ZigBee™ environment Demonstration (ZeD)

Software User's Guide

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About This Book

This guide describes the Freescale ZigBee™ environment Demonstration (ZeD) software graphical user interface (GUI). This guide shows users how to connect a ZigBee evaluation board to a PC and use the GUI to run the ZeD software to accomplish various demonstration and visualization tasks for a ZigBee network.

Audience

This document is intended for users of the Freescale ZeD software. Users must have a basic understanding of the functionality of the boards contained in the Freescale EVKs. For further details on ZeD and the boards in the EVK, refer to the following relevant documentation:

- *ZeD Quick Start Guide* — Contains a brief description of how to install and run the ZeD software
- *ZeD Embedded Software Design User's Guide* — Contains details about the embedded software that runs on the boards
- *13192 Evaluation Board Development Kit (13192EVB) User's Guide* — Provides a detailed description of how to use the Freescale 13192 Evaluation Board (EVB)
- *13192EVK Evaluation Kit (13192EVK) User's Guide* — Provides a detailed description of how to use the Freescale 802.15.4/ZigBee Evaluation Kit (13192-EVK) that contains the 13192-EVB and the Sensor Application Reference Design (SARD) boards.
- *1321x Evaluation Kits User's Guide* — Provides a detailed description of how to use the Freescale 802.15.4/ZigBee Kits. The guide describes all three kits that contain the 1321x Network Coordinator Board (NCB) and 1321x Sensor Reference Board (SRB).

Organization

This document is organized into seven (7) chapters.

Chapter 1	**Introduction** — This chapter provides an overview of the ZeD graphical user interface (GUI).
Chapter 2	**Connecting the PC to an Evaluation Board** — This chapter shows how to connect a PC running the ZeD software to a Freescale board.
Chapter 3	**ZeD Main Window** — Describes the main window of the ZeD software.
Chapter 4	**ZeD Demonstration Scenario** — This chapter takes the user through a demonstration scenario meant to illustrate more of the advanced capabilities such as using binding, groups and scenes commands to control the Home Automation devices that come with the Freescale EVK.
Chapter 5	**ZeD Views** — Provides details on the five ZeD Views available for selection using the buttons in the ZeD Views panel.
Chapter 6	**ZeD Menus and Options** — Shows the functions available from the ZeD software menu bar and the user-adjustable options for the operation of the application as found in the Options window.

Chapter 7 **Endpoint Properties Window** — This chapter provides a description of the endpoint properties window where users can interact with and configure the devices in the ZigBee network.

Revision History

The following table summarizes revisions to this document since the previous release (Rev 1.1)

Revision History

Location	Revision
Entire Document	Updated for 1322x-EVK.

Definitions, Acronyms, and Abbreviations

The following list defines the acronyms and abbreviations used in this document.

EVK	Evaluation Kit
EVB	MC13192 Evaluation Board with S08GT60 MCU
GUI	Graphical User Interface
PC	Personal Computer
USB	Universal Serial Bus
ZeD	ZigBee Environment Demonstration software

References

The following sources were referenced to produce this book:

1. ZigBee Alliance, ZigBee Document 053474r17, ZigBee Specification
2. ZigBee Alliance, ZigBee Document 053520r25, ZigBee Home Automation Profile Specification
3. ZigBee Alliance, ZigBee Document 075123r01, ZigBee Cluster Library Specification
4. Freescale *ZeD Quick Start Guide*
5. Freescale *ZeD Embedded Software Design User's Guide*

Chapter 1
Introduction

The Freescale ZeD software allows users to set up and monitor ZigBee devices in a ZigBee network. A device is a board running an embedded ZigBee application. The boards can be either the MC1322x Network Node (NN), MC1322x Sensor Node (SN) and MC1322x Low Power Node (LPN) part of the 1322x-EVK or the NCB, SRB, EVB, or SARD which are part of either the Freescale 13192-EVK or 1321x-EVK. QE128-EVB boards are also supported if they are loaded with ZeD specific Home Automation applications provided in the “Embedded” folder of the ZeD installation.

See the following documents for detailed information about the boards.

- *13192 Evaluation Board Development Kit (13192EVB) User’s Guide* — Provides a detailed description of how to use the Freescale 13192 Evaluation Board (EVB)
- *13192EVK Evaluation Kit (13192EVK) User’s Guide* — Provides a detailed description of how to use the Freescale 802.15.4/ZigBee Evaluation Kit (13192-EVK) that contains the 13192-EVB and the Sensor Application Reference Design (SARD) boards.
- *1321x Evaluation Kits User’s Guide* — Provides a detailed description of how to use the Freescale 802.15.4/ZigBee Kits. The guide describes all three kits that contain the 1321x Network Coordinator Board (NCB) and 1321x Sensor Reference Board (SRB).
- The *ZeD Quick Start Guide* provides information about installing ZeD and using it to visualize a ZigBee Home Automation network made up of the boards in the Freescale EVKs. Freescale recommends reading and following the use case in the *ZeD Quick Start Guide* before moving on with this guide.

1.1 System Overview

Figure 1-1 shows one ZigBee Coordinator device connected to the PC and four remote devices communicating with the Coordinator. As shown in this figure, the labels on the PC screen reference the devices and the icons reference the endpoints. Each endpoint has a profile and an application device description. This example uses the ZigBee Home Automation profile.

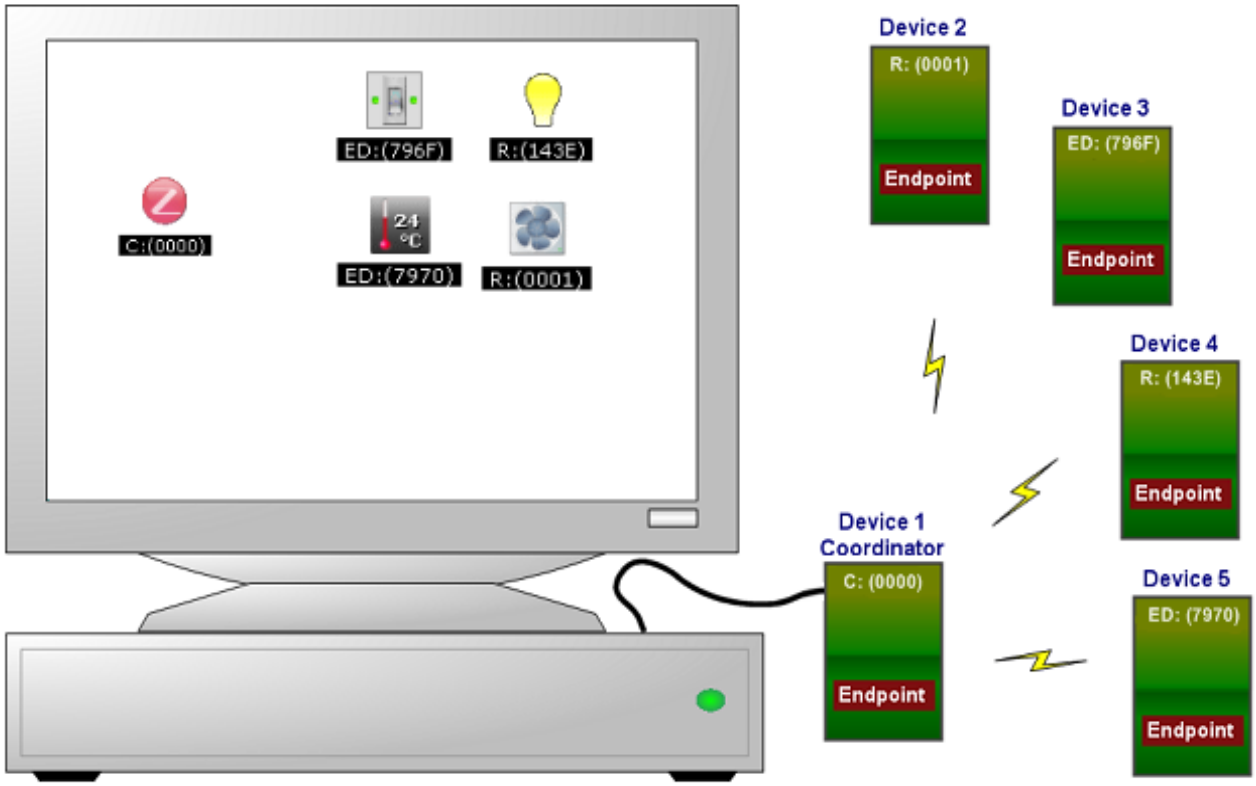

Figure 1-1. Home Automation Setup Example

1.2 Features

The ZeD software has the following features:

- An intuitive and easy-to-use graphical user interface
- Provides a practical and easy to follow way to try out examples that demonstrate ZigBee functionality
- Real time visualization of the status of the devices in the network
- Graphical presentation of different types of Home Automation devices
- Graphical presentation of bindings, groups and scenes
- Multi-tabbed windows that show both general and profile-specific information

Chapter 2
Connecting the PC to an Evaluation Board

This chapter describes how to connect Freescale ZigBee evaluation boards to a PC running the ZeD software. This chapter also describes how to configure the ZeD software so that it can establish communication with the ZigBee Coordinator board. The ZigBee Coordinator board (the board withe the Combined Interface label in the EVK) acts as a gateway so that the ZeD software can discover and extract information about the end devices and nodes in the ZigBee network and display that information on the PC.

2.1 Connecting the Boards

The Freescale ZigBee evaluation boards communicate with a PC by using either a USB port or an RS232 serial port connection.

When employing the USB connection, the Windows® driver for the board creates a virtual COM port that encapsulates and hides the USB driver communication details and thus ensures a common way of communicating with the boards for all connection types. As a result, each board is assigned a COM port number on the PC. To communicate from a PC application to a certain board, users must know the COM port number of the board. ZeD also uses the COM port number but is able to automatically detect it. For details about automatic detection of the board port number in ZeD, see Section 2.3, “Automatic Detection of the Coordinator”.

When using the USB connection, virtual COM port numbers are assigned depending on what PC USB socket is used and on the board type.

For the serial RS232 serial connection type, the COM port number for a certain serial port socket on the PC is always the same (usually COM1 or COM2).

NOTE

If using the onboard AA battery pack to power the SRB and the temperature sensor is being used, the readings will not be accurate. To obtain more accurate readings, power the SRB through its on board DC power connector.

When connecting boards employing the USB port, the way to determine the virtual COM port number is to use the Hardware tab of the Windows System Properties window and then expand the Ports (COM & LPT) section. When users connect and power on a board, a new virtual COM port device and a port number appear in the Device Manager Ports section. A board keeps the same COM port number as long as it remains connected to the same physical USB socket.

For ZeD to monitor the ZigBee network, it must be able to communicate with just one board and this board must be a ZigBee Coordinator running the Combined Interface Device application as defined by the ZigBee Home Automation Profile. The Coordinator board acts as the gateway for the ZeD software to

discover and communicate with the other nodes in the ZigBee Network. A Combined Interface application comes pre-loaded to a SN, NCB or EVB board in the EVK.

The Combined Interface Device application is described in the Home Automation Profile specification as being a ZigBee device capable of controlling and monitoring other devices. A Combined Interface Device is usually attached to, or integrates with, a PC. The other devices in the network only need to be powered on for ZeD to work with them. These other boards are not required to have a virtual COM port assigned to them, or even be connected to the PC.

NOTE

When a PC program is connected to a board using its COM port, no other program should communicate with that board. When starting ZeD, users must ensure that the COM port of the Coordinator board is not in use by other instances of ZeD or other communication software.

2.2 Forming the ZigBee Network

After connecting the Combined Interface Coordinator board to the PC, the ZigBee network must be started on the Coordinator. The predefined channel for starting the network is channel 26 (centered at 2480 MHz). The network Coordinator is started by briefly pressing SW1/S1 on its board. Only after the network has started (LED1 and LED2 on the Coordinator board are on) can the other devices join the network and the board can be autodetected by ZeD.

The other boards can now join the network in a random order by briefly pressing switch S1/ SW1 on each board. Users must wait for a node to join the network. To verify that an End Device has joined the network, verify that LED1 of the end device board is on. To verify that a router has joined the network verify that LED1 and LED2 on the router board are on.

See the *ZeD 13192-EVK Quick Start Guide*, the *ZeD 1321x-EVK Quick Start Guide* or the *ZeD 1322x-EVK Quick Start Guide* for information on how to quickly setup and start a network.

2.3 Automatic Detection of the Coordinator

When the ZeD software starts, it automatically tries to detect the virtual COM port of the ZigBee Coordinator board. For the autodetection process to work, the Coordinator board the following items must be in place.

- The Coordinator board must be connected to the PC using a USB connection
- The ZigBee network must be already formed by the Coordinator.

If using the RS232 serial connection, the COM port of the Coordinator board must be specified manually using the Add Internal button on the Coordinator Selection window as described in Section 2.4, “Coordinator Selection Window”. Automatic detection of the Coordinator at application start-up is enabled by default when users install the ZeD software, but it can be disabled using the ZeD Options window described in Section 6.2, “ZeD Options Window”.

During the Coordinator automatic detection process, ZeD tries to communicate with each of the Freescale ZigBee boards connected to the PC to see if the board is a ZigBee Coordinator. While running the

automatic detection process, ZeD displays the progress in the automatic detection window shown in Figure 2-1.

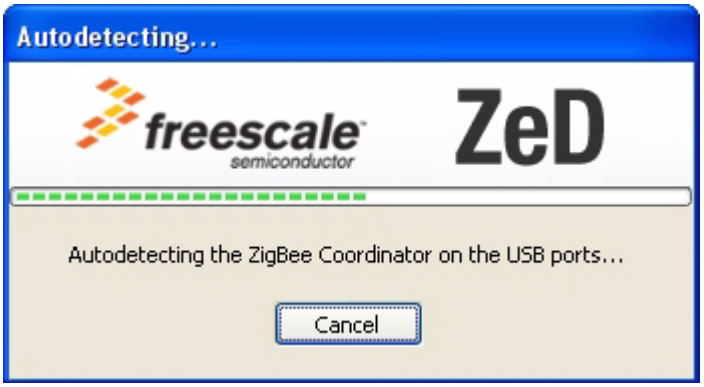

Figure 2-1. ZeD Coordinator Autodetection Window

If the user clicks the Cancel button, the autodetection process ends and the Coordinator Selection window appears. There will only be partial information about the connected boards in the Device List.

2.4 Coordinator Selection Window

The Coordinator Selection window allows users to specify the COM port of the Coordinator board. Users can either confirm the COM port identified by the Coordinator automatic detection process described in Section 2.3, “Automatic Detection of the Coordinator” or indicate another port using the advanced options in the window.

As shown in Figure 2-2, the Coordinator Selection window contains a Device List that shows COM port numbers and device types for the boards connected to those ports, as well as a set of buttons that allow users to customize the Device List. When users click the OK button on the Coordinator Selection window, the ZeD software uses the selected port number in the Device List to start communicating with the Coordinator board.

Alternatively, users can click the Demo Mode button to not use any actual board connection, but enter into a special mode of running the ZeD software that offers a limited and non-functional example of what a ZigBee network looks like.

NOTE

The ZeD software also enters the Demo Mode when communication with the board on the selected COM port cannot be established. Failure to communicate with the board can occur because the board is turned off or the port is open by another application.

As shown in Figure 2-2, if the automatic detection process completes successfully and the following information is displayed in the Coordinator Selection window:

- The Coordinator board COM port number is displayed in the Name column of the first item in the Device List. This item displays the text “ZigBee Coordinator (Autodetected)” in the Type column of the list
- The Name column also displays the baud rate what will be established with the device

- Below the Coordinator device, the Device List also contains the port numbers of the other boards connected to the PC using the USB interface and that were also autodetected. The list items corresponding to these boards will have the text “ZigBee Device” in the Type column of the list
- The Location column of the list shows the TCP port on which ZeD has started a server process. This is where ZeD listens for connections from remote instances of ZeD running on other computers in the TCP network

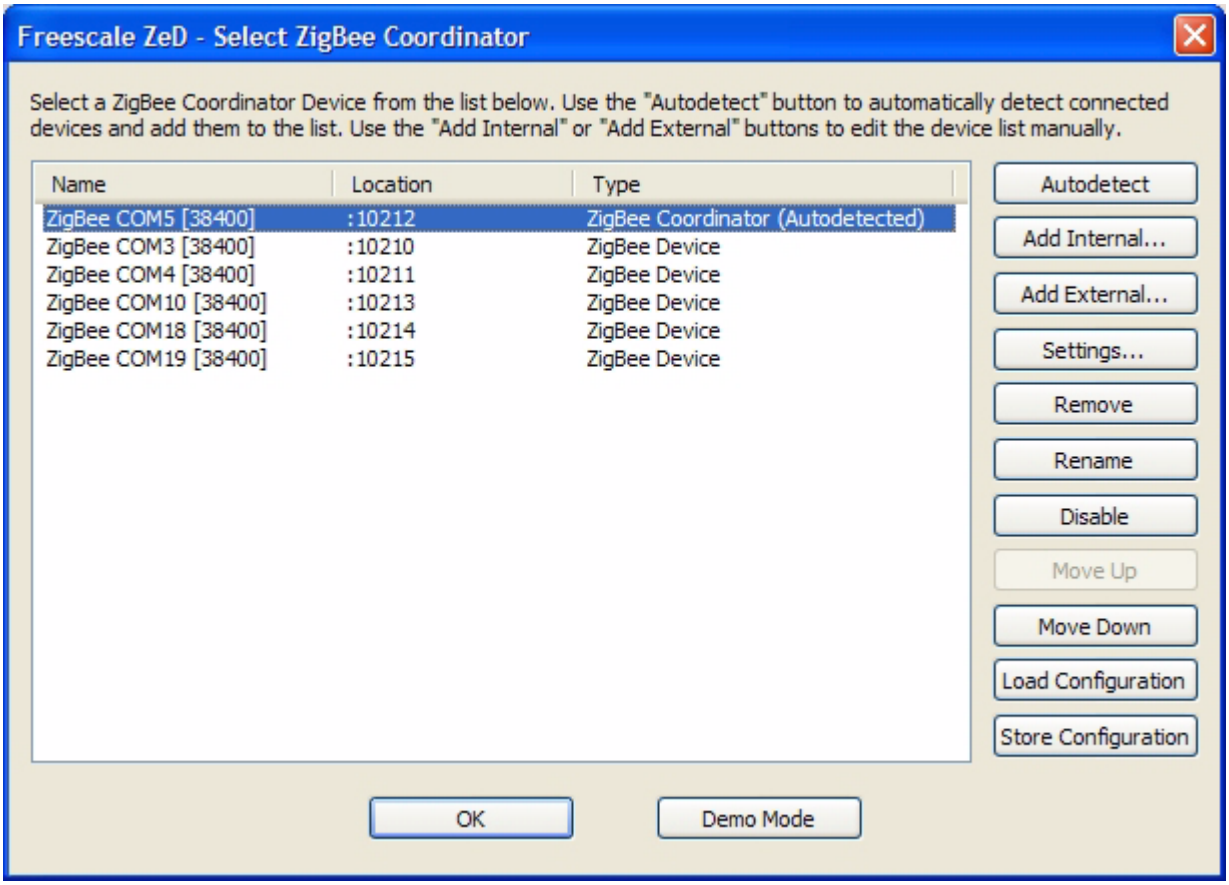

Figure 2-2. The Coordinator Selection Window

Use the buttons on the right side of this window to add and remove devices in the list and manage other advanced settings. The functionality of each of the buttons on the Coordinator Selection window areas follows:

- Autodetect — Repeats the autodetection of the Coordinator port
- Add Internal — Enables users to manually add COM ports for boards connected to the local computer (internal boards) to the Device List. Use this button if the Coordinator Autodetection fails or if the Coordinator board is connected using the RS232 serial COM port.

As shown in Figure 2-3, the Add Internal Ports window appears when users click the Add Internal button. This allows users to adjust of the baud rate for the specified COM port.

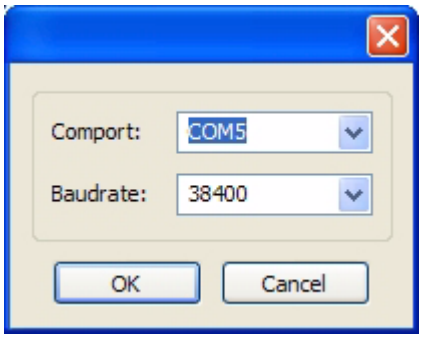

Figure 2-3. Add Internal Ports Window

- Add External — Enables users to add boards connected to another computer to the Device List that may be on a TCP/IP network. Users must start the ZeD software on the other computer (the host computer) and should not proceed to the Main Window of the ZeD software, but allow the application to remain in the Coordinator Selection window at start-up. The host computer should also have the target board present as a locally connected board in the Device List.

