mode (NDM).
void CClientThread::OnDeviceSearch(UINT bContinueSearching, LONG)
{
    TRACE( _T( "CClientThread::OnDeviceSearch()\n" ));

    // Connect to the simulator or to the board on the IR port.
    // m_bSimulate is set with the command line flag /s.  For debugging,
    // the flag is set under Project->Properties->Debugging
    if ( m_bSimulate )
    {
        // Post message that device is connected and supply name of device.
        AfxGetMainWnd()->PostMessage( WM_DEVICE_ATTACHED, 0, (LPARAM)"Simulating" );
    }
```

FIGURE D-4: CLIENTTHREAD.CPP - PAGE 4

```
    else
    {
        // This function is called twice.  Once to start and
        // once to stop.  We don't want to start twice.
        if (( m_bContinueSearching == TRUE ) && ( bContinueSearching == TRUE ))
            return;

        m_bContinueSearching = bContinueSearching;

        while ( m_bContinueSearching )
        {
            MSG msg;

            // Process other messages
            while ( ::PeekMessage( &msg, NULL, 0, 0, PM_NOREMOVE ) )
            {
                if ( !PumpMessage( ) )
                {
                    m_bContinueSearching = FALSE;
                    ::PostQuitMessage( 0 );
                    break;
                }
            }

            // If SearchForDevices() fails due to an error with the socket,
            // it will post a message and change m_bContinueSearching to FALSE.
            SearchForDevices( 5 /* Number of searches */);

            // Check for a connected device.
            PDEVICELISTpDevList = (PDEVICELIST)m_pDevListBuff;

            if ( pDevList->numDevice > 0 )
            {
                // Just assume that there is only one device
                // connected and that it is the MCP IrDA standard demo board.
                //for ( int i = 0; i < (int)pDevList->numDevice; i++ )
                //{
                //    // For each IR port, check for the IrDA standard demo board.
                //    // typedef struct _IRDA_DEVICE_INFO
                //    // {
                //    //     u_char    irdaDeviceID[4];
                //    //     char      irdaDeviceName[22];
                //    //     u_char    irdaDeviceHints1;
                //    //     u_char    irdaDeviceHints2;
                //    //     u_char    irdaCharSet;
                //    // } _IRDA_DEVICE_INFO;
                //    // pDevList->Device[i]. see _IRDA_DEVICE_INFO for fields
                //    // display the device names and let the user select one
                //}
```

FIGURE D-5: CLIENTTHREAD.CPP - PAGE 5

```
                // Don't repeatedly send the device attached message.
                if ( m_bDeviceAttached == FALSE )
                {
                    m_bDeviceAttached = TRUE;

                    memcpy(&m_DestSockAddr.irdaDeviceID[0],
                           &pDevList->Device[0].irdaDeviceID[0], 4);
                    TRACE( _T( "Found Device\nID - %s\nName - %s\n" ),
                                pDevList->Device[0].irdaDeviceID,
                                pDevList->Device[0].irdaDeviceName );

                    TCHAR strW[22];

                    for ( int index = 0; index < 22; index++ )
                        strW[ index ] = pDevList->Device[0].irdaDeviceName[ index ];

                    // Post message that device is connected and supply name of device.
                    AfxGetMainWnd()->PostMessage( WM_DEVICE_ATTACHED, 0, (LPARAM)strW );
                }
            }
            else
            {
                // Don't repeatedly send the device detached message.
                if ( m_bDeviceAttached == TRUE )
                {
                    TRACE( _T( "Device Detached\n" ));
                    m_bDeviceAttached = FALSE;

                    // Post message that there is no device.
                    AfxGetMainWnd()->PostMessage( WM_DEVICE_NOTATTACHED );
                }
            }
        }
    }
}

void CClientThread::OnDeviceConnect(UINT, LONG)
{
    TRACE( _T( "CClientThread::OnDeviceConnect()\n" ));

    // Stop the searching in function OnDeviceSearch()
    m_bContinueSearching = FALSE;

    // Connect to the simulator or to the board on the IR port.
    // m_bSimulate is set with the command line flag /s.  For debugging,
    // the flag is set under Project->Properties->Debugging
    if ( m_bSimulate )
    {
        if ( m_socket.m_hSocket == INVALID_SOCKET )
            m_socket.Create();