  As shown in Figure 2-4, the guest computer can add a connection to the board attached to the host computer by specifying the host computer IP address or host name in the Host edit box and the TCP port for the device in the Port edit box. The TCP port is the number displayed in the Location column on the host computer Coordinator Selection window for the target board.

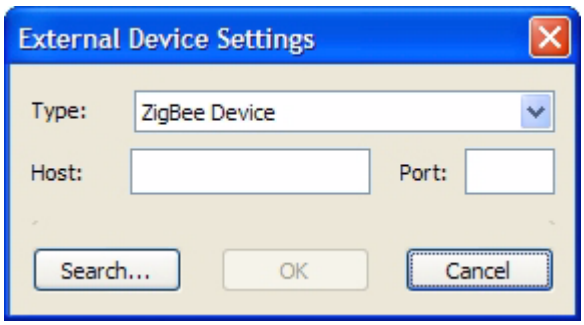

Figure 2-4. External Device Setting Window

The Search button on the External Device Setting window allows users to browse through the workstations and the remotely attached Freescale ZigBee boards that are available in the TCP network as shown in Figure 2-5 which displays the Find External Devices window.

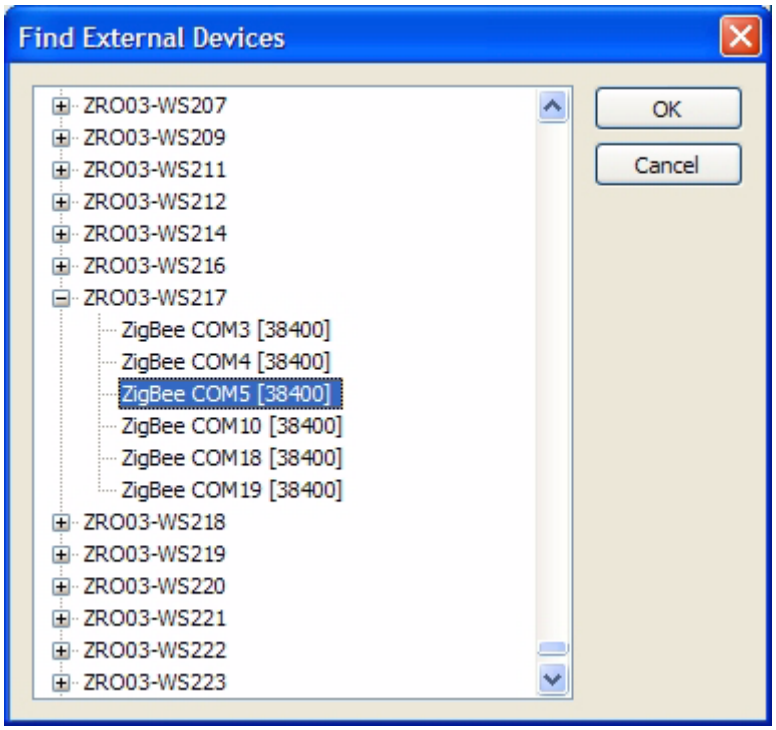

Figure 2-5. Find External Devices Window

As shown in Figure 2-6, once a Coordinator board on another computer is selected, users can click OK on the Find External Devices window to return to the External Device Settings window that now has the Host and Port fields completed with the address of the host computer and the remote board port.

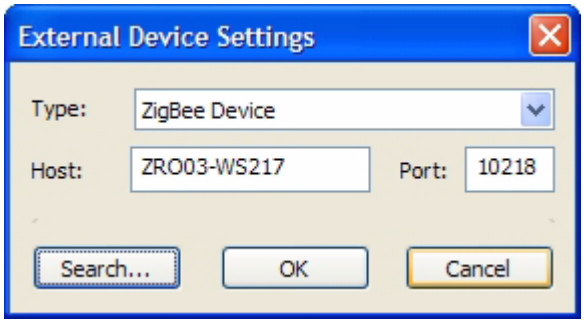

Figure 2-6. External Device Settings Window with Connection Details

The following is a brief summary of the remaining buttons located on the Coordinator Selection window.

- Settings — Enables users to adjust the baud rate for a board that is already added to the Device List
- Remove — Removes the board port from the Device List
- Rename — Renames a board port in the Device List
- Disable — Does not allow a board in the Device List to be used
- Move Up/Down — Changes the position of the board in the Device List
- Load Configuration — Loads a list of ports previously saved using the Save Configuration button

- Store Configuration — Saves a list of ports to the Windows Registry for later use
- Demo Mode — Launches the ZeD Main Window in a special Demo Mode. In this mode, the program does not use actual devices, but uses a list of virtual devices that it loads from the configuration files in the Demo Files folder of the ZeD installation. No network functions can be performed when ZeD is in Demo Mode
- OK — Runs the ZeD software using the selected board port as the Coordinator COM port

Chapter 3
ZeD Main Window

As described in Chapter 2, “Connecting the PC to an Evaluation Board”, once users have selected the COM port of the Coordinator board in the Coordinator Selection window and clicked the OK button, the ZeD main window appears as shown in Figure 3-1. The ZeD Main window allows users to see the topology of the ZigBee network and interact with the ZigBee nodes.

3.1 ZeD Main Window Components

The ZeD main window components are shown in Figure 3-1.

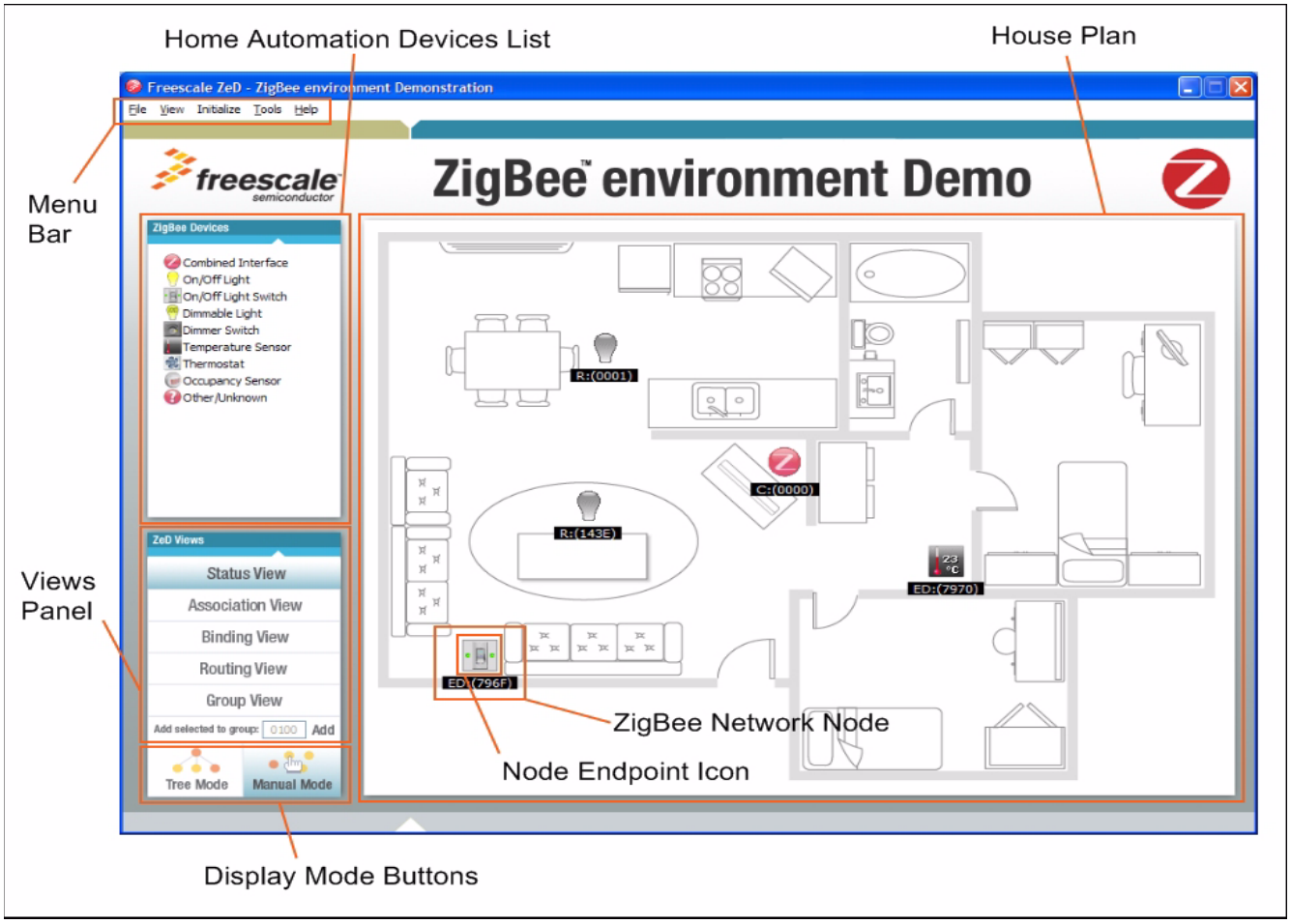

Figure 3-1. ZeD Main Window Components

3.1.1 Overview of the House Plan Image

The House Plan image is the main visualization space for ZeD. The House Plan Image shows the layout of a house that acts as a background image for the nodes in the ZigBee network. The nodes are represented by the icons of the Home Automation device applications that they are running. The position of the node icons only reflect the network topology. Once the nodes have been discovered, users can drag and drop the node icons to their intended location on the House Plan.

NOTE

Users can change the default background image of the House Plan by replacing the `House.bmp` file in the root of the ZeD installation folder with a custom `*.bmp` file. For best results, the custom file should have the same pixel width and height as the default file.

3.1.2 Understanding ZigBee Nodes and Endpoint Icons

A ZigBee node is displayed in the ZeD software as an icons that represents the Home Automation applications running on its endpoints with a label containing the node name. By default, the node name shows the ZigBee node type and the 16-bit ZigBee network address of the node. For example:

- C: (0000) is a ZigBee Coordinator that has the network address 0x0000
- R: (0001) is a ZigBee Router that has the network address 0x0001
- ED: (796F) is a ZigBee End Device that has the network address 0x796F

Each ZigBee node can have multiple endpoints and each endpoint can run a different or the same Home Automation application. That is why in the ZeD software, a node can have multiple icons (one for each endpoint) as shown in Figure 3-2. See the ZigBee Specification for a more detailed explanation about endpoints and ZigBee node types.

Figure 3-2. ZigBee Router Node with 2 On/Off Light Endpoints (Off Indication)

When users double-click an endpoint icon, the Endpoint Properties window appears. See Chapter 7, “Endpoint Properties Window” for details about this window.

When users right click on an endpoint icon, the context menu for the endpoint appears. See Section 5.1, “Common View Features” for details about the options available in this menu.

3.1.3 Home Automation Devices List

As shown in Figure 3-3, the ZigBee Home Automation Devices List contains a list of icons that correspond to the types of Home Automation devices supported by the current version of ZeD. This list allows users to quickly identify the device type of a node endpoint based on its icon. For more information about the device types, see the Home Automation Profile specification available from the ZigBee Alliance.

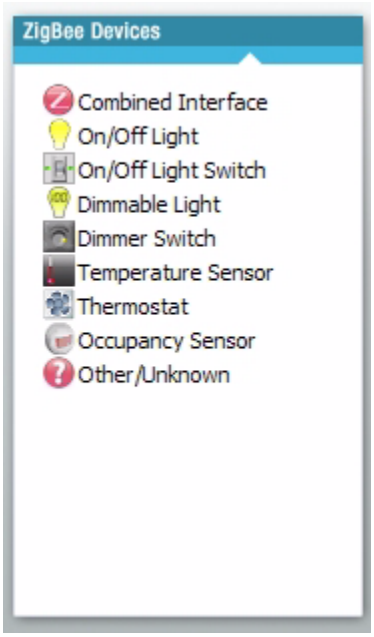

Figure 3-3. ZigBee Home Automation Devices List

If an endpoint on a ZigBee node has an application device identifier which is different from the supported device types, it appears in the ZeD software as an Other/Unknown device as shown in Figure 3-3.

3.1.4 ZeD Views Panel

The ZeD Views panel is shown in Figure 3-4. The panel contains five view buttons that correspond to different views available in ZeD. Users can switch views by clicking the desired view button. In each view, ZeD displays different lines and other graphical elements that allow users to gain a better understanding of certain aspects of the ZigBee network. For more informations about each view, see Chapter 6, “ZeD Menus and Options”.

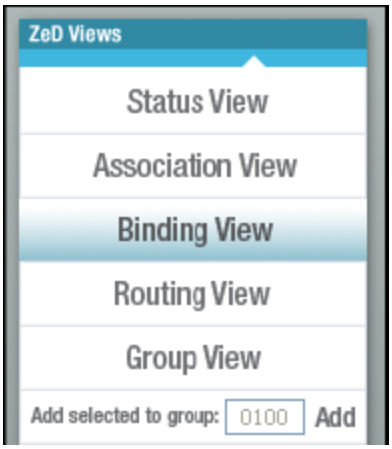

Figure 3-4. ZeD Views Panel

3.1.5 Display Mode Buttons

The ZeD Display Mode buttons shown in Figure 3-5 allow users to switch between Tree and Manual display modes. When users can drag and drop the node icons on the house plan background, ZeD is in Manual display mode.

Figure 3-5. Display Mode Buttons

Tree mode offers a better view of the topology of the network because the icons are displayed in a tree structure. The tree structure shows how each child network node is associated to its parent from the ZigBee network perspective. Freescale recommends using Tree Mode in the Association View. See Section 4.3, “Viewing Associations” for a detailed description of the Association View and an example of using Tree Mode. When in Tree mode, clicking on the Manual mode button makes the node icons go back to their positions on the house plan.

3.2 ZeD Status Messages Window

By default, ZeD also displays a Status Messages window as shown in Figure 3-6. This window provides information about the actions performed by the ZeD software while communicating with the nodes in the network. This information is primarily used for debugging purposes and requires advanced working knowledge of ZigBee networking to understand and is beyond the scope of this guide. Please refer to the ZTC and ZCL documentation that comes with BeeStack for more details on the various messages exchanged with the nodes.

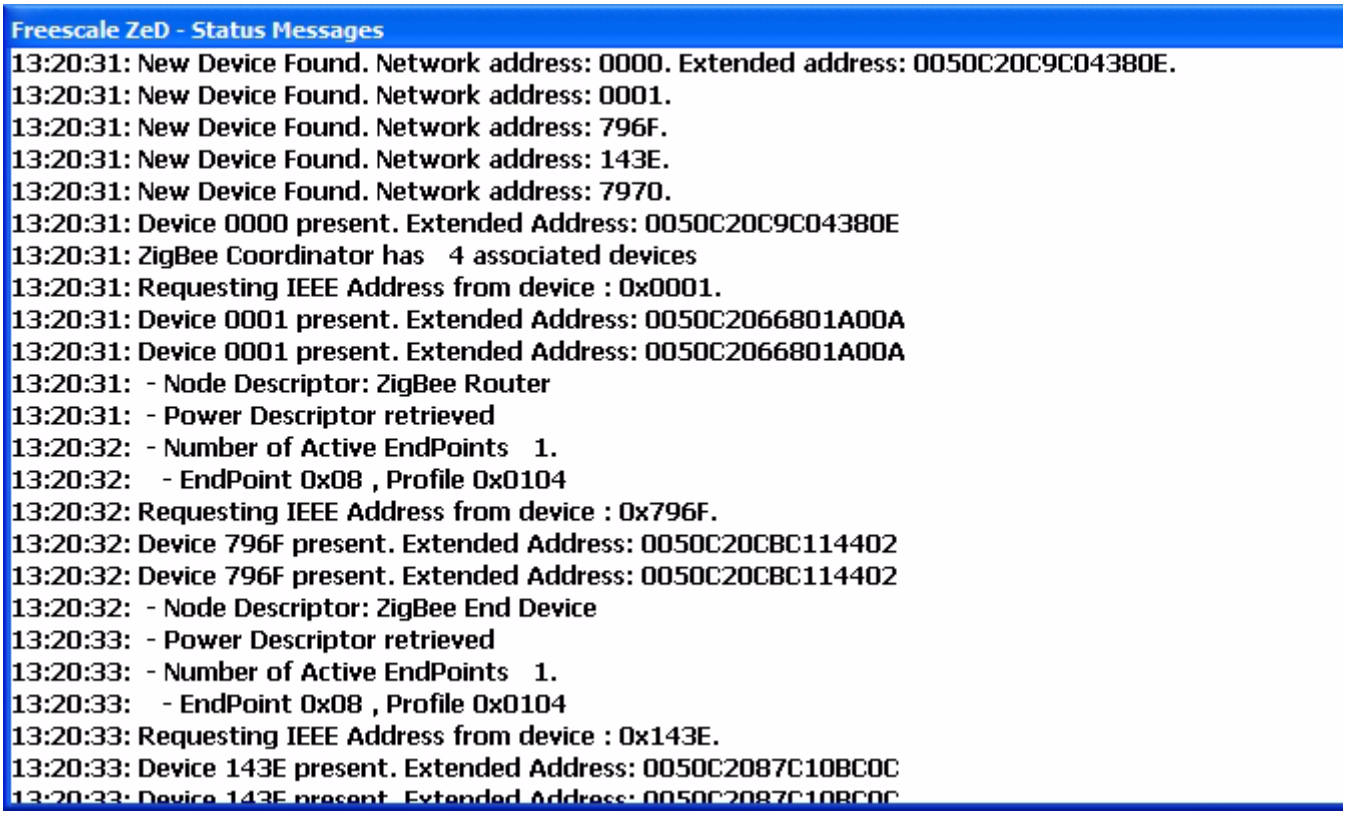

Figure 3-6. Status Messages Window

Chapter 4
ZeD Demonstration Scenario

This chapter takes the user through a demonstration scenario that shows more of the advanced capabilities such as using binding, groups, and scenes commands used to control the Home Automation devices that ship with the Freescale EVKs.

4.1 Demonstration Scenario Requirements

This demonstration scenario assumes that users are employing a very simple ZigBee network made up of the Combined Interface, On/Off Light, and On/Off Switch boards that come with the Freescale EVKs. For showing the functionality of Groups and Scenes, the Dimmable Light device is also used in the scenario. To learn how to form a network and join devices to it, follow the steps for forming a network in the *ZeD Quick Start Guide*.

NOTE

See the *ZeD Quick Start Guide* and follow the steps for forming a Home Automation ZigBee network and making the Home Automation devices communicate with each other before moving on with the scenario presented in this chapter.

This use case first shows how to form a ZigBee network on the coordinator board and how to join the Light and Switch applications boards to the network while ZeD is running. Then it will demonstrate how to use the ZeD GUI to configure the boards by indicating the address of the Light device to the Switch so that the control commands from the Switch can reach the Light (a process called Binding). This chapter also demonstrates how to form a ZigBee group, which is another way of making application-level connections between the ZigBee devices that allows the system to send broadcast messages.

4.2 Starting and Viewing the Network

To start the network, perform the following tasks:

1. Power on the boards and start the network by briefly pressing SW1 on the Coordinator board that is running the Combined Interface. Do not join any other boards yet.
2. Start ZeD as described in Section 3.2. Running ZeD of the ZeD Quick Start Guide. After the auto detection and selection of the coordinator port, the Combined Interface endpoint icon will appear in the ZeD main window as shown in Figure 4-1.

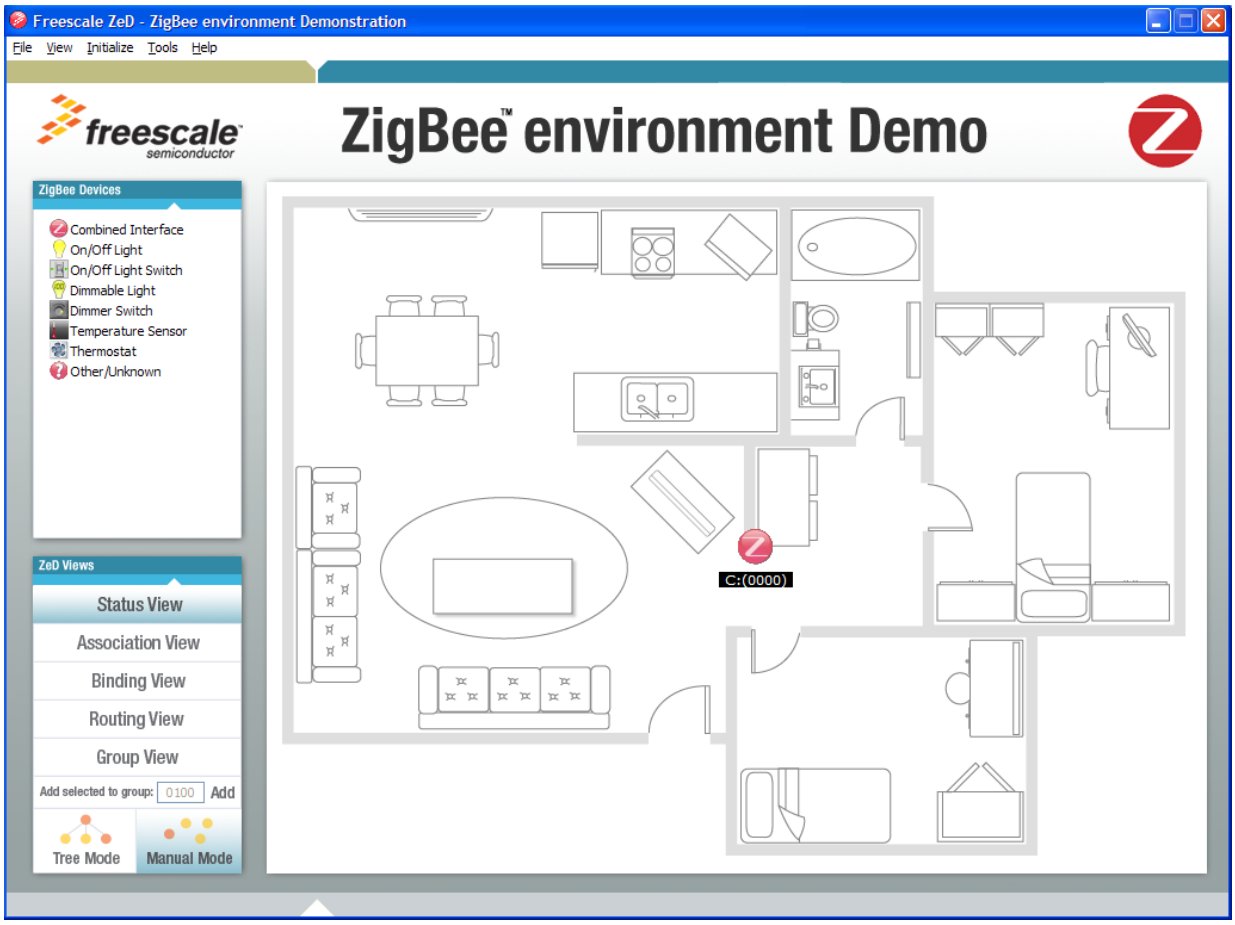

Figure 4-1. ZeD Main Window Showing Combined Interface Device Icon

NOTE

Users can always press F5 while running ZeD to refresh the ZeD views. ZeD rescans the network and shows any newly connected devices or changes the icons of the devices that no longer answer to requests to red.

3. Briefly press SW1 on the board running the On/Off Switch application so that it will join the network. As shown in Figure 4-2, the On/Off Switch endpoint icon appears close to the Combined Interface Device endpoint icon after a few seconds on the ZeD main window.

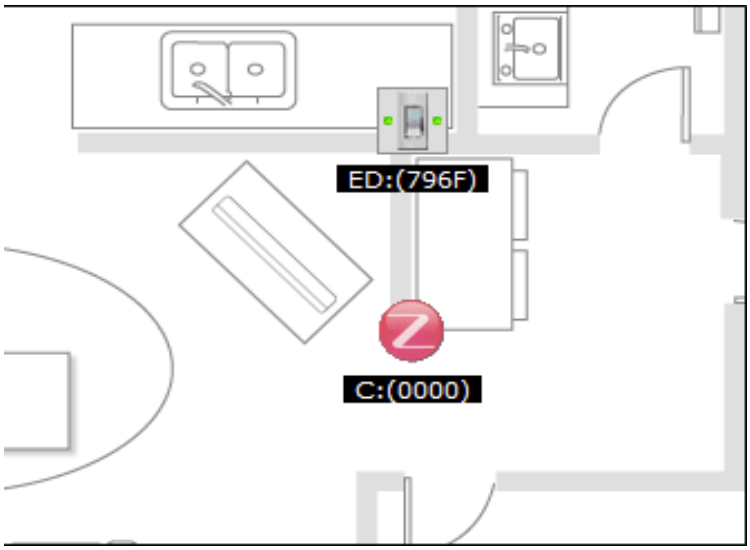

Figure 4-2. ZeD Main Window Showing On/Off Switch Icon

4. Briefly press SW1 on the board running the On/Off Light application so that it will join the network. As shown in Figure 4-3, the On/Off Light endpoint icon (a light bulb) appears after a few seconds on the ZeD main window close to the Combined Interface icon. Notice that the light bulb icon is currently displayed in the off state.

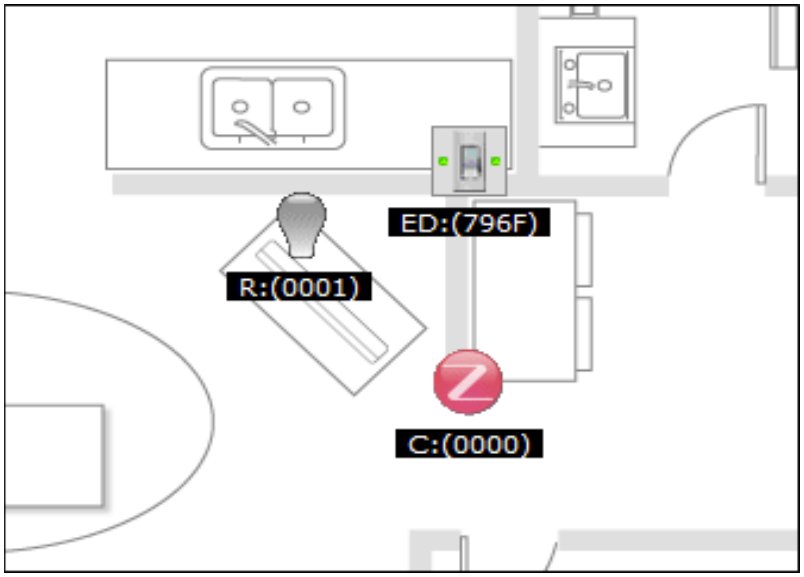

Figure 4-3. ZeD Main Window Showing On/Off Light Icon (Bulb Off State)

Figure 4-4 shows the now formed ZigBee network. In the current ZeD Status View, the window currently only shows the endpoints (the switch, the light, and coordinator). Users can drag and move the icons on the ZeD screen to the desired locations on the house plan background.

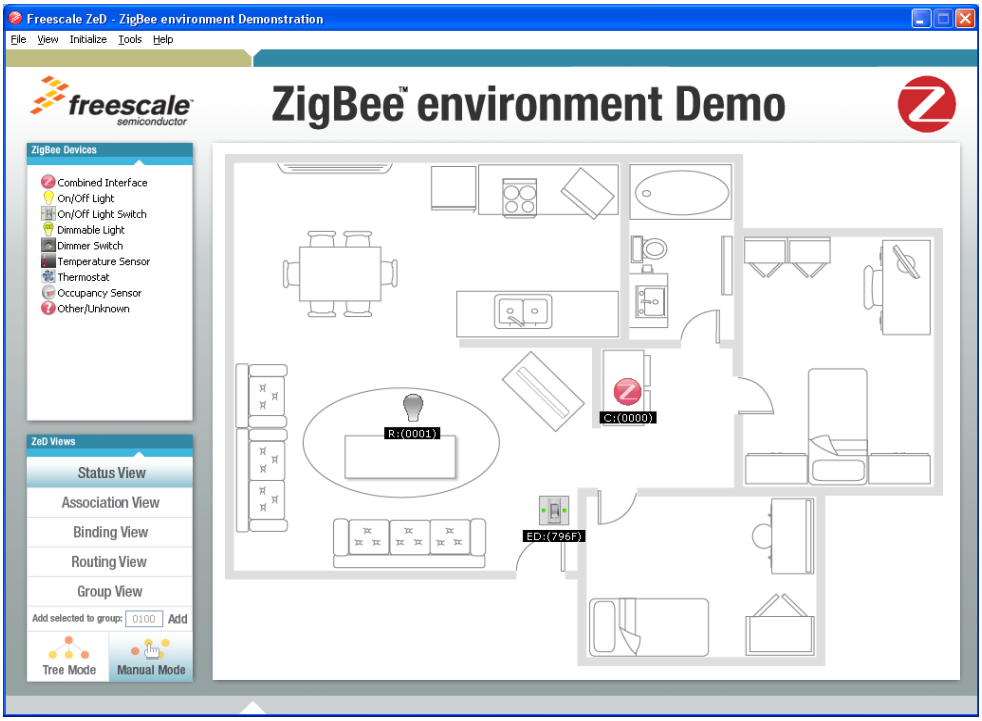

Figure 4-4. ZeD Main Window Showing ZigBee Network Endpoints (Status View)

4.3 Viewing Associations

When a ZigBee device joins a ZigBee network, it connects to another device in the network. The new joined node becomes the child of the node it has connected to. Only ZigBee routers and Coordinators can act as parents to nodes joining the network. ZeD offers a way to visualize how devices are joined to one another. To view device association, click the Association View button in the ZeD views panel as shown in Figure 4-5.

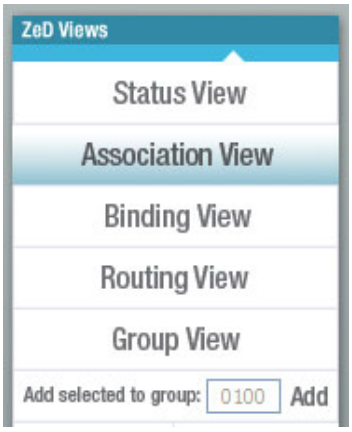

Figure 4-5. ZeD Views Panel with Binding View Active

In Figure 4-6, both On/Off Light and On/Off Switch nodes have joined the network by connecting to the Combined Interface coordinator as indicated by the lines between the icons and the direction of the arrows. The color of the circles around the nodes indicate the ZigBee node type as follows:

- Red = Coordinators
- Blue = Routers
- Yellow = End Devices

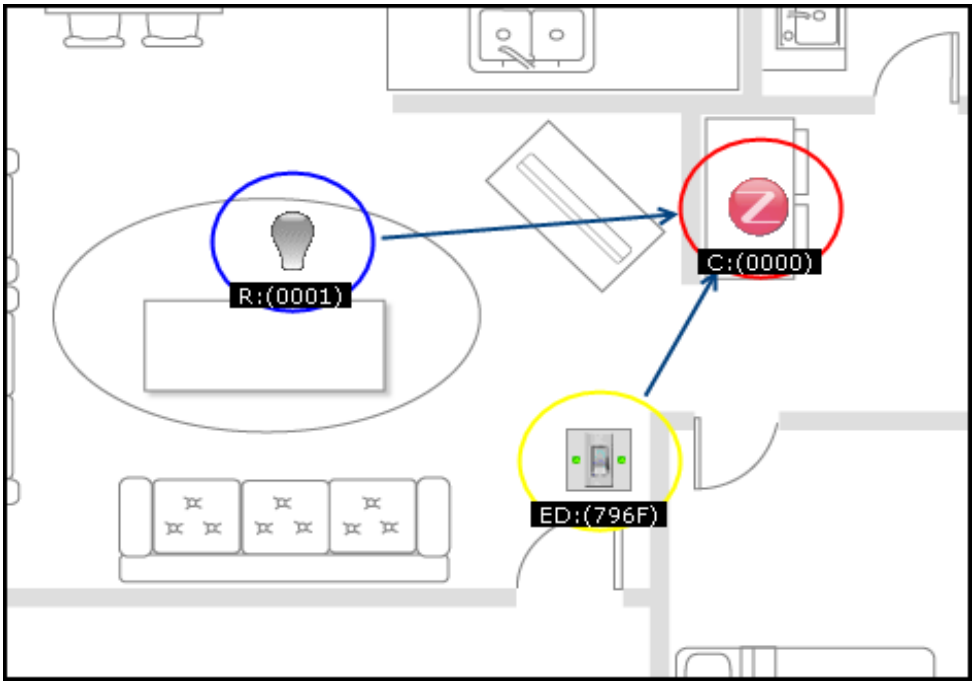

Figure 4-6. ZeD Main Window Showing the Association View

NOTE

As shown in Figure 4-7, the current ZeD display mode is Manual Mode. Users can switch to Tree Mode to get a better view of the device association hierarchy in the ZigBee Network. Press the Manual Mode button to go back to the original device positions on the house plan. In Manual Mode, users can move the node icons by clicking and dragging them to the desired location on the House Plan.

Figure 4-7. Display Mode Buttons

4.4 Placing Boards in Application Mode

This section describes how to place the boards in Application Mode so that the user interface on the boards can perform application specific functions. After starting the network or being joined to a network, the boards are in Configuration Mode and the switches and LEDs on the boards have functions related to the network formation process. By placing the boards in Application Mode, the functions of the switches and LEDs change to application related functions.

For example, in Application Mode, LED2 on the On/Off Light board represents the actual on/off state of the light. Refer to the Freescale appropriate EVK documentation for more details on board user interface.

To place the boards in Application Mode, perform the following steps.

1. Press and hold SW1 on the board that is running the On/Off Light application. LED1 and LED2 will turn off. When LED2 is off, it means that the light is turned off. This is consistent with the light bulb icon appearing in the off state on the ZeD GUI.
2. Press and hold SW1 on the board that is running the On/Off Switch application. LED1 will turn off and LED2 will turn on. SW1 on the board now takes on the function of toggling a light that the On/Off Switch is bound to. The switch will not work until a binding is made to the Light device it needs to control. Making a Binding is addressed in the next section.

4.5 Making a Binding

A ZigBee binding is an application level-connection between two devices that is based on their complementary functions. To make the On/Off Switch send the On/Off/Toggle light commands to the On/Off Light, a binding needs to be made from the On/Off Switch endpoint on the device to the On/Off Light endpoint on the remote device. A binding is always made on a cluster. A cluster is a way to specify what functions the endpoint can perform.

For example, the On/Off Light endpoint has an On/Off cluster that is specified as being a server cluster for the endpoint. This means that the endpoint can accept On/Off/Toggle commands. The On/Off Switch endpoint has the same On/Off cluster, but it is specified as a client cluster for the endpoint. This means that the endpoint is able to send the On/Off/Toggle commands. A binding is made between two endpoints, one of them having the binding cluster as a client cluster and the other endpoint having the binding cluster as a server cluster. This indicates matching complementary functions.

To make a binding between the On/Off Light and the On/Off Switch endpoints on the On/Off cluster, perform the following tasks:

1. Switch to ZeD Binding View by clicking the Binding View button (Figure 4-8). The Binding View allows users to see the bindings between the devices.

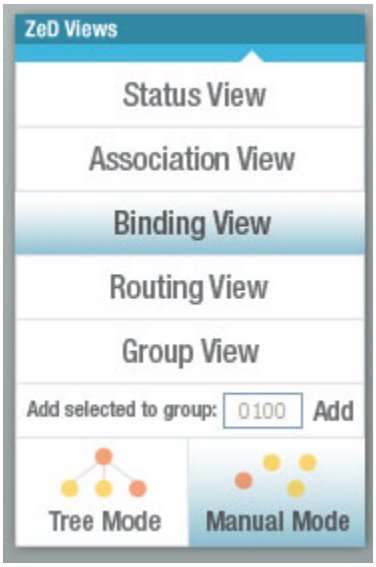

Figure 4-8. ZeD Views Panel with Binding View Active

2. Notice that the view already shows a binding from the On/Off Light to the Combined Interface as shown in Figure 4-9. This binding is automatically made by ZeD when the device is detected so that the light will report to the Combined Interface when it turns on or off.

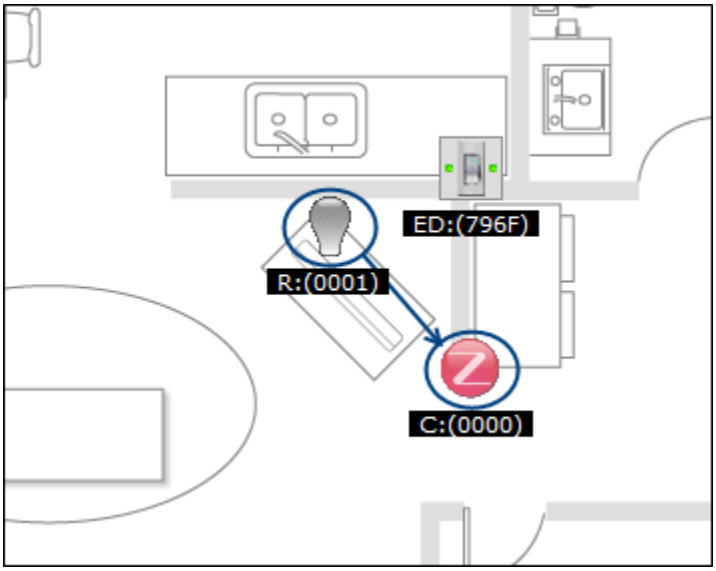

Figure 4-9. ZeD Binding View Showing Binding between On/Off Light and Combined Interface

3. Double-click the On/Off Switch icon in the ZeD Main Window. As shown in Figure 4-10, the EndPoint Properties window appears. This window contains various On/Off Switch Endpoint properties and allows users to review and set bindings for the current endpoint. See Chapter 7, "Endpoint Properties Window" for more information on this window.

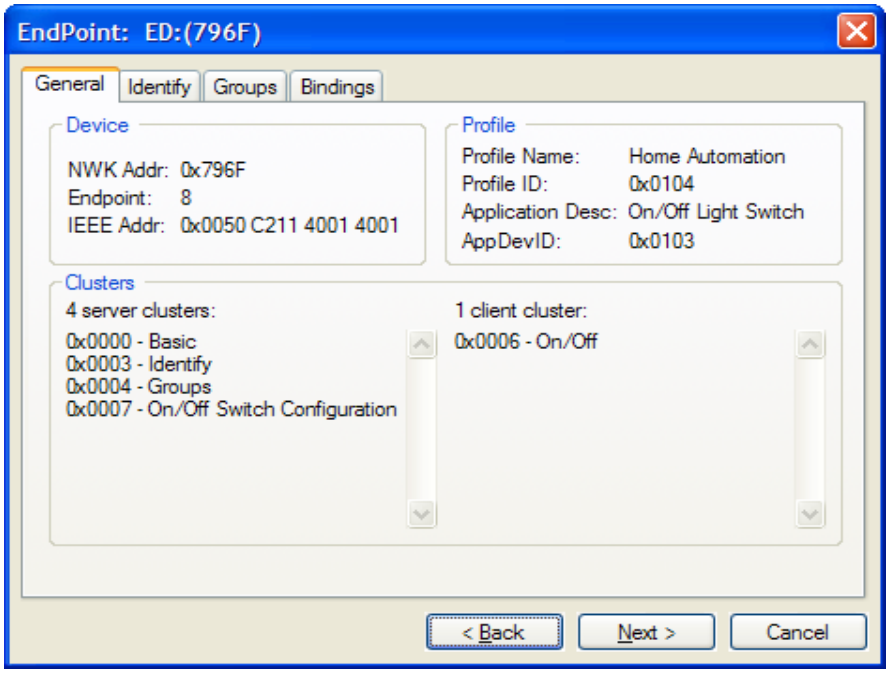

Figure 4-10. Endpoint Properties Window

5. Click on the Bindings tab. The Bindings Window appears as shown in Figure 4-11.

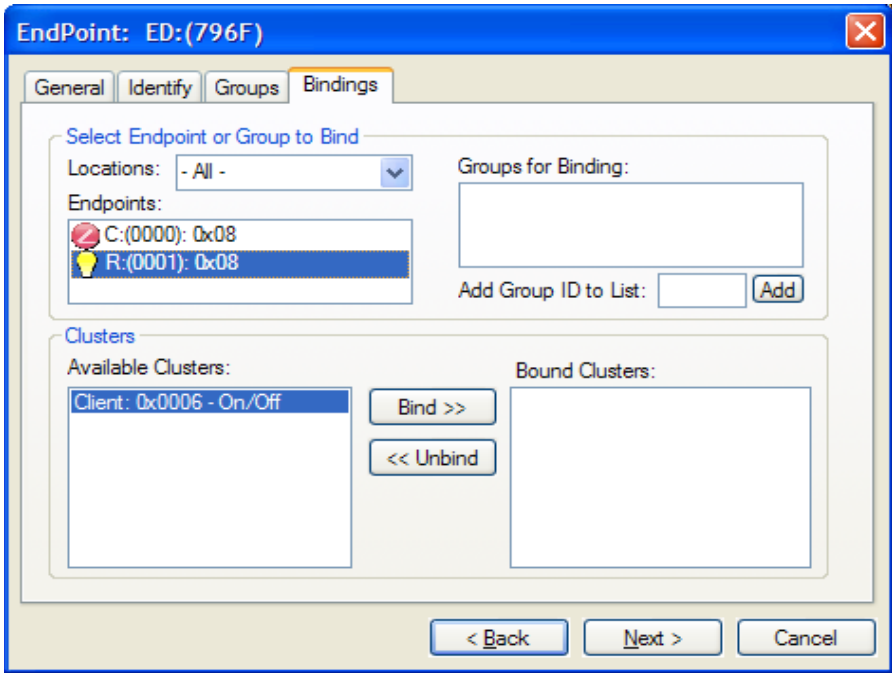

Figure 4-11. Binding Window

6. From the Endpoints: list box, select the On/Off Light device, R:(0001): 0x08.
7. From the Available Clusters list box, select the cluster, Client: 0x0006 On/Off.
8. Click the Bind button. After a few moments, the cluster will appear in the Bound clusters list box.
9. Click on the Cancel button to close the properties window.
10. As shown in Figure 4-12, users can now see a new binding shown as an arrow from the On/Off Switch to the On/Off Light on the ZeD Binding View in the ZeD main window.