        // Try to connect to the peer
        if ( m_socket.Connect( m_strServerName, SOCKET_PORT ) == 0 )
        {
            if ( GetLastError() != WSAEWOULDBLOCK )
            {
                DisplaySocketError();
                ::PostQuitMessage( 0 );    // Terminates thread.
            }
        }
    }
```

FIGURE D-6: CLIENTTHREAD.CPP - PAGE 6

```
    else //if ( m_bSimulate == FALSE )
    {
        //    SOCKADDR_IRDA m_DestSockAddr = { AF_IRDA, 0, 0, 0, 0, "IrDAService" };
        //    typedef struct _SOCKADDR_IRDA
        //    {
        //    u_short     irdaAddressFamily;
        //    u_char      irdaDeviceID[4];
        //    char        irdaServiceName[25];
        //    } SOCKADDR_IRDA, *PSOCKADDR_IRDA, FAR *LPSOCKADDR_IRDA;

        // The MFC functions don't seem to support the options needed for the IrDA standard.
        // Therefore, use the SOCKET handle first to set options and attach here before
        //  connecting.

        // Enable 9 Wire mode before connect().
        int Enable9WireMode  = 1;

        if ( setsockopt( m_hSocket, SOL_IRLMP, IRLMP_9WIRE_MODE, (const char *) &Enable9WireMode,
            sizeof(int) )  == SOCKET_ERROR )
        {
            DisplaySocketError();
        }
        else
        {
            if ( m_socket.Create() )
            {
                if ( m_socket.Attach( m_hSocket ) != 0 )
                {
                    if ( m_socket.Connect((const struct sockaddr *) &m_DestSockAddr,
                         sizeof(SOCKADDR_IRDA)) == SOCKET_ERROR )
                    {
                        DisplaySocketError();
                    }

                    WCE_INS m_socket.OnConnect( 0 );
                }
                else
                {
                    DisplaySocketError();
                }
            }
        }
    }
}
```

FIGURE D-7: CLIENTTHREAD.CPP - PAGE 7

```
void CClientThread::OnDeviceDisconnect(UINT, LONG)
{
    TRACE( _T( "CClientThread::OnDeviceDisconnect()\n" ));

    m_bDeviceAttached = FALSE;

    // active close
    if ( m_socket.m_fConnected )
    {
        m_socket.m_fConnected = FALSE;
        m_socket.ShutDown();
        m_socket.Close();// Deallocates socket handles and frees associated resources.
        m_hSocket = NULL;
    }

    AfxGetMainWnd()->PostMessage( WM_CONNECTION_CLOSE );
}

BOOL CClientThread::SearchForDevices(int nNumberOfSearches)
{
    if ( nNumberOfSearches == 0 )
        return FALSE;

    PDEVICELIST    pDevList = (PDEVICELIST)m_pDevListBuff;

    // Initialize the number of devices to zero.
    pDevList->numDevice = 0;
    int nDevListLen = m_nDevListLen;    // Want to preserve the size of the allocated list
                                        //   so we can reuse it.

    // The MFC function GetSockOpt() only supports two levels (SOL_SOCKET and IPPROTO_TCP).
    // Need to use the SOL_IRLMP level with the option IRLMP_ENUMDEVICES which doesn't seem
    // to be supported either.  Therefore, use the handle to get the options.  When the user
    // tries to connect, use the MFC function Attach() to attach the handle to our class.
    // IRLMP_ENUMDEVICES returns a list of all available IrDA standard devices in pDevList.

    if (( INVALID_SOCKET == m_hSocket ) || ( NULL == m_hSocket ))
    {
        m_hSocket = socket( AF_IRDA, SOCK_STREAM, 0 );

        if ( INVALID_SOCKET == m_hSocket )
        {
            CString str;
            int nError = WSAGetLastError();

            if ( nError == WSAEAFNOSUPPORT )
                str.Format( IDS_NOIRDA_SUPPORT );
            else
            {
                str.Format( IDS_SOCKET_FAILURE, nError );
                str = str + CString( (LPCSTR)IDS_EXITAPP );
            }

            if ( AfxMessageBox( str, MB_ICONEXCLAMATION | MB_YESNO ) == IDYES )
                // There is nothing that can be done without a socket, so shut down
                // the application or the user will get this error repeatedly.
                AfxGetMainWnd()->SendMessage( WM_CLOSE );

            return FALSE;
        }
    }
```

FIGURE D-8: CLIENTTHREAD.CPP - PAGE 8

```
    if ( getsockopt( m_hSocket, SOL_IRLMP, IRLMP_ENUMDEVICES, (char *) pDevList, &nDevListLen )
== SOCKET_ERROR )
    {
        DisplaySocketError();