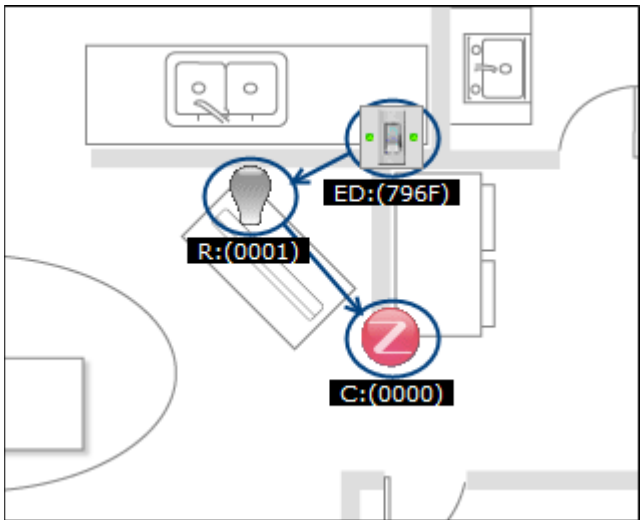

Figure 4-12. New Binding Made from the On/Off Switch to the On/Off Light

11. Briefly press SW1 on the board that is running the On/Off Switch application. This button toggles the remote light. LED2 on the board that is running the On/Off Light application will turn on. As shown in Figure 4-13, the On/Off Light is represented in the ZeD Main window as a light-bulb icon in the on state. Another press of SW1 toggles the light to off again.

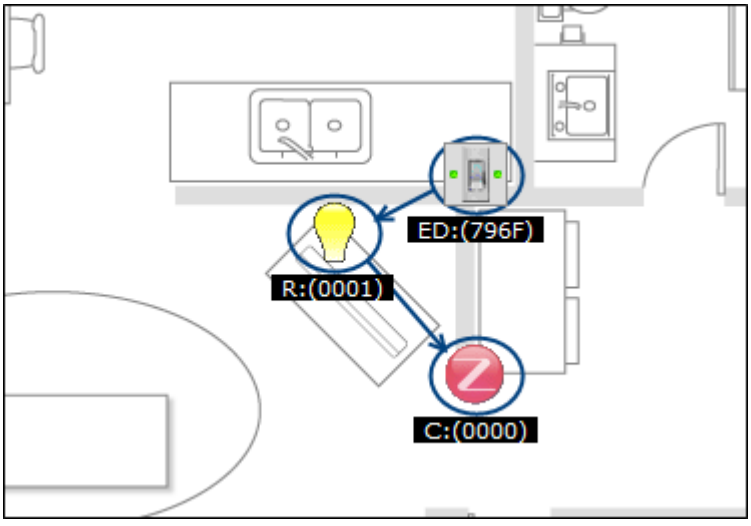

Figure 4-13. The On/Off Light State changes to On

4.6 Removing a Binding

To remove a binding between the On/Off Light and the On/Off Switch endpoints on the On/Off cluster, perform the following tasks:

1. Double-click the On/Off Switch icon in the ZeD Main Window. The EndPoint properties window appears.
2. Click on the Bindings tab. The Window is shown in figure Figure 4-14.

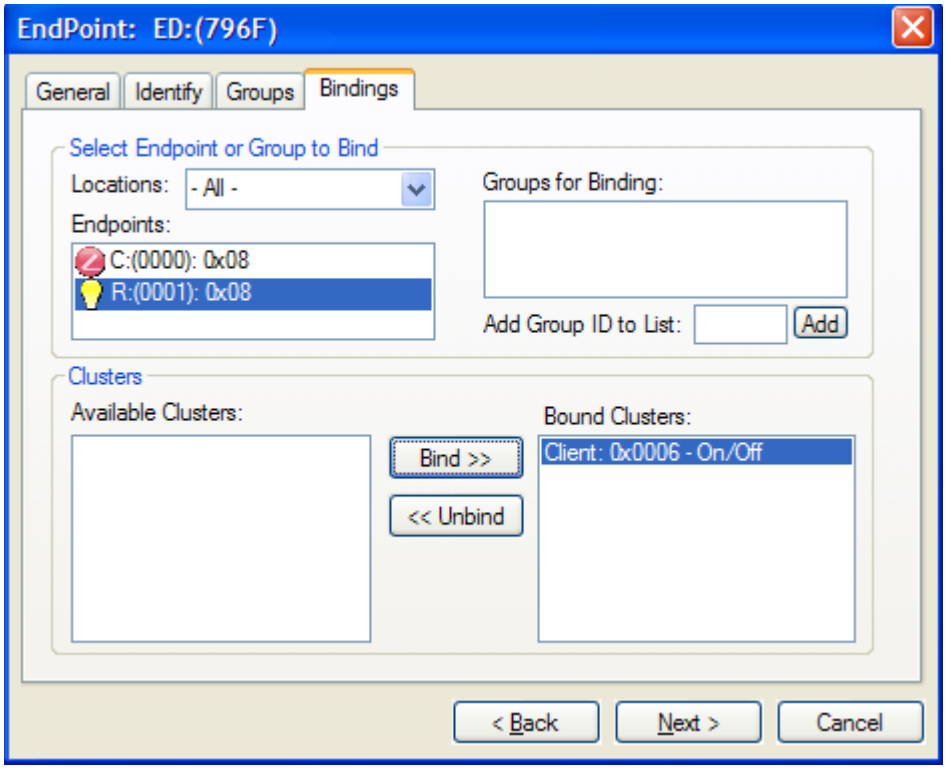

Figure 4-14. Binding Window Showing the On/Off Cluster as Bound

4. From the Endpoints: list box, select the On/Off Light device, R:(0001): 0x08.
5. From the Bound Clusters list box, select the cluster, Client: 0x0006 On/Off.
6. Click the Unbind button. After a few moments, the cluster appears in the Available Clusters list box.
7. Click the Cancel button to close the properties window.

4.7 Forming a Group

A ZigBee group is another way to specify application specific connections between devices in a ZigBee network. The purpose of a group is have the ability to send broadcast messages that simultaneously reach more than one device.

For example, using groups, a switch can send an on/off command to three lights at the same time using a single broadcast ZigBee packet. The endpoints that are the receivers of the commands (the lights) should be indicated to add the same group ID to their group list. The endpoint that initiates the command (the switch) should make a binding to the group ID on the cluster that the command belongs to.

NOTE

Group bindings do not need matching client and server sides of a cluster in order to be performed. A device can make a binding from itself to a group on any clusters that are specified on the device endpoint.

ZeD simplifies the formation of groups by using the ZeD Group View. To make a connection from the On/Off Switch to the On/Off Light using groups, perform the following steps:

1. Make sure that the binding is removed from the On/Off Switch to the On/Off Light on the On/Off cluster by following the steps in Section 4.6, “Removing a Binding”. Removing the binding is required to prevent packet duplication.
2. Click on the Group View button in the ZeD Views panel. The group configuration controls that can be found under the Group View button become enabled as shown in Figure 4-15. The group configuration controls are the Group ID edit box and the “Add” button.

Figure 4-15. The Group View Configuration Controls

3. Fill in a new group ID in the Group ID edit box from the (a 4 hexadecimal digit number) or proceed with the default group ID.

4. As shown in Figure 4-16, drag the mouse to select the On/Off Light, On/Off Switch, and Combined interface endpoint icons on the window. They will be marked with a circle when they are selected. Users can also select them by holding the Ctrl key and clicking on each endpoint icon.

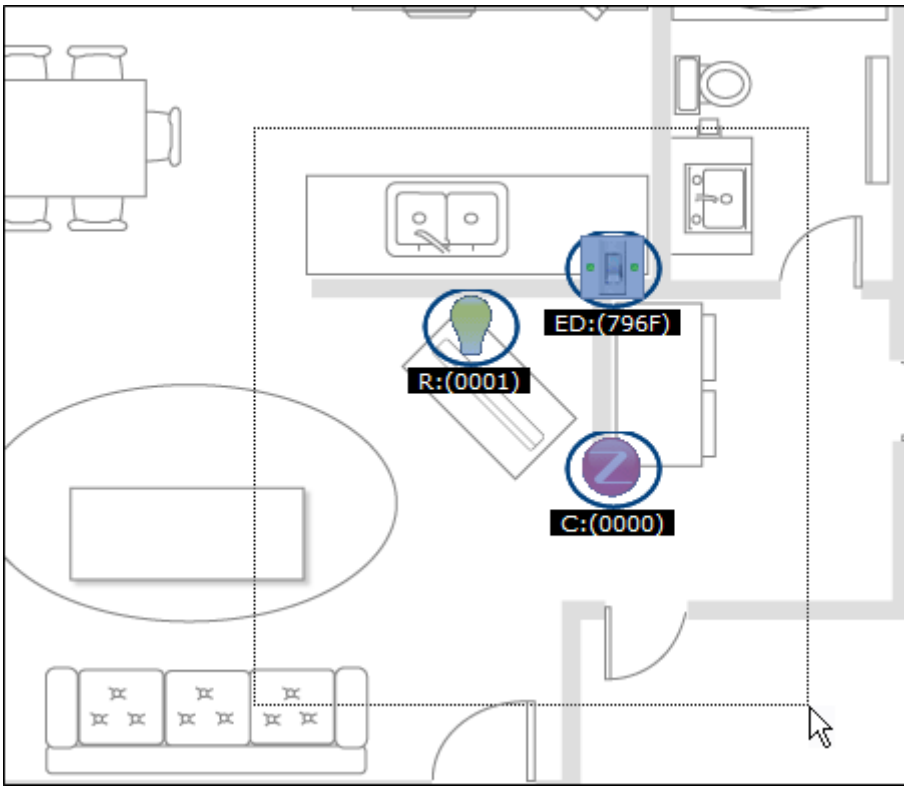

Figure 4-16. Selecting Devices to Add to a Group

5. With the endpoints selected, click the Add button which is located next to the Group ID edit box. Wait a few seconds for the group to be added to the devices.
6. The On/Off Light and Combined Interface endpoints are now part of the group with the provided group ID. The On/Off Switch endpoint has a binding made to this group ID on the On/Off cluster.

NOTE

Adding the Combined Interface node to the group is useful in order for it to also receive the broadcast commands from the On/Off Switch and update the switch icon in the GUI.

7. Notice that the group ID now appears next to the node icons.
   - Group IDs displayed in blue mean that the endpoint belongs to a certain group
   - Group IDs displayed in teal mean that the endpoint has a binding made to the group ID

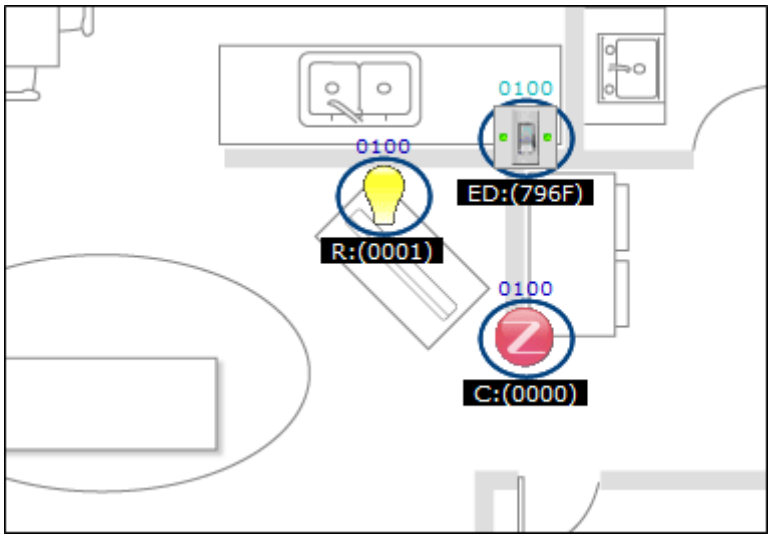

Figure 4-17. ZigBee Nodes Showing their Group IDs and Group IDs for Bindings

8. Press and hold SW2 (Off command) on the board that is running the On/Off Switch application. LED2 on that board turns off. As shown in Figure 4-18, the light bulb icon on the ZeD GUI also turns off. The LEDs on the On/Off Switch icons turn red to indicate that the Combined Interface has received the On/Off Switch Off command broadcast to the group.

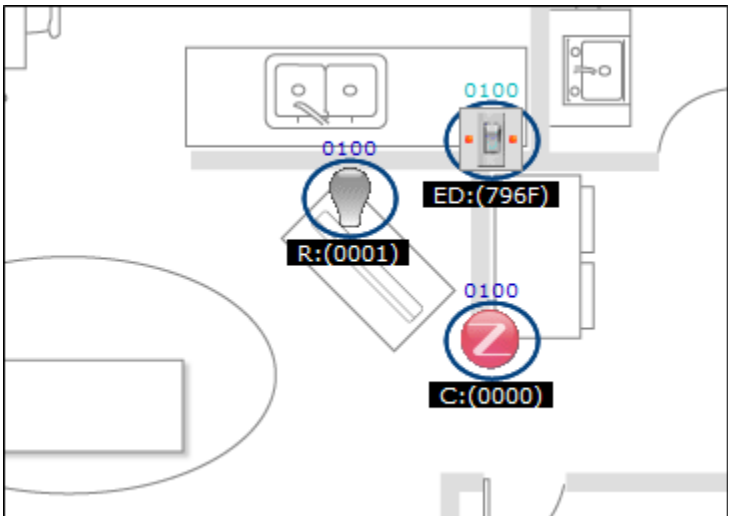

Figure 4-18. Light and Switch Icons Update their State after a Group Off Command

4.8 Remote Controlling Lights

This demonstration scenario shows how to use ZeD to remotely control a Dimmable Light using the Local Controls tab in the Endpoint properties window that appears when users double-click the light icon. To remotely control a dimmable light, perform the following steps:

1. Briefly press SW1 on the board running the Dimmable Switch application so that it joins the network used in the previous steps. As shown in Figure 4-19, the Dimmable endpoint icon appears after a few seconds on the ZeD main window.

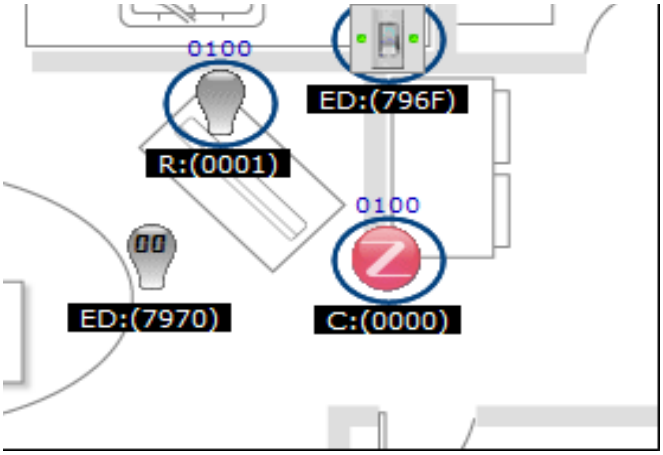

Figure 4-19. Dimmable Light Joining the Existing Network

2. Place the Dimmable Light board in Application Mode by pressing and holding SW1 on that board for about 2 seconds.
3. Double click the Dimmable Light icon in ZeD.
4. Go to the “Local Controls” Tab. The tab is shown in Figure 4-20.

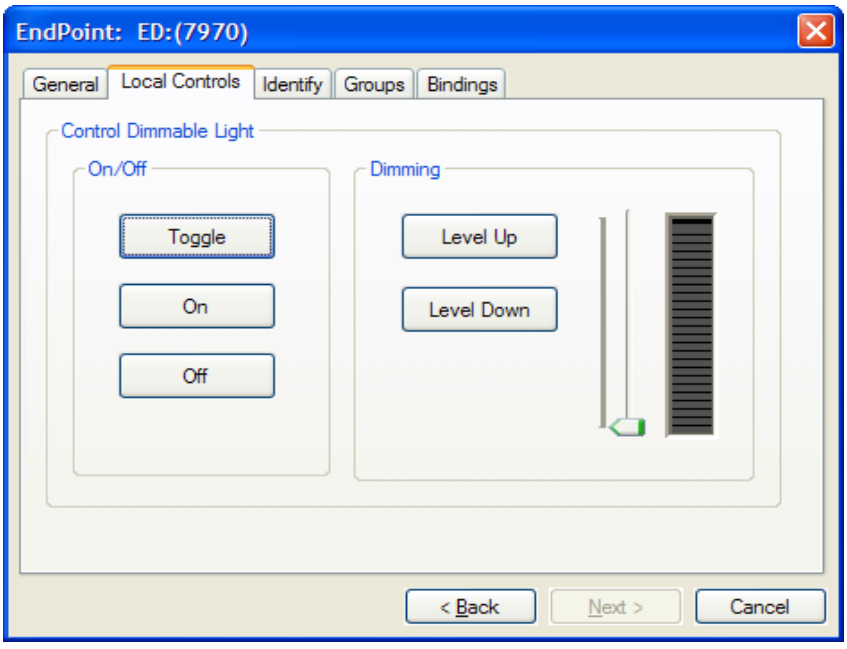

Figure 4-20. Dimmable Light Local Controls

5. Press the Level Up button twice. The value (as a percentage) in the Dimmable Light icon moves up to 33% and then to 66% as shown in Figure 4-21. LED2 and LED3 on the board also turn on to simulate that the light is changing state from off to dim.

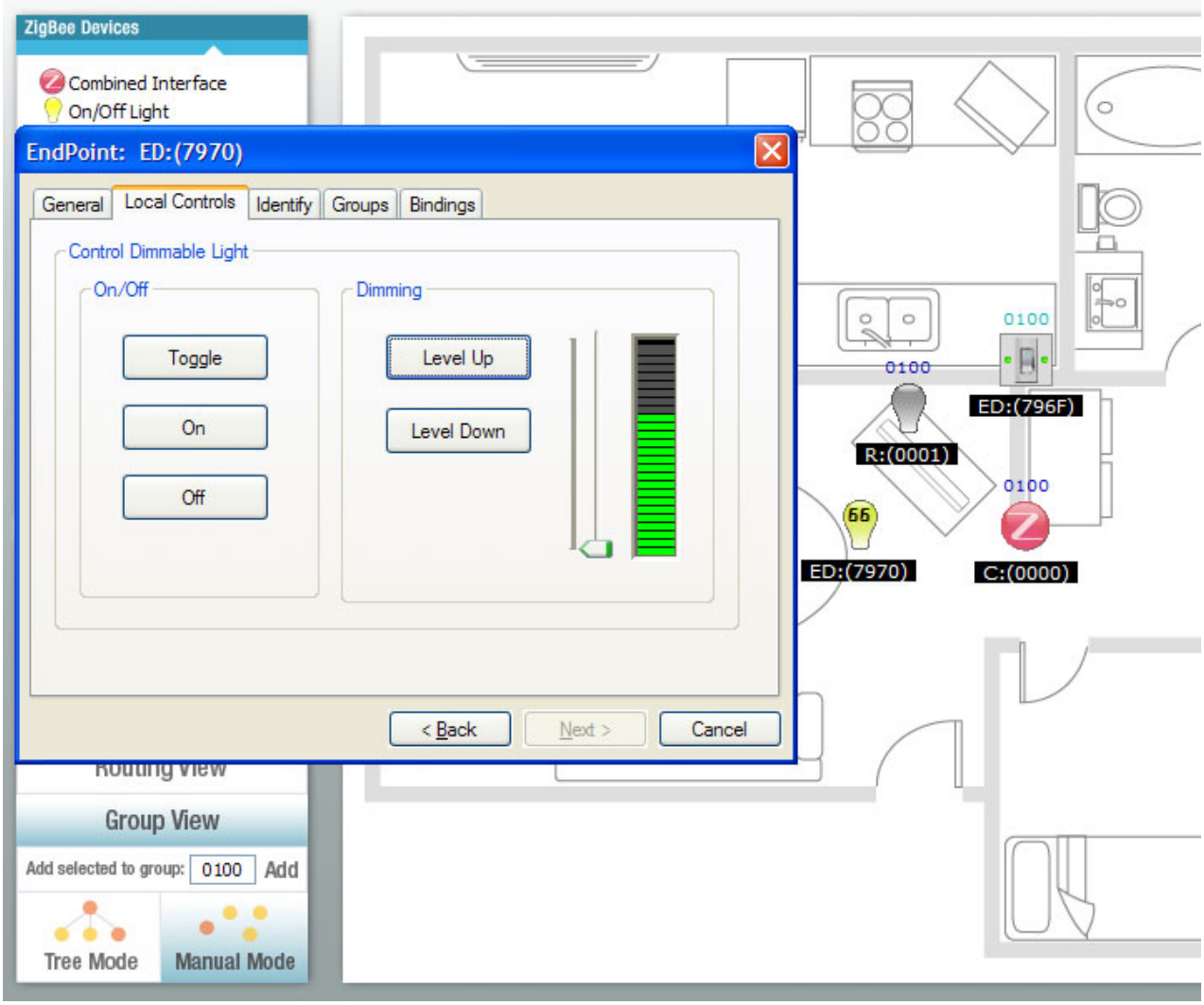

Figure 4-21. Dimmable Light Changing State from off to dim

6. Press the Off button. The value (as a percentage) in the Dimmable Light icon changes state back to 0 and becomes grey to indicate that the light is off. However, the level in the Endpoint window Dimming portion remains at 66% as shown in Figure 4-22.

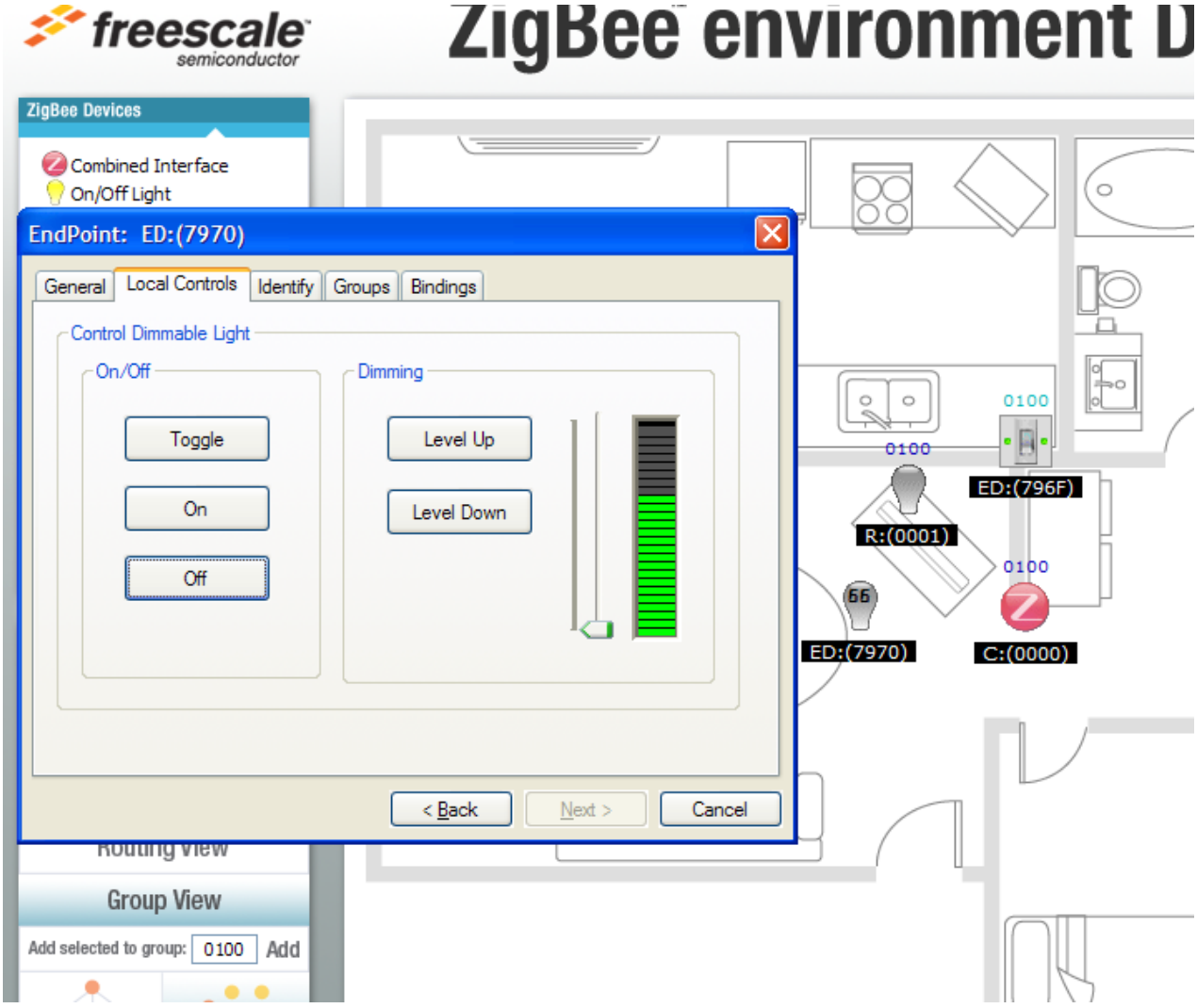

Figure 4-22. Turning Dimmable Light Off

7. Press the On button again. Notice now that the value in the Dimmable Light icon changes state back to 66% (lit state) which indicates that the light is now on again.

8. Click on the Groups Tab on the Dimmable Light Endpoint properties window. This group provides an alternative way of adding groups and also allows users to remove all or one of the groups that the endpoint was added to. The Groups Tab is shown in Figure 4-23.

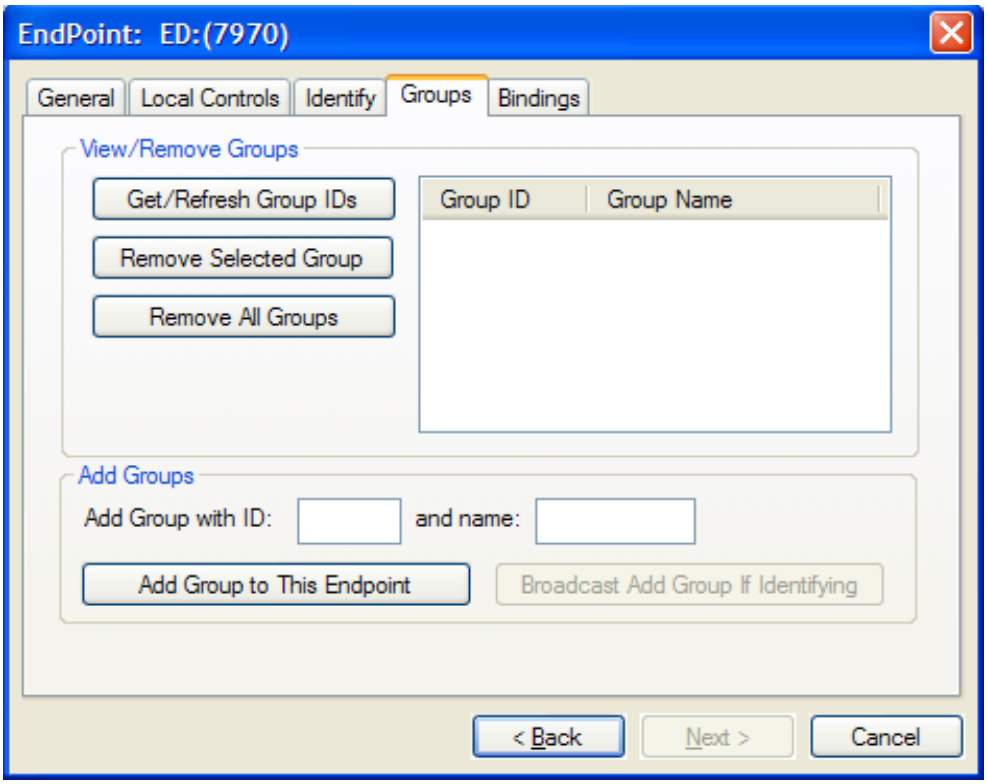

Figure 4-23. Dimmable Light Group Tab

9. Enter 0100 in the text box next to “Add Group with ID”
10. Press “Add Group to This Endpoint”

11. Notice how the Dimmable Light has also been added to the 0100 group that the other three devices belong to and that the group list in the Group Tab has also been updated as shown in Figure 4-24.

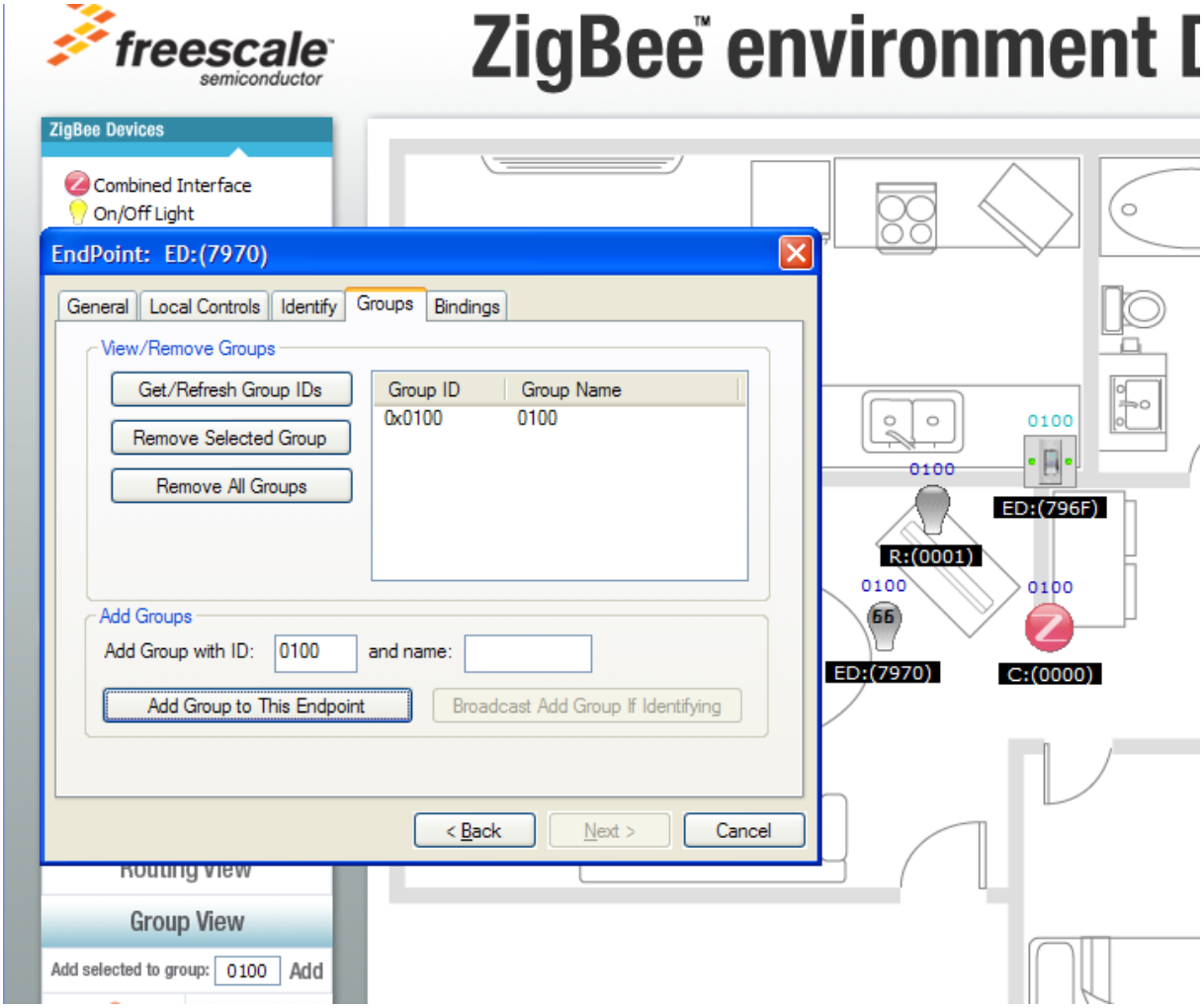

Figure 4-24. Dimmable Light Added to Group

12. Click “Cancel” to exit the Endpoint properties window.

4.9 Storing and Recalling a Scene

Scenes allow users to tell each Home Automation node in a group to save its state at any point in time so that it can be recalled later. Scenes in ZeD are implemented in the Endpoint properties of the Combined Interface coordinator. To tell the devices in the 0100 group to store their state in a scene entry, perform the following steps:

1. Double Click the Combined Interface icon.
2. Choose the Scenes Tab as shown in Figure 4-25.

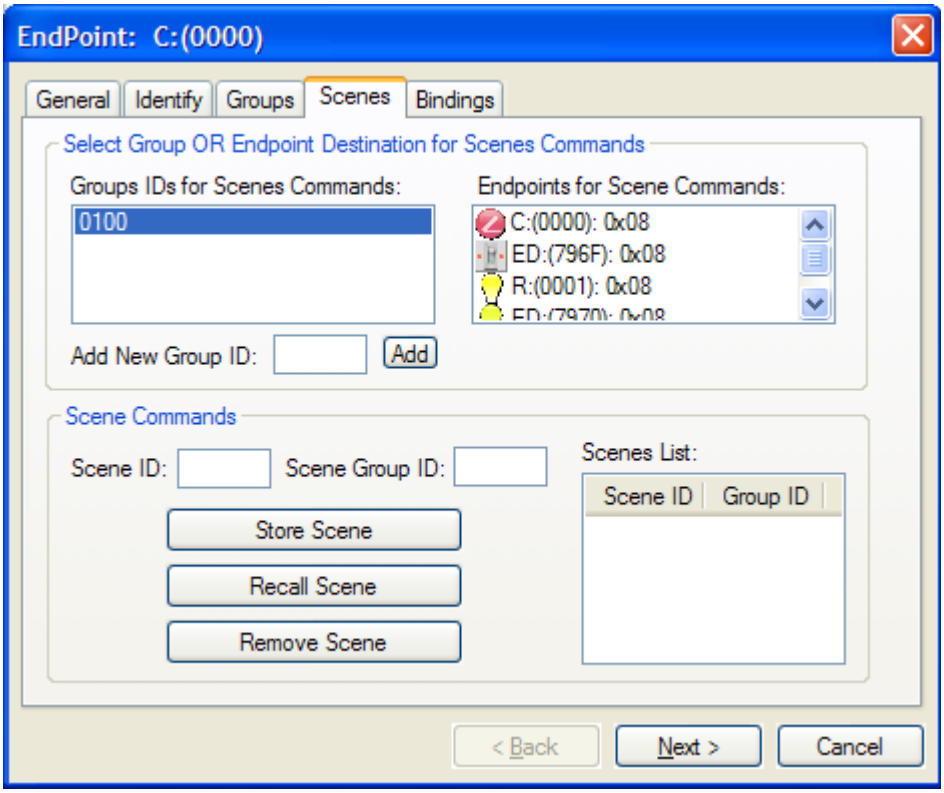

Figure 4-25. The Scenes Tab

3. Select the 0100 group is selected in the “Group IDs for Scenes Commands” list box.
4. Enter ID 1 for the scene in the Scene ID edit box.
5. Enter the 0100 group ID in the Scene Group ID edit box.
6. Click the Store Scene button.

7. Notice how the scene has been added to the Scenes List as shown in Figure 4-26.

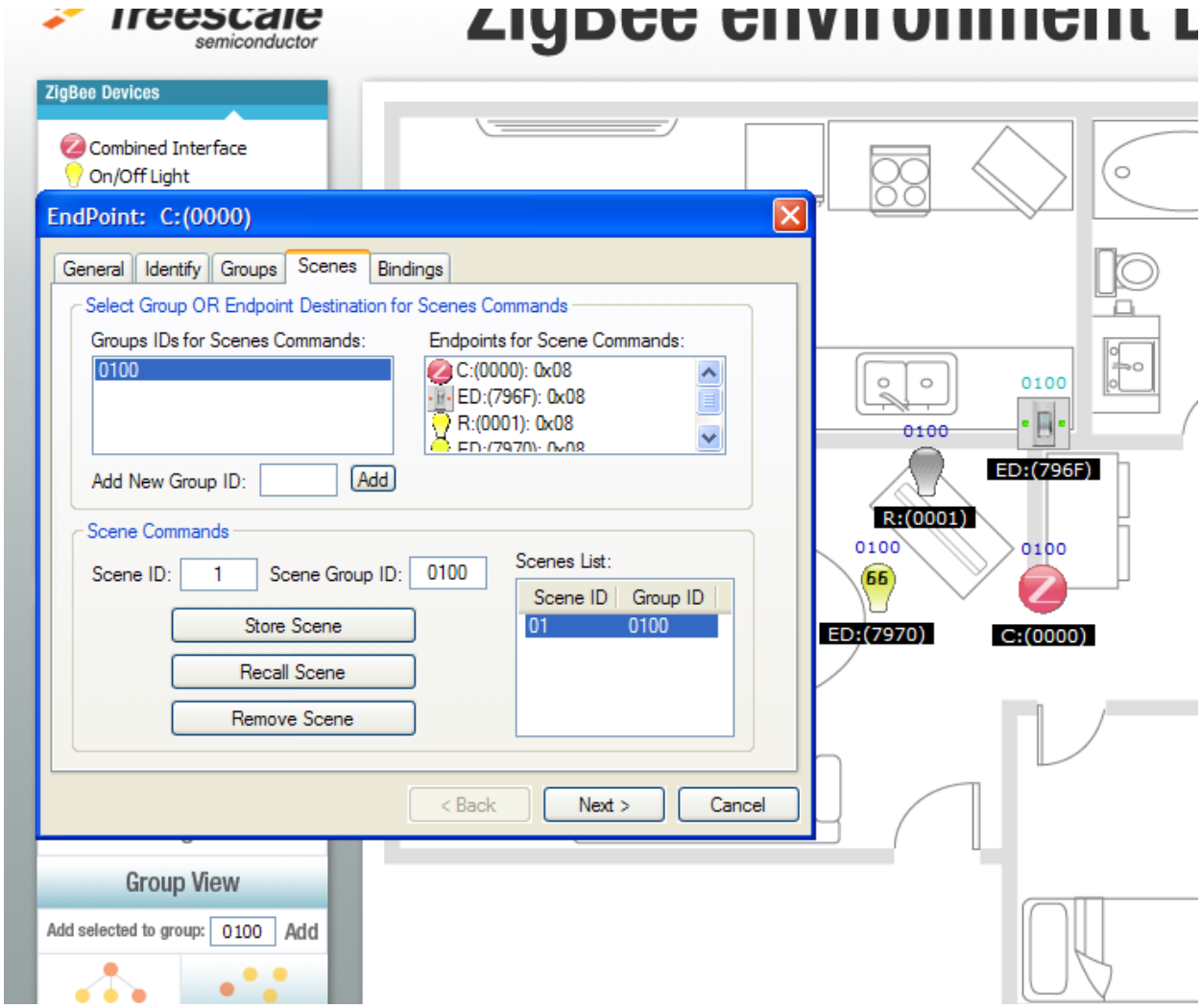

Figure 4-26. Storing a Scene

8. Notice that the On/Off Light is in the off state and the Dimmable Light is in the on state at the 66% level.

9. Press SW1 on the On/Off Switch board. This makes a group “Toggle” command to the lights. The On/Off Light turns on and the Dimmable Light turns off as shown in Figure 4-27.