        // Stop the searching in function OnDeviceSearch()
        m_bContinueSearching = FALSE;
        return FALSE;
    }
    else
    {
        // Failed to find an IR port.  Keep searching for the specified number of times.
        if ( pDevList->numDevice == 0 )
            return SearchForDevices( --nNumberOfSearches );
    }

    return TRUE;
}

void CClientThread::DisplaySocketError()
{
    int nError = WSAGetLastError();
    CString str;
    str.Format( IDS_SOCKET_FAILURE, nError );
    AfxMessageBox( str, MB_OK | MB_ICONEXCLAMATION );
}
```

APPENDIX E: PPC SOURCE CODE - MCPSOCKET.CPP

FIGURE E-1: MCPSOCKET.CPP - PAGE 1

```
// MCPSocket.cpp : implementation file
//

#include "stdafx.h"
#include "IrDA Demo.h"
#include "MCPSocket.h"
#include "ClientThread.h"
#include <af_irda.h>


// CMCPSocket

CMCPSocket::CMCPSocket()
{
    m_nBytesSent = m_nSendDataLen = 0;
    m_nRecvDataLen = sizeof(int);// initialize for 4 byte data length
    m_nBytesRecv = 0;
    m_fConnected = FALSE;
    m_bReadDataLength = TRUE;
}

CMCPSocket::~CMCPSocket()
{
}
// CMCPSocket member functions

// Peer has closed the TCP connection.
void CMCPSocket::OnClose(int nErrorCode)
{
    ((CClientThread*)m_pThread)->m_hSocket = NULL;
    ((CClientThread*)m_pThread)->m_bDeviceAttached = FALSE;
    m_fConnected = FALSE;
    ShutDown();
    Close();
    TRACE( _T( "CMCPSocket::OnClose:  CAsyncSocket::Close() called\n" ));
    AfxGetMainWnd()->SendMessage( WM_CONNECTION_CLOSE, 0, 0 );
    WCE_INS CCeSocket::OnClose(nErrorCode);
    WCE_DEL CAsyncSocket::OnClose(nErrorCode);
}
```

FIGURE E-2: MCPSOCKET.CPP - PAGE 2

```
void CMCPSocket::OnConnect(int nErrorCode)
{
    OutputDebugString( _T( "CMCPSocket::OnConnect\n" ));

    if ( nErrorCode == 0 )
    {
        m_fConnected = TRUE;
        AfxGetMainWnd()->SendMessage( WM_CONNECTION_DONE, 0, 0 );
    }
    else
    {
        // Error in doing a Connect to peer, I will just quit this thread.
        // Or you might want to notify the parent thread of nErrorCode.
        m_fConnected = FALSE;
    AfxGetMainWnd()->SendMessage( WM_CONNECTION_CLOSE, 0, 0 );
    }

    WCE_INS CCeSocket::OnConnect(nErrorCode);
    WCE_DEL CAsyncSocket::OnConnect(nErrorCode);
}

void CMCPSocket::OnReceive(int nErrorCode)
{
    int nRead = 0;
    char strBuffA[MAX_BUFF];

    //nRead = Receive( m_ReceiveBuff,DATA_SIZE );
    nRead = Receive( strBuffA, DATA_SIZE );

    // Convert the ASCII string to the Unicode string.
    for ( int index = 0; index <= sizeof( strBuffA ); index++ )
        m_ReceiveBuff[ index ] = strBuffA[ index ];

    // if something was read
    if ( nRead > 0 )
    {
        m_ReceiveBuff[nRead] = '\0';
        AfxGetMainWnd()->SendMessage(WM_NEWMESSAGE, (WPARAM)m_ReceiveBuff, (LPARAM)nRead);
    }