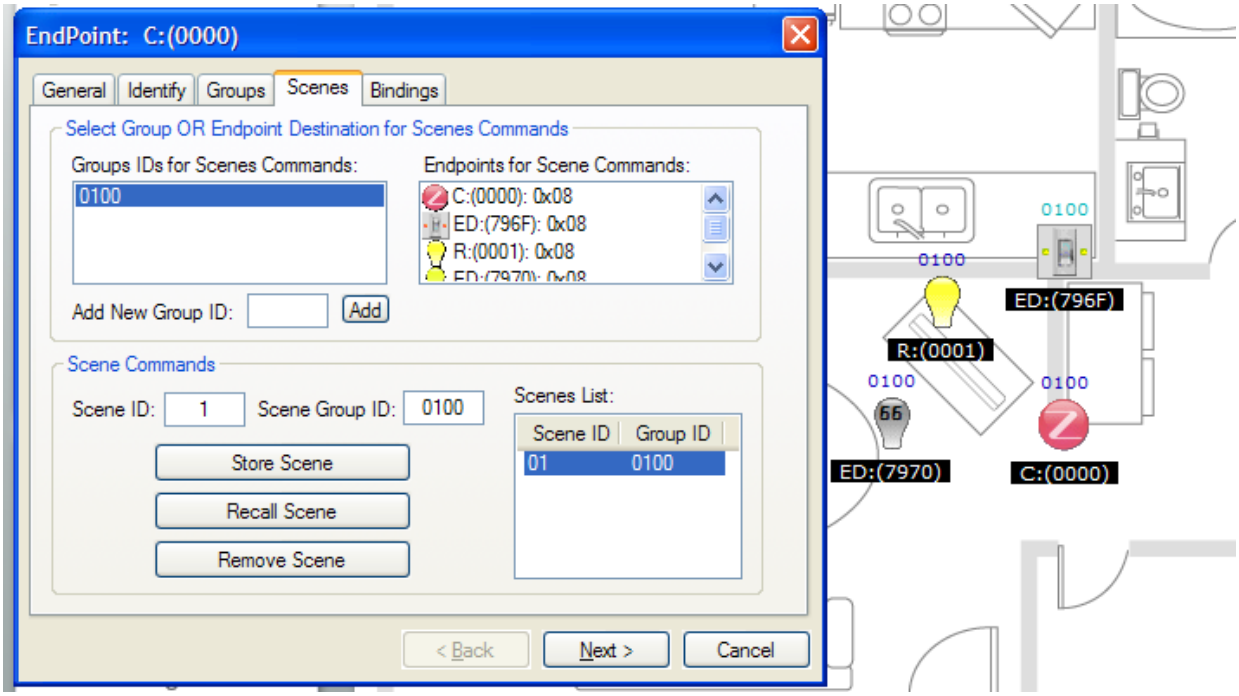

Figure 4-27. Modifying Light States Using Group “Toggle”

10. Click the Recall Scene button in the Scene Tab.
11. Notice how both lights have changed to their previously stored states shown in Figure 4-26.

Chapter 5
ZeD Views

This chapter provides details on the five ZeD Views available for selection using the buttons in the ZeD Views panel.

5.1 Common View Features

Some of the ZeD features are available for all views. All the views have an Info Tip feature as shown in Figure 5-1. This feature appears when users hover the mouse pointer over an Endpoint. The Info Tip shows information about the name of the device as displayed on the node icon label, its virtual location that can be related to the room on the house plan the device is found in, the device type and ZigBee profile the application belongs to.

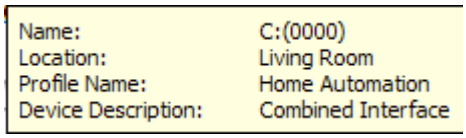

Figure 5-1. Endpoint Info Tip

All Endpoints, regardless of the selected View, also have a right-click Popup menu as shown in Figure 5-2.

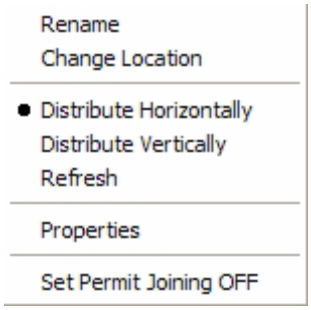

Figure 5-2. Endpoint Popup Menu

In the Popup menu, users can change the name of the Device, its location description, and the way multiple Endpoint icons of a node can be arranged (i.e. Horizontal or Vertical). Also, for ZigBee Coordinators and Routers users can choose to deny or permit the node to accept new nodes to join. See the Section 5.3, “Association View” for an example of how to use the Permit Joining option.

Users can also bring up the Endpoint Properties window by selecting Properties, or by double-clicking the Endpoint icon. For a guide of how to use the features in the Endpoint Properties window see Chapter 7, “Endpoint Properties Window”.

Use the refresh option to see if a node still responds, or to update the node information.

NOTE

The nodes may have a red label as shown in Figure 5-3.This indicates an inactive or non-responding device.

Figure 5-3. Non-responsive or Absent Device

Pressing “F5” in any view retrieves all information about the selected devices, or performs the node information discovery process again for the entire network if no device icons are selected.

Pressing “F6” in any view retrieves binding information about the selected devices or about all devices if no device icons are selected.

5.2 Status View

The Status View is the view selected when the Zed software starts (the default view) and while the initial discovery of nodes in the network is performed. When discovering nodes in the network, ZeD displays the `Detecting Devices. Please Wait...` status message on the house plan background as shown in Figure 5-4.

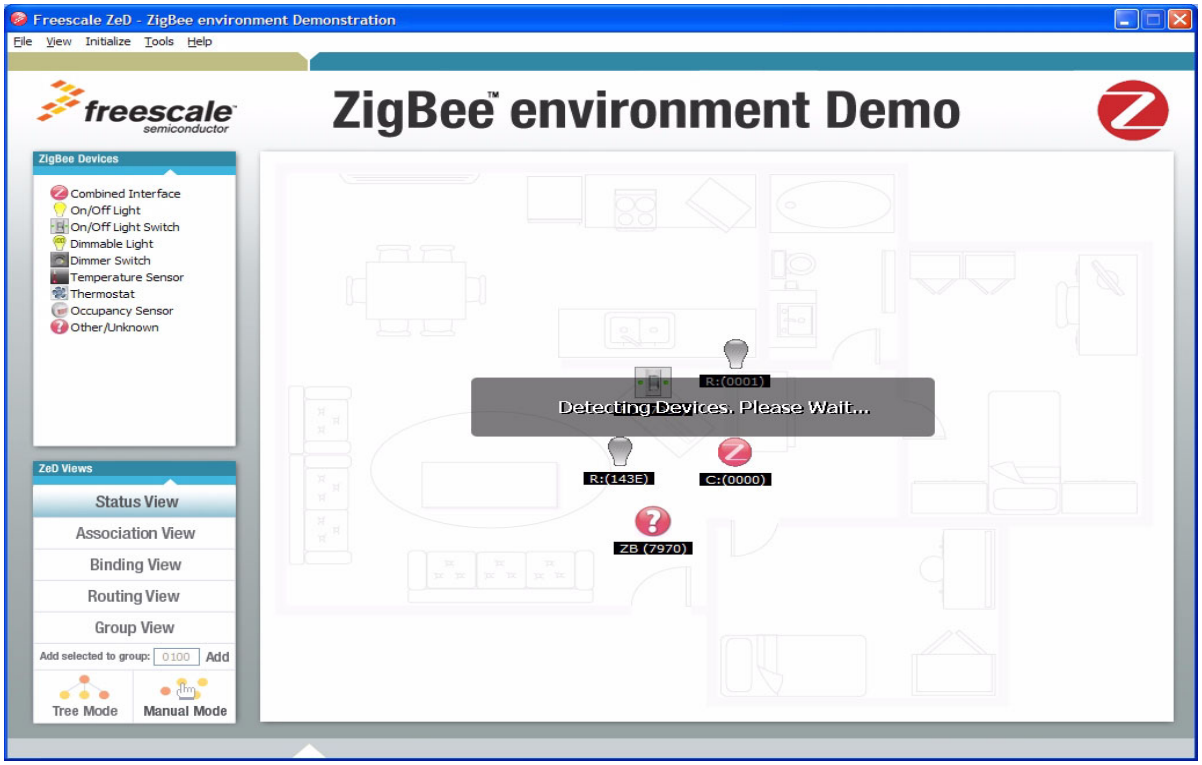

Figure 5-4. ZeD Status View During Node Discovery

In the Status View, users can move the devices so that they are located inside the house drawing at the physical location without any other markings or auxiliary graphical elements.

5.3 Association View

As shown in Figure 5-5 , when the ZeD main window is in the Association View, each device has a circle around it. The devices may also have an arrow drawn between a device and its parent in the ZigBee network. The circles around the devices have the following characteristics:

- Red indicates a ZigBee Network Coordinator
- Blue indicates a ZigBee Router
- Yellow indicates a ZigBee End Device
- Green indicates an Unknown Device

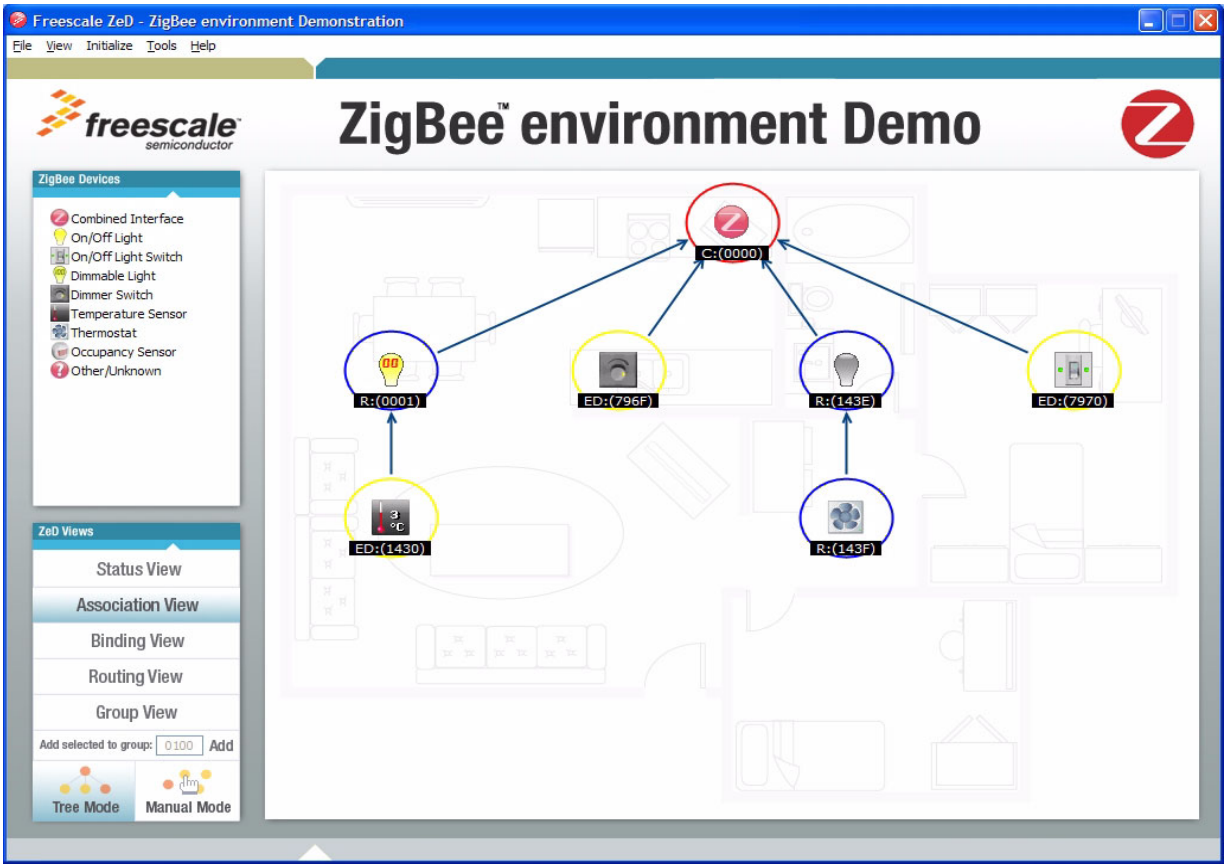

Figure 5-5. Association View using Tree Display Mode

By selecting a device, only the associations for that given device are shown. To see all associations, deselect all devices by pressing the ESC key.

5.3.1 Creating a Higher Depth Network

ZigBee nodes usually associate to the first device that sends them a beacon request. This makes some networks start (by default) in a star topology, where a lot of nodes are joined to the Coordinator. A higher depth network, with several layers of associations between the Coordinator and leaf End Devices, can sometimes be useful to better visualize concepts such as routing.

Users can toggle the Permit Joining status of a ZigBee node to shape the network topology. This allows the ZeD software to build ZigBee networks with greater depth. This is accomplished using the Set Permit Joining command in the node Popup menu.

To keep a specific node from allowing new devices to associate to it, the Set Permit Joining OFF option as shown in Figure 5-6.

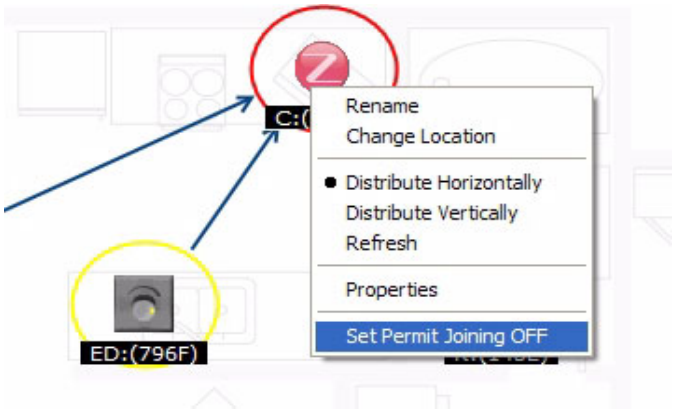

Figure 5-6. Turning Permit Joining Off

The node that has Permit Joining turned off displays a Forbidden sign on the left of its icon(s) as shown in Figure 5-7. New devices trying to join the network are not able to associate to this node.

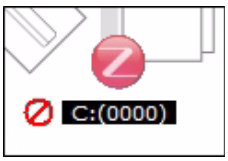

Figure 5-7. Coordinator with Permit Joining Set to Off

Toggling the node back allows the node to accept new devices and allows the devices to associate to the node. Set the Permit Joining ON option in the node Popup menu. The same menu as shown in Figure 5-6.

Figure 5-8 shows a high depth network with more than two associations between the Coordinator and a leaf node.

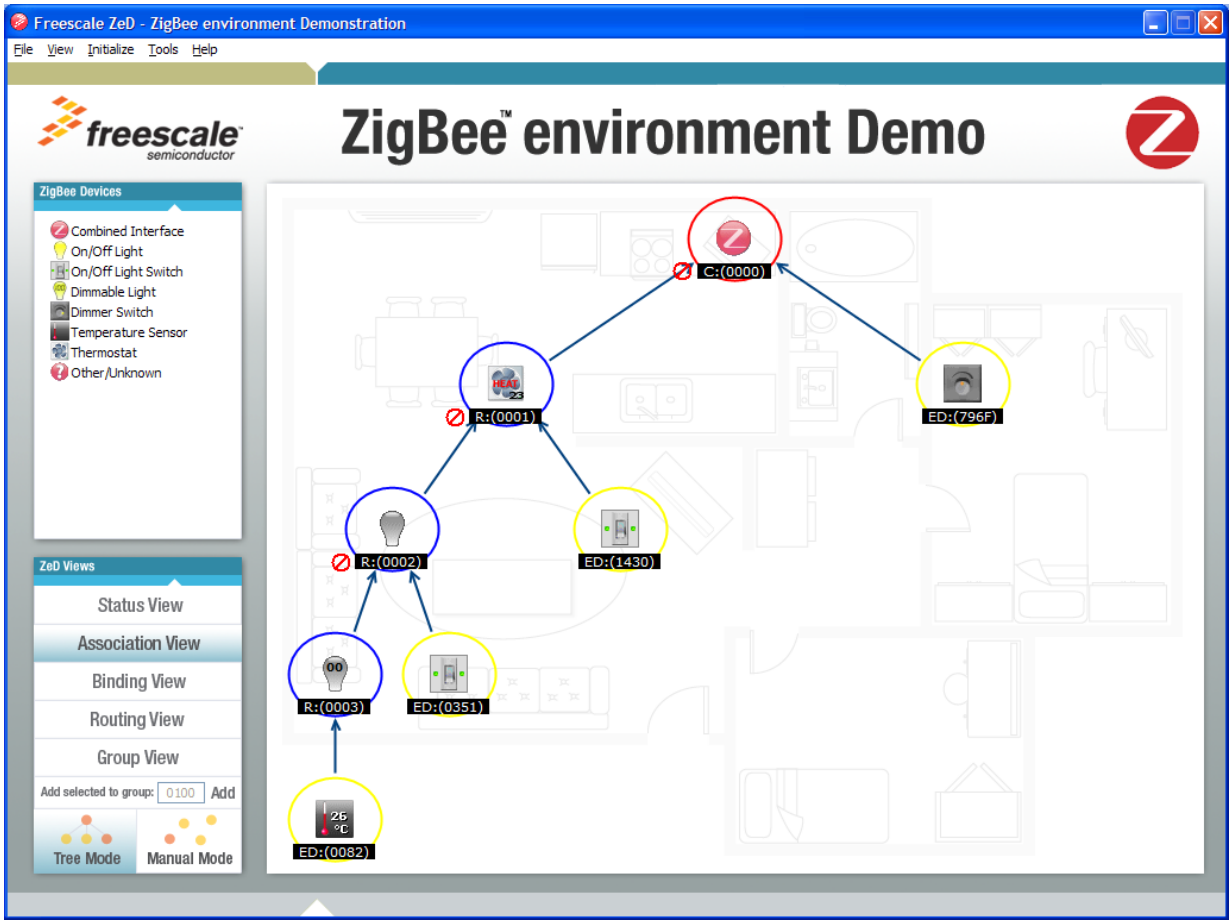

Figure 5-8. High Depth Network

The following list shows how to use the Permit Joining feature to form this network:

1. Form the network on a ZC.
2. Join ED 796F to ZC.
3. Join ZR 0001 to ZC
4. Set permit joining off on ZC.
5. Join ED 1430. It will associate to ZR 0001.
6. Join ZR 0002. It will associate to ZR 0001.
7. Set permit joining off on ZR 0001.
8. Join ED 0351. It will associate to ZR 0002.
9. Join ZR 0003. It will associate to ZR 0002.
10. Set permit joining off on ZR 0002.
11. Join ED 0082. It will associate to ZR 0003.

5.4 Binding View

The Binding View allows users to see the existing bindings between the ZigBee Endpoints. A ZigBee binding is an application level connection between two Endpoints based on their complementary functions. It allows communication between Endpoints based on the matching of common clusters which specify what functions a certain Endpoint implements. Bindings are made from one Endpoint to another so that when the sending Endpoint needs to transmit data on a certain cluster, it uses the binding information to determine the destination of the data. When a binding is made from one Endpoint to another, the ZeD Binding View displays an arrow from the source to the destination of the binding. For more details on Bindings, see the ZigBee specification.

Figure 5-9 shows a binding from the On/Off Light Switch Endpoint on the node with network address 0x796F to the On/Off Light Endpoint on the node with network address 0x0001. The two Endpoints are bound on a common cluster (On/Off Cluster). As a result of the binding, when On/Off commands are issued on the On/Off Light Switch, these commands are sent to the On/Off Light.

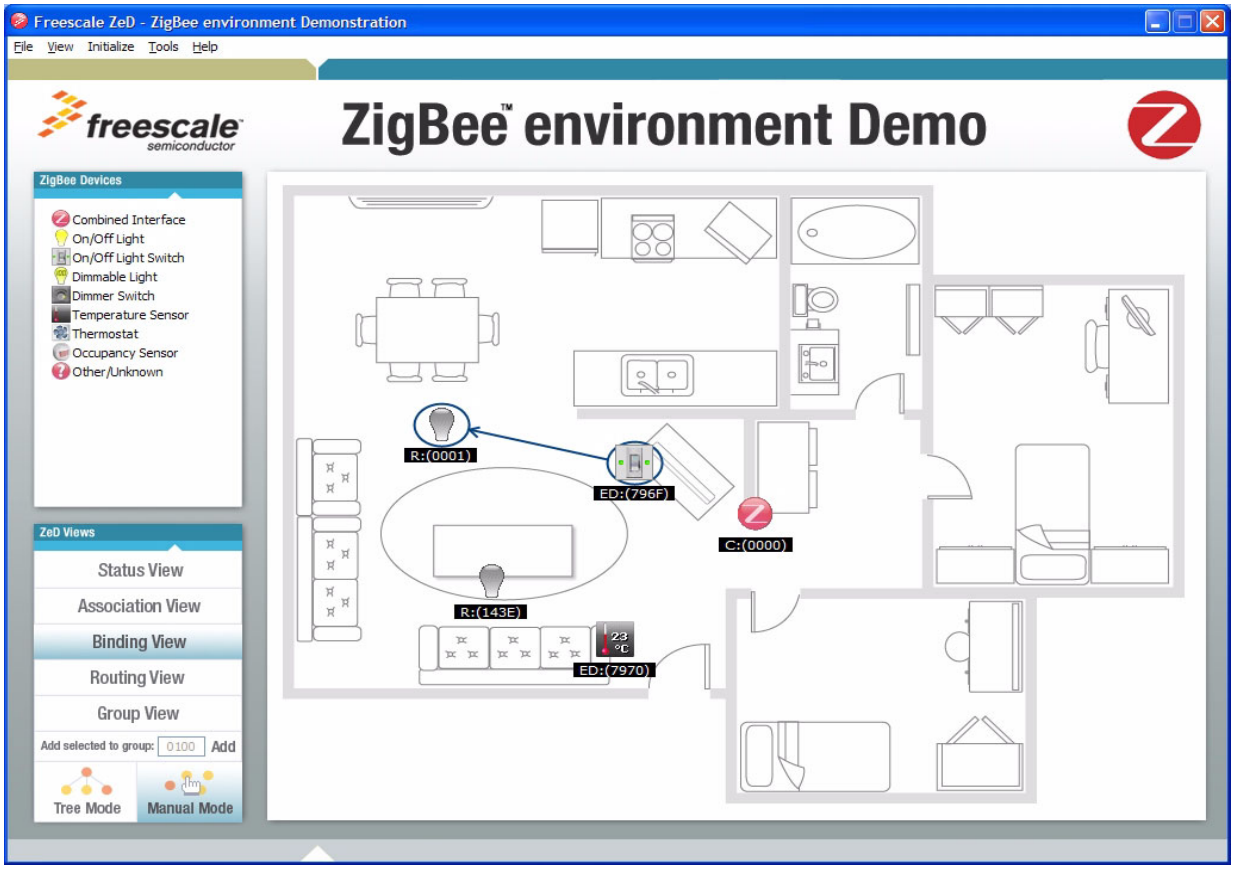

Figure 5-9. Binding View

By selecting an Endpoint icon, only the bindings for the given Endpoint are shown. To see all bindings, deselect all devices by pressing the ESC key.

The ZeD software also allows the creation of bindings on the ZigBee Endpoints. To create bindings, use the Binding tab on the Endpoint Properties window. See Section 7.4, “Bindings Tab” for details on how to create user-defined bindings.

5.5 Routing View

The Routing View lets the user see how data packets are transmitted from one node to another on the ZigBee network. ZigBee networks allow for tree or mesh routing. ZeD uses the routing information it obtains from the devices to show the routing paths between them using an animated packet transmission indicator. To show the routing animation users must select two devices. The routing of packets is then displayed between the two selected devices as shown in Figure 5-10. The lines between the devices are the ones corresponding to network association tree. They can be used to compare mesh routing to tree routing in the ZigBee network.

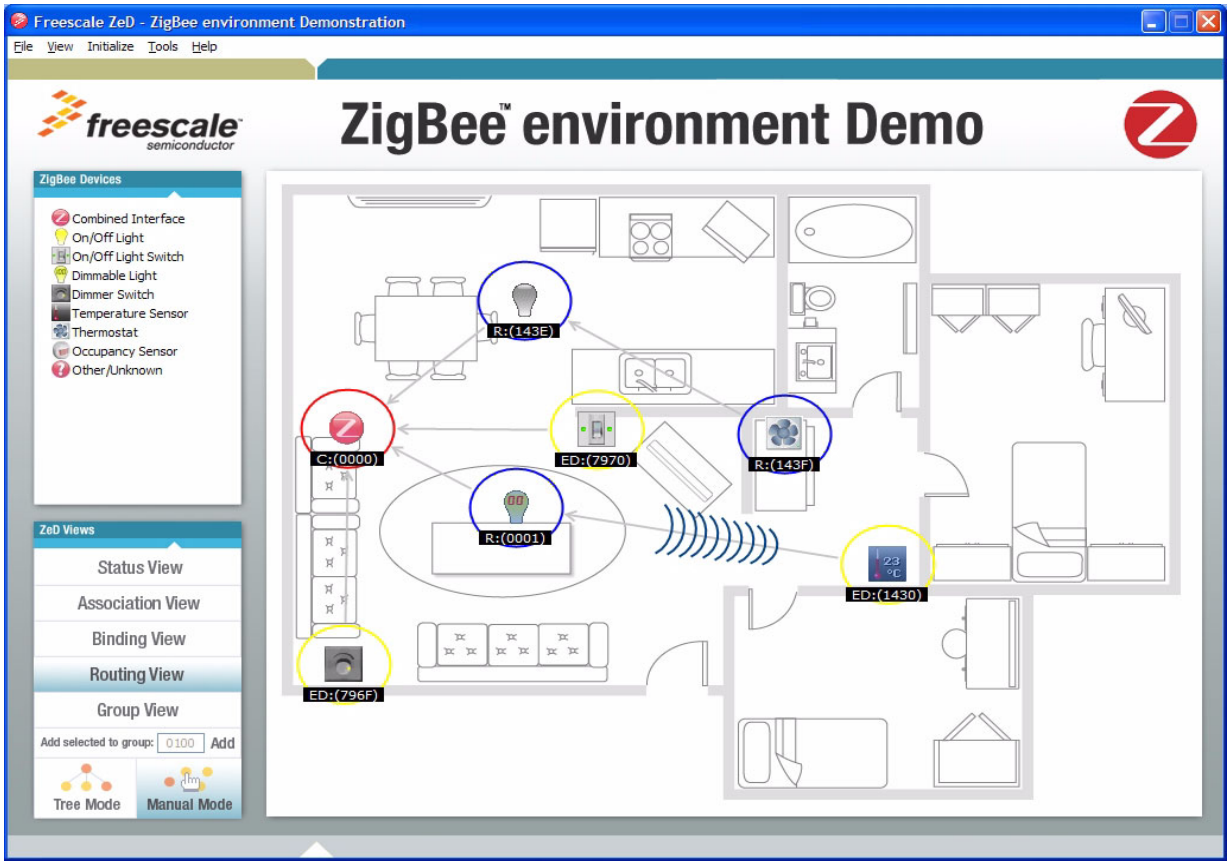

Figure 5-10. Routing View

If users select another device, the routing between this device and the second selected device are shown. To terminate the routing view, deselect all icons.

5.6 Group View

Group View allows users to configure ZigBee groups. Groups are another application-level connection between multiple Endpoints that allow for the transmission of broadcast data packets. When several Endpoints are added to a group, they all receive broadcast data packets sent to that group. Bindings to groups are also possible. For example, an On/Off Switch can be bound to multiple On/Off Lights using their 16-bit group ID.

In order to form groups using the Group View, use the Group View Configuration Controls which are located under the Group View button. As shown in Figure 5-11, these controls consist of the following:

- Group ID edit box — Allows users to specify a custom 16-bit group ID for the devices to be added to the group.
- Add button — Adds the Endpoints corresponding to the selected icons to the group with the specified ID if they are input devices (such as lights). If the selected Endpoint is that of an output device (such as a switch), a binding to the specified group ID is made on the Endpoint.

Figure 5-11. Group View Configuration Controls

To select the Endpoint icons that are added to a group, use the mouse as shown in Figure 5-12 or Ctrl-Click each icon. The selected Endpoints are marked with a small circle around each Endpoint.

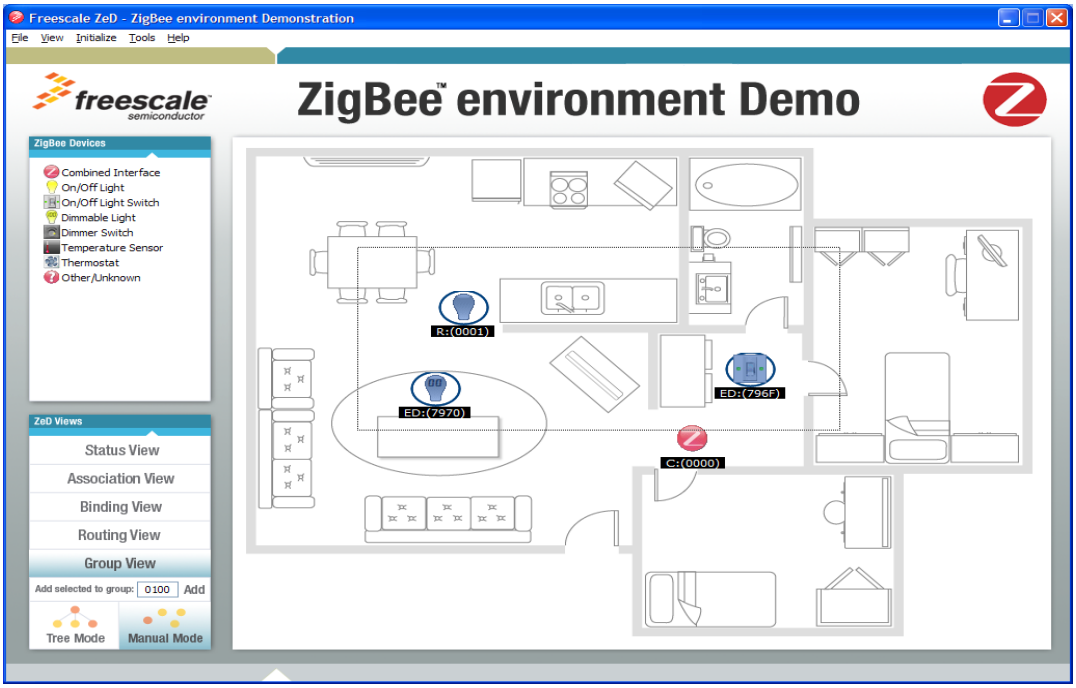

Figure 5-12. Group View Endpoint Selection

For the example shown in Figure 5-12, when users click on the Add Group Control button, the two On/Off Light Endpoints are added to the group with ID 0x0100 and the On/Off Switch Endpoint is bound to the group with ID 0x0100.

Chapter 6
ZeD Menus and Options

This chapter shows the functions available from the ZeD software menu bar and the user-adjustable options for the operation of the application as found in the Options window.

6.1 The ZeD Menu Bar

As shown in Figure 6-1, the ZeD menu bar contains the following menu options:

- File
- View
- Initialize
- Tools
- Help

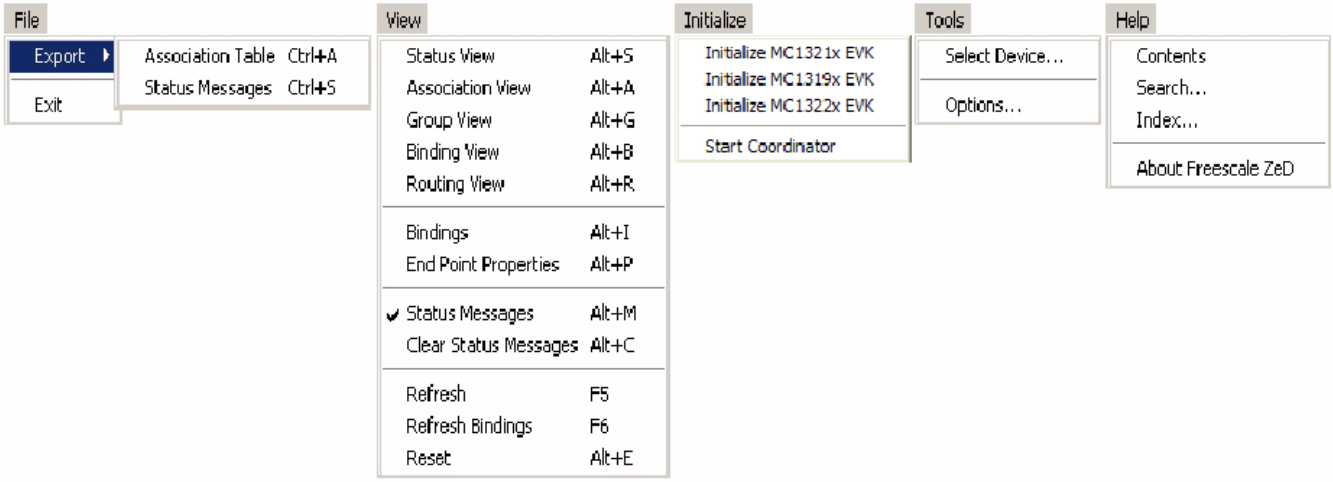

Figure 6-1. Menu Bar

6.1.1 File

The File menu provides the following options:

- Export Association Table — Exports the list of nodes in the ZigBee Network along with their properties to a text file. This text file contains the following fields for each node:
  - Short Address - The 16 bit Short Address of the Node
  - IEEE Address - The MAC Address of the Node
  - Logical type — Coordinator, Router, End Device or Unknown
  - APS — APS Flag Frequency as returned by the device Node Descriptor request
  - MAC — MAC Capability Flags as returned by the device Node Descriptor request
  - MFCode — Manufacturer Code as returned by the device Node Descriptor request
  - Buffer — Maximum Buffer Size as returned by the device Node Descriptor request
  - Tx — Maximum Transfer Size as returned by the device Node Descriptor request
  - EP — Endpoint Index
  - ID — Endpoint ID - real Endpoint Index on the Node
  - Device — Device ID
- Export Status Messages — Exports the text in the Status Messages window to a text file
- Exit — Exits the ZeD application

6.1.2 View

The first part of the View menu contains the five views that can also be selected from the buttons in the ZeD Views panel. The ZeD Views were explained in Chapter 5, “ZeD Views”. The remaining part of the View menu provides the following options:

- Endpoint Properties — Selecting this option corresponds to double-clicking the Coordinator icon and shows the Endpoint Properties window for the Coordinator. This window is described in Chapter 7, “Endpoint Properties Window”
- Status Messages — Hides/shows the ZeD Status Messages window
- Clear Status Messages — Removes all previous text from the ZeD Status Messages window
- Refresh — Refreshes the ZigBee Network by performing a network discovery process which updates the state of all devices and adds newly found devices. If one or more node icons are selected, this option updates only the information about the selected nodes.
- Refresh Bindings — Retrieves the binding tables from all the devices in the ZigBee Network. These bindings can also be seen using the ZeD Binding View already described in Section 5.4, “Binding View”.

6.1.3 Initialize

This menu allows users to perform an EVK specific initialization of the nodes in the ZigBee network. For this option to work, users should connect all the boards in the EVK that ZeD was provided with to a ZigBee network. The usage of the Initialize Commands is presented in Chapter 4 of the ZeD Quick Start Guide. After forming a network with the boards in the EVK and having the nodes detected by ZeD, each of the two options in the Initialize menu performs the following functions:

- The Endpoint icons are moved to predefined positions on the house plan background
- The On/Off Light and Combined Interface Device Endpoints are added to group 0x1111; a binding is added on the On/Off Switch Endpoint to group ID 0x1111
- The Thermostat and Combined Interface Device Endpoints are added to group 0x2222; a binding is added on the Temperature Sensor Endpoint to group 0x2222
- If using the 1321x-EVK or 1322x-EVK, the Dimmable Light and Combined Interface Device Endpoints are added to group 0x3333; a binding is added on the Dimmer Switch Endpoint to group 0x3333
- If using the 1322x-EVK, the 2nd On/Off Light and 2nd On/Off Switch and Combined Interface Device Endpoints are added to group 0x4444; a binding is added on the 2nd On/Off Switch Endpoint to group 0x4444

If one or more nodes corresponding to the boards in the EVK is missing, ZeD displays a warning message.

The Start Coordinator commands sends a network start/restart command to the Combined Interface board. This is similar to resetting the board and pressing SW1.

6.1.4 Tools

The Tools Menu contains the following options:

- Select Device — Displays the Coordinator Selection window where users can choose another board to be the network Coordinator while ZeD is running. For more details about the Coordinator Selection window, see Section 2.4, “Coordinator Selection Window”.
- Options — Displays the ZeD Options window. For more details about this window, see Section 6.2, “ZeD Options Window”.

6.1.5 Help

The Help Menu contains the following options:

- Contents — Shows the ZeD software Help File
- Search — Allows users to search the ZeD Help File
- Index — Displays the ZeD Help File index
- About — Displays the ZeD About window

6.2 ZeD Options Window

The ZeD Options window contains a set of options that allow users to customize ZeD software behavior. The window contains the following two options tabs:

- General Options
- Advanced Options

6.2.1 ZeD General Options

Figure 6-2 shows the ZeD General options tab.

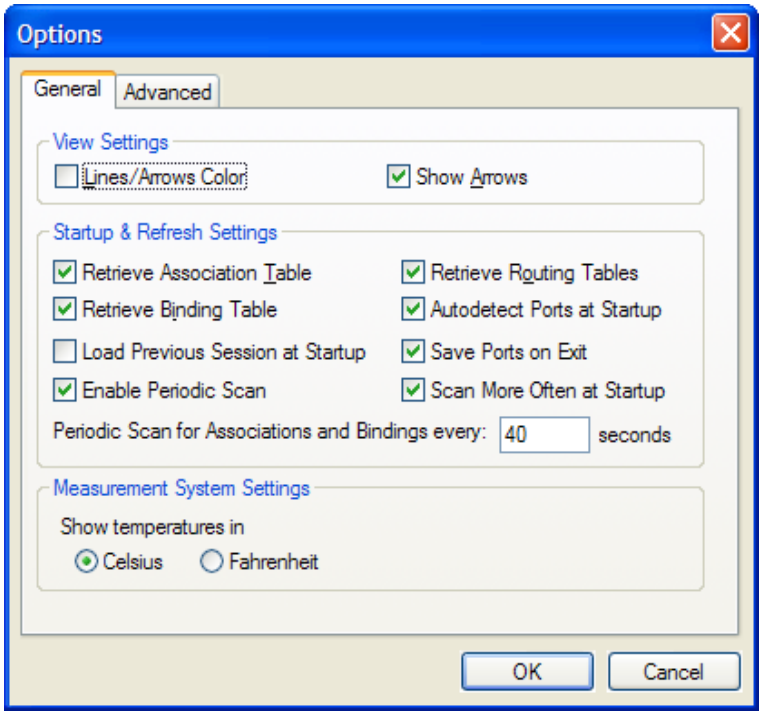

Figure 6-2. General Options Tab

The ZeD General Options tab as shown in Figure 6-2, contains the following functions:

- Lines/Arrows Color — This option changes the color of the lines and arrows in ZeD Association, Binding, Routing, and Group Views
- Show Arrows — The check box toggles the display of arrows at the end of the lines between Endpoints in the ZeD Association, Binding, and Routing Views
- Retrieve Association Table — If this option is enabled, ZeD tries to discover and explore the entire ZigBee network tree and detect all the nodes in the network at program start-up or when users select a new coordinator
- Retrieve Binding Table — If this option is enabled, ZeD retrieves the binding information for each node in the network at program start-up or when users select a new coordinator
- Retrieve Routing Table — If this option is enabled, ZeD retrieves the routing information for each node in the network at program start-up or when users select a new coordinator

- Autodetect Ports at Start-up — If this option is enabled, ZeD tries to autodetect the Coordinator port when the program starts
- Load Previous Sessions at Start-up — If this option is enabled, ZeD loads the ZigBee network node configuration used the last time that ZeD was ran
- Save Ports on Exit — If this option is enabled, the ports in the Coordinator Selection window list are saved in the Windows registry and can be recalled using the Load Configuration button in the same window
- Periodic Scan for Associations and Bindings Every ... Seconds — Sets the time interval between two successive network scans performed by ZeD that traverses the network tree to see if any new devices have joined, or if there are devices that stopped responding. If the Binding View is selected, each of these scans is followed by the retrieval of the binding information stored on each device in the network
- Enable Periodic Scan - Enables and Disables the Periodic Scan
- Scan More Often at Start-up - If this option is selected, the interval between two Periodic Scans grows from 10 seconds at application start-up, up to the value defined in the Periodic Scan for Associations and Bindings Every ... Seconds over the span of 10 minutes. If values below 10 seconds or above 3600 seconds are specified for Periodic Scan, this option is ignored.
- Show Temperatures in Celsius or Fahrenheit — This option sets the temperature scale for the graphical display of devices such as a Temperature Sensor.

6.2.2 ZeD Advanced Options

Figure 6-3 shows the ZeD Advanced options tab.