    TRACE( _T( "CClientSocket::OnReceive( int nErrorCode = %d )   nRead = %d\n"), nErrorCode,
nRead );
    WCE_INS CCeSocket::OnReceive(nErrorCode);
    WCE_DEL CAsyncSocket::OnReceive(nErrorCode);
}
void CMCPSocket::OnSend(int nErrorCode)
{
    OutputDebugString( _T( "CMCPSocket::OnSend\n" ));

    // Make sure we are connected to peer before sending data.
    // OnSend will also be called right after connection is established,
    // DoAsyncSendBuff() will not send any data because the initial
    // state of this CConnectSoc object has 0 bytes to send.
    if (m_fConnected)
        DoAsyncSendBuff();

    WCE_INS CCeSocket::OnSend(nErrorCode);
    WCE_DEL CAsyncSocket::OnSend(nErrorCode);
}
```

FIGURE E-3: MCPSOCKET.CPP - PAGE 3

```
// Called by the dialog when the user tries to send data.
void CMCPSocket::AsyncSendBuff(void* lpBuf, int nBufLen)
{
    // We don't queue up data here.
    // If you are going to queue up data packet, it would be better to limit the size
    // of the queue and remember to clear up the queue whenever the current packet has been sent.
    if ( m_nSendDataLen != 0 || nBufLen > MAX_BUFF )
    {
        TCHAR szError[256];
        wsprintf( szError, _T( "CConnectSoc::AsyncSendBuff() can't accept more data\n" ));
        AfxMessageBox( szError );
        return;
    }
    else
    {
        if ( nBufLen > MAX_BUFF )
        {
            TCHAR szError[256];
            wsprintf( szError, _T( "CConnectSoc::AsyncSendBuff() oversize buffer.\n" ));
            AfxMessageBox( szError );
            return;
        }

        memcpy( m_sendBuff, lpBuf, nBufLen );
        m_nSendDataLen = nBufLen;
        m_nBytesSent = 0;
        DoAsyncSendBuff();
    }

    AfxGetMainWnd()->SendMessage( WM_SEND_COMPLETE );
    TRACE( _T( "CMCPSocket::AsyncSendBuff()\n" ));
}
```

FIGURE E-4: MCPSOCKET.CPP - PAGE 4

```
// Send the data left in the buffer.  Called by AsyncSendBuff() and OnSend().
// If TCP stack cannot accept more data and gives error of WSAEWOULDBLOCK,
// we break out of the while loop. Whenever TCP stack can accept more data,
// our CConnectSoc::OnSend() will be called.
void CMCPSocket::DoAsyncSendBuff()
{
    while ( m_nBytesSent < m_nSendDataLen )
    {
        int nBytes;

        if (( nBytes = Send( (LPCTSTR)m_sendBuff + m_nBytesSent, m_nSendDataLen - m_nBytesSent ))
             == SOCKET_ERROR )
        {
            if ( GetLastError() == WSAEWOULDBLOCK )
                break;
            else
            {
                TCHAR szError[256];
                wsprintf( szError, _T( "Server Socket failed to send: %d" ), GetLastError() );
                Close();
                AfxMessageBox( szError );
                m_nBytesSent = 0;
                m_nSendDataLen = sizeof( int );
                return;
            }
        }
        else
        {
            m_nBytesSent += nBytes;
        }
    }

    if ( m_nBytesSent == m_nSendDataLen )
    {
        m_nBytesSent = m_nSendDataLen = 0;
    }
}
```

APPENDIX F: PPC SOURCE CODE - TRANSPARENTBITMAP.CPP

FIGURE F-1: TRANSPARENTBITMAP.CPP - PAGE 1

```
#include "StdAfx.h"
#include "transparentbitmap.h"

CTransparentBitmap::CTransparentBitmap(void)
{
}

CTransparentBitmap::CTransparentBitmap(UINT nIDResource, COLORREF cTransparentColor) :
m_cTransparentColor( cTransparentColor )
{
    LoadBitmap( nIDResource );
}

CTransparentBitmap::~CTransparentBitmap(void)
{
}
```

FIGURE F-2: TRANSPARENTBITMAP.CPP - PAGE 2

```
void CTransparentBitmap::DrawTransparentBitmap(CDC* pDC, int xStart, int yStart)
 {
    CBitmap    bmAndBack, bmAndObject, bmAndMem, bmSave;
    CDC        dcMem, dcBack, dcObject, dcTemp, dcSave;

    dcTemp.CreateCompatibleDC( pDC );
    dcTemp.SelectObject( this );          // Select the bitmap


    BITMAP bm;
    GetObject( sizeof( BITMAP ), (LPSTR)&bm );

    CPoint     ptSize;
    ptSize.x = bm.bmWidth;                // Get width of bitmap
    ptSize.y = bm.bmHeight;               // Get height of bitmap
    dcTemp.DPtoLP(&ptSize, 1);            // Convert from device
                                          // to logical points

    // Create some DCs to hold temporary data.
    dcBack.CreateCompatibleDC(pDC);
    dcObject.CreateCompatibleDC(pDC);
    dcMem.CreateCompatibleDC(pDC);
    dcSave.CreateCompatibleDC(pDC);

    // Create a bitmap for each DC. DCs are required for a number of GDI functions.

    // Monochrome DC
    bmAndBack.CreateBitmap(ptSize.x, ptSize.y, 1, 1, NULL);

    // Monochrome DC
    bmAndObject.CreateBitmap(ptSize.x, ptSize.y, 1, 1, NULL);

    bmAndMem.CreateCompatibleBitmap(pDC, ptSize.x, ptSize.y);
    bmSave.CreateCompatibleBitmap(pDC, ptSize.x, ptSize.y);

    // Each DC must select a bitmap object to store pixel data.
    CBitmap* pbmBackOld   = dcBack.SelectObject(&bmAndBack);
    CBitmap* pbmObjectOld = dcObject.SelectObject(&bmAndObject);
    CBitmap* pbmMemOld    = dcMem.SelectObject(&bmAndMem);
    CBitmap* pbmSaveOld   = dcSave.SelectObject(&bmSave);

    // The only mapping mode Windows CE supports is MM_TEXT
    // Set proper mapping mode.
    // dcTemp.SetMapMode(pDC->GetMapMode());

    // Save the bitmap sent here, because it will be overwritten.
    dcSave.BitBlt(0, 0, ptSize.x, ptSize.y, &dcTemp, 0, 0, SRCCOPY);

    // Set the background color of the source DC to the color
    // contained in the parts of the bitmap that should be transparent
    COLORREF cColor = dcTemp.SetBkColor( m_cTransparentColor );

    // Create the object mask for the bitmap by performing a BitBlt
    // from the source bitmap to a monochrome bitmap.
    dcObject.BitBlt(0, 0, ptSize.x, ptSize.y, &dcTemp, 0, 0, SRCCOPY);
```

FIGURE F-3: TRANSPARENTBITMAP.CPP - PAGE 3

```
    // Set the background color of the source DC back to the original
    // color.
    dcTemp.SetBkColor(cColor);

    // Create the inverse of the object mask.
    dcBack.BitBlt(0, 0, ptSize.x, ptSize.y, &dcObject, 0, 0, NOTSRCCOPY);

    // Copy the background of the main DC to the destination.
    dcMem.BitBlt(0, 0, ptSize.x, ptSize.y, pDC, xStart, yStart, SRCCOPY);

    // Mask out the places where the bitmap will be placed.
    dcMem.BitBlt(0, 0, ptSize.x, ptSize.y, &dcObject, 0, 0, SRCAND);

    // Mask out the transparent colored pixels on the bitmap.
    dcTemp.BitBlt(0, 0, ptSize.x, ptSize.y, &dcBack, 0, 0, SRCAND);

    // XOR the bitmap with the background on the destination DC.
    dcMem.BitBlt(0, 0, ptSize.x, ptSize.y, &dcTemp, 0, 0, SRCPAINT);

    // Copy the destination to the screen.
    pDC->BitBlt(xStart, yStart, ptSize.x, ptSize.y, &dcMem, 0, 0, SRCCOPY);

    // Place the original bitmap back into the bitmap sent here.
    dcTemp.BitBlt(0, 0, ptSize.x, ptSize.y, &dcSave, 0, 0, SRCCOPY);

    // Reset the memory bitmaps.
    dcBack.SelectObject(pbmBackOld);
    dcObject.SelectObject(pbmObjectOld);
    dcMem.SelectObject(pbmMemOld);
    dcSave.SelectObject(pbmSaveOld);