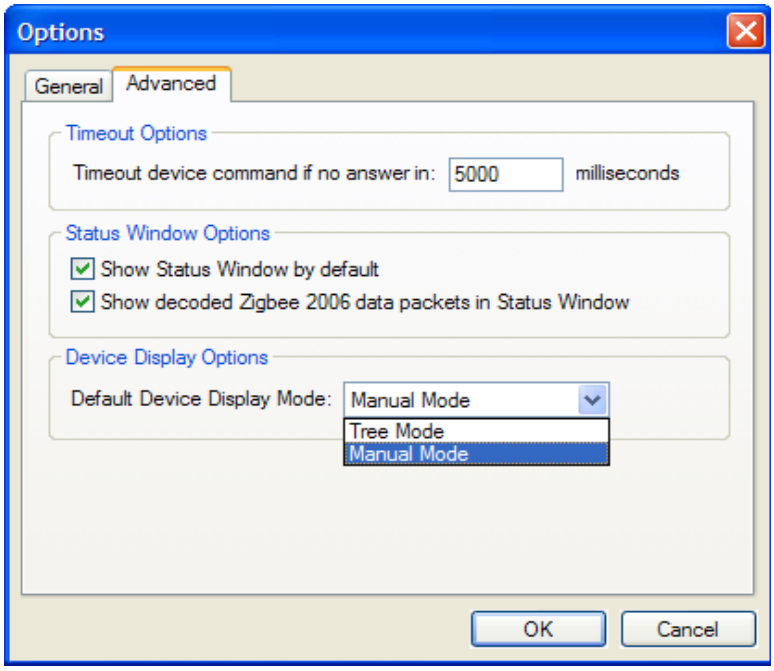

Figure 6-3. Advanced Options Tab

The ZeD Advanced Options tab as shown in Figure 6-3, contains the following functions:

- Timeout Device Command if no Answer in ... Milliseconds — This option specifies the timeout interval to wait for an answer or acknowledgement from a ZigBee node. Notice that some commands issued by ZeD, such as the ones for adding bindings to a device, usually require more time and are not affected by this timeout value
- Show Status Window by Default — If this option is selected, the Status Messages window is displayed at ZeD start-up
- Show Decoded ZigBee 2006 Data Packets in Status Window — If this option is selected, the ZigBee control and data packets that are sent to and from the ZeD software to and from the devices in the network are displayed in the Status Messages window along with their meaning. See the *ZeD Embedded Software Design User's Guide* and the *BeeStack ZTC User's Guide* for information about the ZigBee 2006 network and applications primitives used by ZeD
- Default Device Display Mode — If this option is selected, users can select which of the Tree or Manual Display Modes will be the default mode for the Endpoint icon positions when ZeD is started. In Manual Mode, the Endpoint icons are placed next to their parent node icon. In Tree Mode, the position of the icons reflects the association tree of the ZigBee network.

Chapter 7
Endpoint Properties Window

This chapter provides a description of the endpoint properties window where users can configure numerous ZigBee network configuration options.

When users double-click on an Endpoint icon or choose the Properties option from the Endpoint popup menu, the Endpoint Properties window appears as shown in Figure 7-1. This window contains a set of property pages selected by using the following tabs at the top of the window.

- General
- Identify
- Groups
- Bindings

Some devices also have a Local Controls tab. By using the Back/Next buttons at the bottom of the Endpoint Properties window, users can browse through all the Endpoints without having to double click each icon.

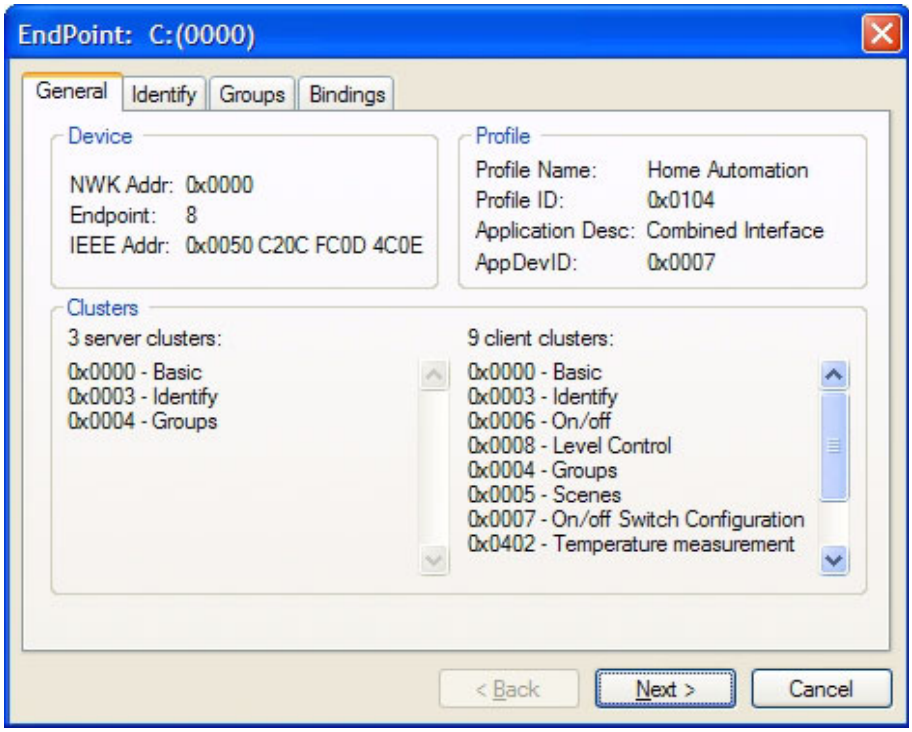

Figure 7-1. General Tab of the Endpoint Properties Window

7.1 General Tab

The General tab of the Endpoint Properties window provides information about the corresponding Node, the Endpoint profile and application, and the ZigBee clusters available on the Endpoint. Figure 7-1 shows this tab for the Combined Interface Device endpoint. The following list describes the information as shown under this tab:

- NWK Addr — 16-bit network (short) address of the node in the ZigBee network
- Endpoint — The Endpoint index of the selected icon. This is an 8 bit value from 1 to 240. A value of 0 corresponds to an unknown Endpoint index
- IEEE Addr — The 64-bit IEEE (extended) address of the node
- Profile Name — The name of the ZigBee profile that the Endpoint belongs to. For the boards delivered with the Freescale EVK, this is always the Home Automation Profile
- Profile ID — The 16-bit identifier of the ZigBee Profile that the Endpoint belongs to
- Application Desc — The name (description) of the application running on the Endpoint
- AppDevID — The application device identifier of the application running on the Endpoint as defined by the Home Automation Profile specification
- Nr. Server Clusters — The number of clusters that are defined as server (input) clusters for the device
- Nr. Client Clusters — The number of clusters that are defined as client (output) clusters for the device
- Lists of Server and Client Clusters — Is a list of available clusters on the device given as a list of 16-bit cluster identifiers and the cluster names as defined by the ZigBee Cluster Library specification

7.2 Identify Tab

The Identify tab allows for the identification of the board that runs the node that the Endpoint belongs to. Identification usually means that the board will flash LED3 while in Application Mode to indicate its presence. To identify a board, users must enter the duration of the identification period (in seconds) in the Identify Time edit box and then click on the Identify Device button as shown in Figure 7-2.

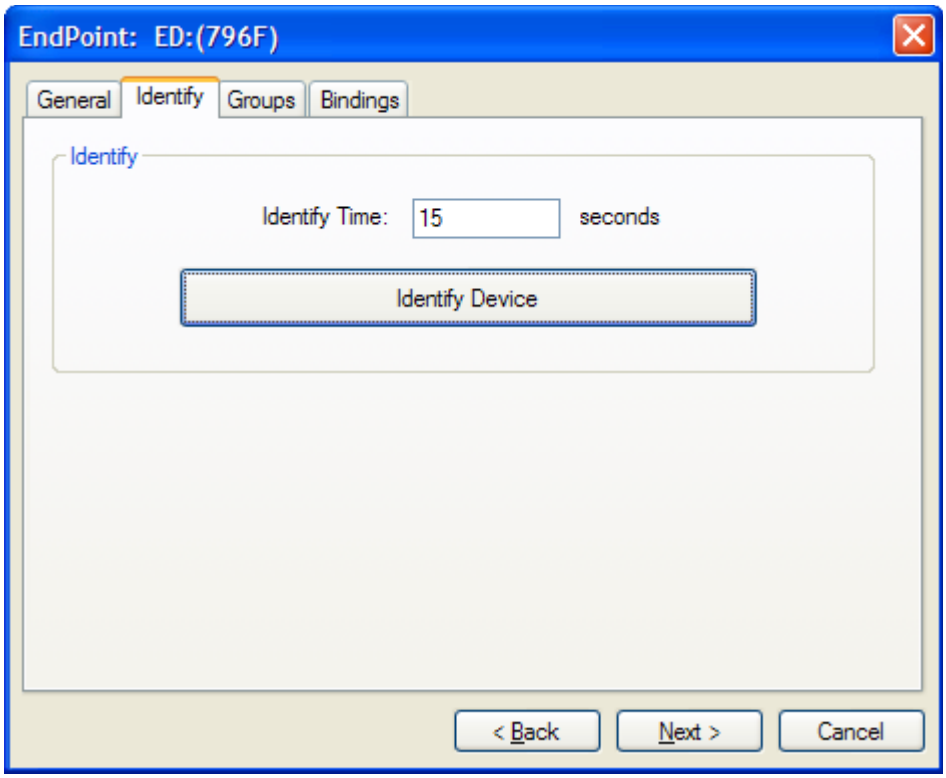

Figure 7-2. Identify Property Tab

7.3 Groups Tab

The Groups tab as shown in Figure 7-3, is used to view and edit the Groups list for the Endpoint. The buttons on the View/Remove Groups section of the window perform the following functions:

- View/Refresh Groups IDs — When this option is selected, the ZeD software obtains the list of identifiers of the groups that the Endpoint belongs to. The list is displayed in the list box on the right
- Remove Selected Group — The group that is selected in the list box is deleted from the Endpoint
- Remove All Groups — All the groups are deleted from the Endpoint
- Add Group to This Endpoint— Clicking this button adds a custom group identifier to the endpoint.
- Broadcast Add Group If Identifying — This button is enabled only on the coordinator device and sends the add group action as a broadcast to all devices in the network which add the group to their endpoints only if the endpoints are in the Identify mode.

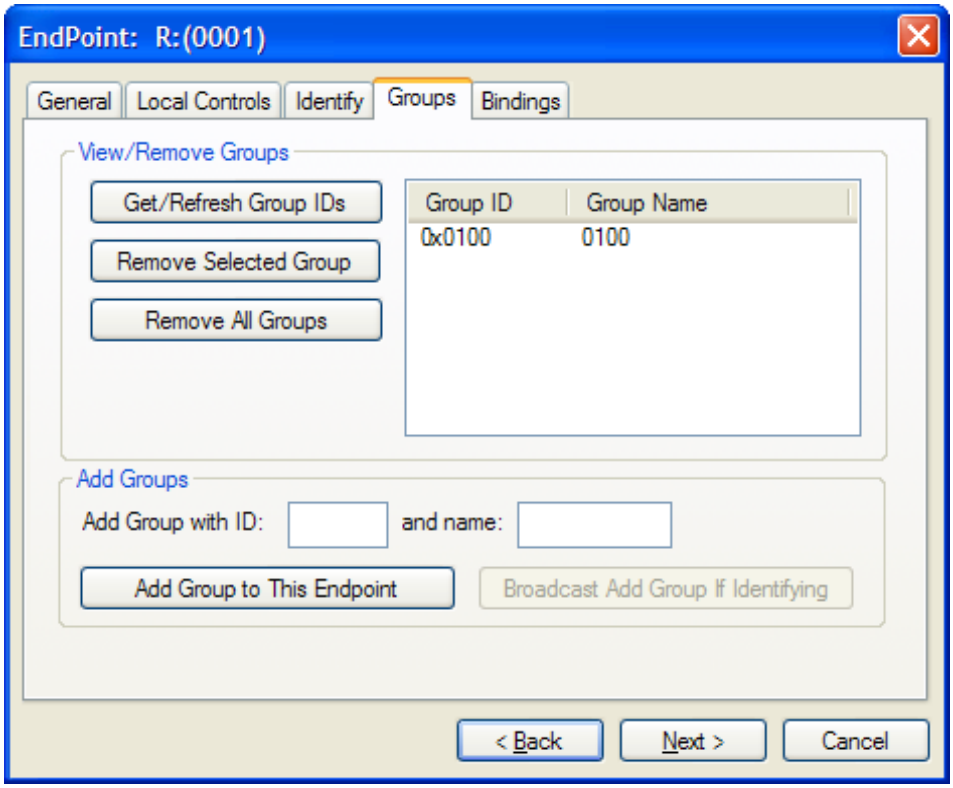

Figure 7-3. Groups Tab

7.4 Bindings Tab

The Bindings tab as shown in Figure 7-4, is used to add and remove bindings on an Endpoint. The Bindings tab supports both normal and group bindings.

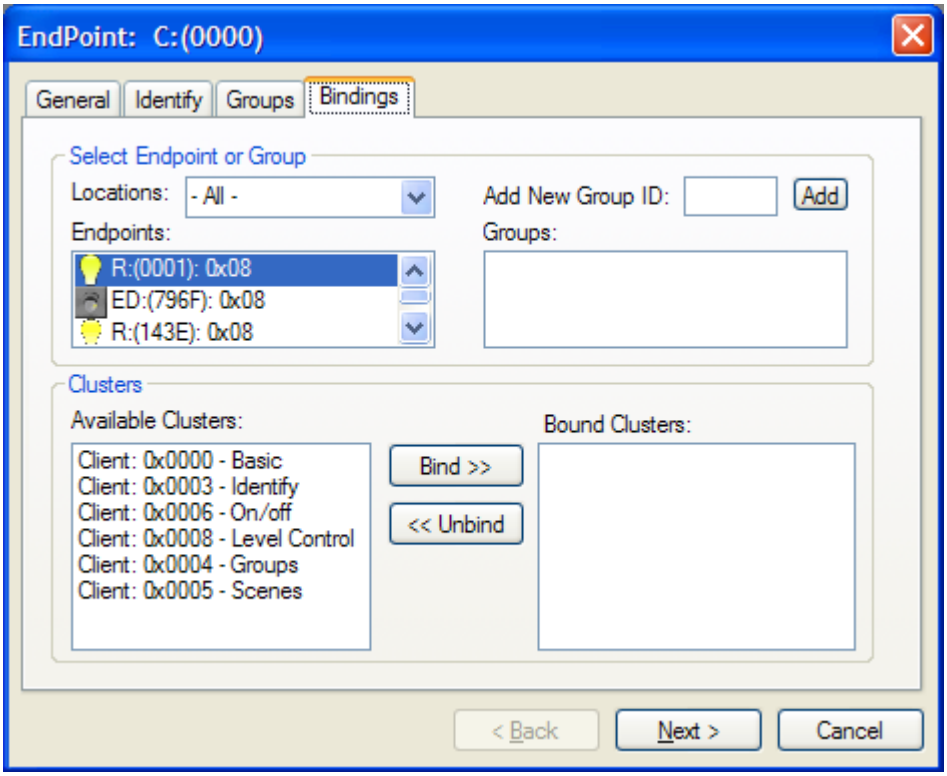

Figure 7-4. Bindings Tab

To add a normal binding to another endpoint, users must first select the destination endpoint from the Endpoints list. When the endpoint is selected, the Available clusters list displays the clusters that the two endpoints can use to be bound to one another. In order for a cluster to be used for binding, it must be declared as a server on one of the Endpoints and a client on the other.

In the Available Clusters list, the client clusters on the current (source) endpoint that match server clusters on the selected destination endpoint will be displayed as “Client: 0xHHHH - Cluster Name”, where 0xHHHH is the 16-bit cluster identifier.

The server clusters on the current endpoint that match client clusters on the selected destination endpoint will be displayed as “Server: 0xHHHH - Cluster Name”, where 0xHHHH is the 16-bit cluster identifier.

If one of the matching client or server clusters is selected, users can press the Bind button to make a binding on that cluster to the selected destination Endpoint. The cluster entry is moved to the Bound Clusters list as shown in Figure 7-5. To unbind the Endpoints, users must click on the cluster entry in the Bound Clusters list and click the Unbind button.

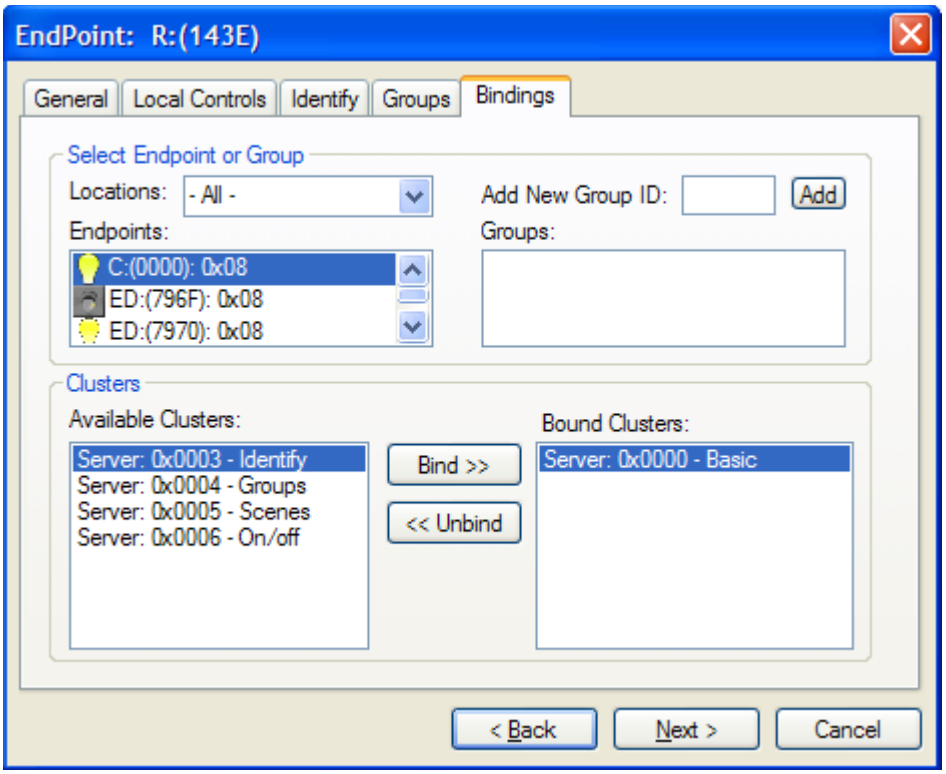

Figure 7-5. Binding Window with a Binding Made on the Basic Cluster.

If there are group bindings made on the current endpoint as source and device bindings are set to be retrieved, the group identifiers appear in the Groups list. To make a binding to a new group, the group identifier must be entered in the Add New Group ID edit box, and then users must click the Add button to add the group identifier to the Groups list. For group bindings, all clusters on the current endpoint are available for binding. To make or unmake a group binding, the group identifier in the Groups list must be selected and then the binding is made or removed the same way as a normal binding. That is, use the clusters lists and the Bind and Unbind buttons.

7.5 Local Controls Tab

The Local Controls tab is available only on some devices such as Lights. Figure 7-6 shows the Local Controls tab for the On/Off Light device. The buttons allow users to control the local light device. The effect of the commands (turning the light on or off) can be seen on the board LEDs as a state change and a change of state of the device icon on the GUI (the light bulb icon turns on and off).

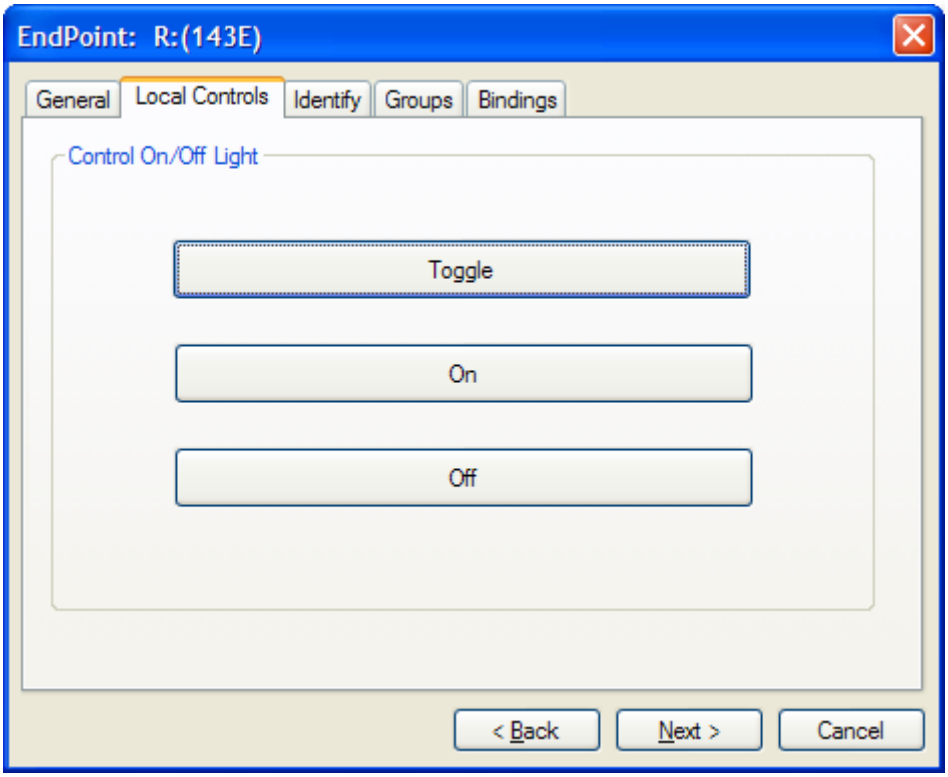

Figure 7-6. Local Controls for On/Off Light