    // Memory DCs and Bitmap objects will be deleted automatically
 }

void CTransparentBitmap::DrawBitmap(CDC *pDC, CRect rect, BOOL bCenter)
{
    ASSERT_VALID( pDC );
    //ASSERT_VALID( pBitmap );

    CDC dcMem;
    dcMem.CreateCompatibleDC( pDC );

    CBitmap* pOldBitmap = dcMem.SelectObject( this );

    if ( bCenter )
    {
        BITMAP bitmap;
        GetObject( sizeof( BITMAP ), &bitmap );
        CSize sizeBitmap( bitmap.bmWidth, bitmap.bmHeight );
        CSize diff = rect.Size() - sizeBitmap;
        rect.DeflateRect( diff.cx / 2, diff.cy / 2 );
    }

    pDC->BitBlt( rect.left, rect.top, rect.Width(), rect.Height(), &dcMem, 0, 0, SRCCOPY );
    dcMem.SelectObject( pOldBitmap );}
```

NOTES:

APPENDIX G: PPC SOURCE CODE - INCLUDE FILES

FIGURE G-1: IrDA DEMO.H

```
// IrDA Demo.h : main header file for the PROJECT_NAME application
//
#pragma once

#ifndef __AFXWIN_H__
    #error include 'stdafx.h' before including this file for PCH
#endif

#include "resource.h"// main symbols

// CIrDADemoApp:
// See IrDA Demo.cpp for the implementation of this class
//
class CIrDADemoApp : public CWinApp
{
public:
    CIrDADemoApp();

// Overrides
    public:
    virtual BOOL InitInstance();

// Implementation

    DECLARE_MESSAGE_MAP()
};
extern CIrDADemoApp theApp;
```

FIGURE G-2: IrDA DEMODLG.H - PAGE 1

```
/////////////////////////////////////////////////////////////////////////////////////////
;                         Software License Agreement
;
;  The software supplied herewith by Microchip Technology Incorporated
;  (the "Company") is intended and supplied to you, the Companyís
;  customer, for use solely and exclusively with products manufactured
;  by the Company.
;
;  The software is owned by the Company and/or its supplier, and is
;  protected under applicable copyright laws. All rights are reserved.
;  Any use in violation of the foregoing restrictions may subject the
;  user to criminal sanctions under applicable laws, as well as to
;  civil liability for the breach of the terms and conditions of this
;  license.
;
;  THIS SOFTWARE IS PROVIDED IN AN "AS IS" CONDITION. NO WARRANTIES,
;  WHETHER EXPRESS, IMPLIED OR STATUTORY, INCLUDING, BUT NOT LIMITED
;  TO, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A
;  PARTICULAR PURPOSE APPLY TO THIS SOFTWARE. THE COMPANY SHALL NOT,
;  IN ANY CIRCUMSTANCES, BE LIABLE FOR SPECIAL, INCIDENTAL OR
;  CONSEQUENTIAL DAMAGES, FOR ANY REASON WHATSOEVER.
/////////////////////////////////////////////////////////////////////////////////////////

// IrDA DemoDlg.h : header file
//

#pragma once

class CMCPSocket;
class CClientThread;
class CTransparentBitmap;

//#include "PushButton.h"

// CIrDADemoDlg dialog
class CIrDADemoDlg : public CDialog
{
// Construction
public:
    LRESULT OnConnectionClose(WPARAM, LPARAM);
    LRESULT OnNewMessage(WPARAM lParam, LPARAM);
    LRESULT OnConnectionDone(WPARAM wParam, LPARAM);  // pending connection has been established
    LRESULT OnConnectionClosed(WPARAM wParam, LPARAM);// pending connection has been established
    LRESULT OnDeviceAttached(WPARAM wParam, LPARAM);
    LRESULT OnDeviceNotAttached(WPARAM wParam, LPARAM);
    LRESULT OnSendDataComplete(WPARAM wParam, LPARAM);
    CIrDADemoDlg(CWnd* pParent = NULL);// standard constructor

    CClientThread* m_pClientThread;
    CString m_strServerName;
    BOOL m_bSimulate;
    CString m_strTxFileName;
```

FIGURE G-3: IrDA DEMODLG.H - PAGE 2

```
// Dialog Data
    enum { IDD = IDD_IRDADEMO_DIALOG };

// Implementation
protected:
    HICON                  m_hIcon;
    int                    m_nLastCommand;
    CString                m_lastString;
    CTransparentBitmap*    m_pConnectedBitmap;
    CTransparentBitmap*    m_pConnectNotBitmap;
    CTransparentBitmap*    m_pCurrentStateBitmap;
    BOOL                   m_bConnecting;
    int                    m_bProgramState;
    WCE_DEL CAnimateCtrl   m_DeviceAnimation;
    UINT_PTR               m_pTimer;
    CString                m_strRawRecvData;
    CString                m_strTraceBuffer;

    void ClearTraceBuffer();
    void RedrawConnectionBitmap();
    void DrawConnectionImage();
    BOOL ConnectWithServer();
    void DisconnectWithServer();
    void CleanupThread();
    virtual void DoDataExchange(CDataExchange* pDX);    // DDX/DDV support
    void SendData(int nData);
    void SendData(CString strData);
    void InitializeSocketThread();
    void SearchForDevices();
    void CreateDeviceAnimation();
    void EnableButtons(BOOL nEnable);

    // Generated message map functions
    virtual BOOL OnInitDialog();
    afx_msg void OnSysCommand(UINT nID, LPARAM lParam);
    WCE_DEL afx_msg void OnPaint();
    afx_msg HCURSOR OnQueryDragIcon();
    afx_msg void OnBnUpdateConnection( CCmdUI* pCmdUI );
    DECLARE_MESSAGE_MAP()

public:
    afx_msg void OnBnClickedReadData();
    afx_msg void OnBnClickedClearData();
    afx_msg void OnBnClickedConnect();
    afx_msg void OnBnClickedAsciiHex();
    afx_msg void OnBnClickedSendByte();
    afx_msg void OnBnClickedSendFile();
    afx_msg void OnBnClickedReceiveFile();
    afx_msg void OnBnClickedShowRawData();

protected:
    virtual void OnOK();
public:
    void SetProgramState(int nState);
    afx_msg void OnTimer(UINT nIDEvent);
};
```

FIGURE G-4: CLIENTTHREAD.H

```
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/////////////////////////////////////////////////////////////////////////////////////////

#pragma once

#include "MCPSocket.h"

// CClientThread

class CClientThread : public CWinThread
{
    DECLARE_DYNCREATE(CClientThread)

protected:
    CClientThread();           // protected constructor used by dynamic creation
    virtual ~CClientThread();

public:
    CMCPSocket    m_socket;
    CString       m_strServerName;
    BOOL          m_bSimulate;
    SOCKET        m_hSocket;
    BOOL          m_bDeviceAttached;
    virtual BOOL InitInstance();
    virtual int ExitInstance();

protected:
    int            m_nDevListLen;
    int            m_bContinueSearching;
    unsigned char* m_pDevListBuff;
    SOCKADDR_IRDA  m_DestSockAddr;
    BOOL SearchForDevices(int nNumberOfSearches);
    void DisplaySocketError();
    afx_msg void OnTermThread(UINT, LONG);
    afx_msg void OnDeviceSearch(UINT, LONG);
    afx_msg void OnDeviceConnect(UINT, LONG);
    afx_msg void OnDeviceDisconnect(UINT, LONG);
    DECLARE_MESSAGE_MAP()
public:
//    virtual BOOL OnIdle(LONG lCount);
};
```

FIGURE G-5: MCPSOCKET.H

```
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/////////////////////////////////////////////////////////////////////////////////////////

#pragma once

class CIrDADemoDlg;

// CMCPSocket command target

WCE_INS class CMCPSocket : public CCeSocket
WCE_DEL class CMCPSocket : public CAsyncSocket
{
public:
    CMCPSocket();
    virtual ~CMCPSocket();

    CWinThread* m_pThread; // the thread we are running in
    CCriticalSection* m_pCriticalSection;
    CString* m_pLastString;

    TCHAR m_sendBuff[MAX_BUFF];
    int   m_nSendDataLen;    // length of data to send
    int   m_nBytesSent;      // bytes sent so far

    TCHAR m_ReceiveBuff[MAX_BUFF];
    int   m_nRecvDataLen;     // bytes to receive
    int   m_nBytesRecv;       // bytes received so far
    BOOL  m_fConnected;       // TCP connection
    BOOL  m_bReadDataLength;  // reading packet header
    void  AsyncSendBuff(void* lpBuf, int nBufLen);

    CIrDADemoDlg* m_pIrDADemoDlg;
    virtual void OnConnect(int nErrorCode);
    virtual void OnSend(int nErrorCode);
    virtual void OnReceive(int nErrorCode);
    virtual void OnClose(int nErrorCode);

protected:
    void    DoAsyncSendBuff();
};
```

FIGURE G-6: TRANSPARENTBITMAP.H

```
#pragma once
#include "afxwin.h"

class CTransparentBitmap :
    public CBitmap
{
public:
    CTransparentBitmap(void);
    CTransparentBitmap(UINT nIDResource, COLORREF cTransparentColor);
    ~CTransparentBitmap(void);
    void DrawBitmap(CDC *pDC, CRect rect, BOOL bCenter);
    void DrawTransparentBitmap(CDC* pDC, int xStart, int yStart);

    COLORREF m_cTransparentColor;
};
```


FIGURE G-7: STDAFX.H - PAGE 1

```
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/////////////////////////////////////////////////////////////////////////////////////////

#pragma once

#ifndef VC_EXTRALEAN
#define VC_EXTRALEAN    // Exclude rarely-used stuff from Windows headers
#endif

#ifndef _WIN32_WCE
// Modify the following defines if you have to target a platform prior to the
// ones specified below.
// Refer to MSDN for the latest info on corresponding values for different platforms.
#ifndef WINVER         // Allow use of features specific to Windows(r) 95
                       //    and Windows NT 4 or later.
#define WINVER 0x0400  // Change this to the appropriate value to target Windows 98
                       //    and Windows 2000 or later.
#endif

#ifndef _WIN32_WINNT   // Allow use of features specific to Windows NT(r) 4 or later.
#define _WIN32_WINNT 0x0400  // Change this to the appropriate value to target Windows 98
                       //    and Windows 2000 or later.
#endif

#ifndef _WIN32_WINDOWS    // Allow use of features specific to Windows 98 or later.
#define _WIN32_WINDOWS 0x0410   // Change this to the appropriate value to target Windows Me
                          //    or later.
#endif

#ifndef _WIN32_IE        // Allow use of features specific to IE 4.0 or later.
#define _WIN32_IE 0x0400  // Change this to the appropriate value to target IE 5.0 or later.
#endif
#endif
```

FIGURE G-8: STDAFX.H - PAGE 2

```
#define _ATL_CSTRING_EXPLICIT_CONSTRUCTORS// some CString constructors will be explicit

// turns off MFC's hiding of some common and often safely ignored warning messages
#define _AFX_ALL_WARNINGS

#include <afxwin.h>         // MFC core and standard components
#include <afxext.h>         // MFC extensions
#include <afxdisp.h>        // MFC Automation classes

#include <afxdtctl.h>       // MFC support for Internet Explorer 4 Common Controls
#ifndef _AFX_NO_AFXCMN_SUPPORT
#include <afxcmn.h>         // MFC support for Windows Common Controls
#endif // _AFX_NO_AFXCMN_SUPPORT

#include <afxsock.h>        // MFC socket extensions
#include <af_irda.h>
#include <afxmt.h>
//#include <lm.h>

// user defined messages
#define WM_NEWMESSAGE           WM_USER+200
#define WM_TERM_THREAD          WM_USER+201
#define WM_CONNECTION_CLOSE     WM_USER+202
#define WM_CONNECTION_DONE      WM_USER+203
#define WM_DEVICE_CONNECT       WM_USER+204
#define WM_DEVICE_DISCONNECT    WM_USER+205
#define WM_DEVICE_SEARCH        WM_USER+206
#define WM_DEVICE_ATTACHED      WM_USER+207
#define WM_DEVICE_NOTATTACHED   WM_USER+208
#define WM_SEND_COMPLETE        WM_USER+209
#define WM_TIMER_SEND_DATA      WM_USER+210
#define WM_TIMER_TX_BYTES       WM_USER+211
#define WM_TIMER_RX_BYTES       WM_USER+212

#define DATA_SIZE               290
#define MAX_BUFF                4096
#define SOCKET_PORT             9000

#ifndef _WIN32_WCE
#define WCE_INS                 /##/
#define WCE_DEL
#endif
```

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