CHAPTER 3

The RFID "Hello World" Application

This chapter will provide a step-by-step walkthrough of creating a basic solution using Microsoft BizTalk RFID and the Contoso device simulator. It will demonstrate the essential end user activities—managing RFID devices and implementing an event processing pipeline.

Overview

This section will provide a walkthrough of building a basic RFID application using BizTalk RFID. It will demonstrate the basic concepts and building blocks, including device providers, devices, processes, and event handlers. It is intended as a quick start to familiarize you with the various components of BizTalk RFID and how they can be applied to implement RFID-enabled solutions.

Our first end-to-end RFID solution, Hello RFID, will implement a basic scenario: capturing data generated by tags passing through a portal reader. It will not address filtering, workflow, I/O, or similar comprehensive features found in real-world applications, as these will be covered in later chapters.

As shown in Figure 3-1, the application will consist of a simulated reader (instead of a real RFID reader—using the simulator that ships out of the box with BizTalk RFID) feeding tag information into a database through BizTalk RFID. The rest of this chapter will walk through how to bring together all of these moving parts into a coherent solution.

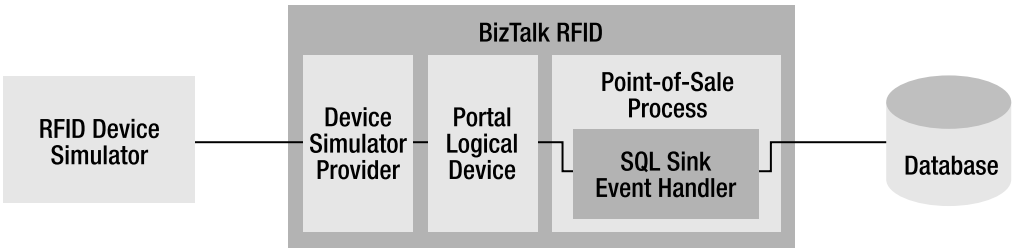

Figure 3-1. *Hello RFID overview*

Using the Device Simulator

The device simulator that ships with Microsoft BizTalk RFID provides basic simulation functionality, including generating tag reads and responding to commands (such as writing data to tags or changing I/O ports). It is a console application with a low level of interactivity (i.e., it dumps information into a console window, but is controlled through a configuration file rather than a runtime interface). Exercise 3-1 shows you how to start the device simulator.

Exercise 3-1. Starting the Device Simulator

This exercise will demonstrate how to start the device simulator and make it available to BizTalk RFID.

1. Start a console by clicking Start ➤ All Programs ➤ Accessories ➤ Command Prompt.
2. Change the working directory to the BizTalk RFID Services device simulator directory by entering the `cd` command shown here:

```
C:\>cd "\Program Files\Microsoft BizTalk RFID\Samples\
Device Service Provider\Contoso\ContosoEndToEnd\ContosoDeviceSimulator"
```

■ **Note** When starting the simulator, if you receive a `System.Unauthorized` exception error related to the log file not being writable, restart the command prompt with administrative privileges. To do this, click Start ➤ All Programs ➤ Accessories, and then right-click Command Prompt. From the context menu, select Run as Administrator. Continue from step 2.

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3. Execute the `runContosoSimulator.cmd` batch file, as shown in Figure 3-2, to start the simulator. Leave the simulator running, as it will be needed in the remainder of the exercises in this chapter.

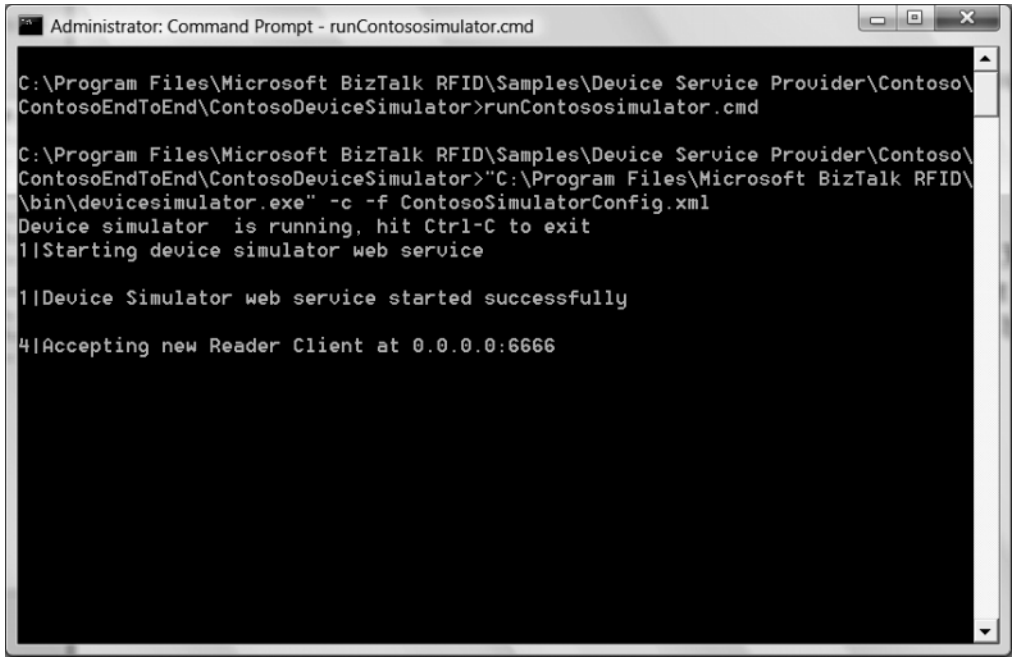


Figure 3-2. *Device simulator running in console*

Starting from the baseline configuration, the device simulator can be tweaked to enable other types of scenarios and tag generation patterns. This is done by manipulating the reader and behavior setting configuration files.

Configuring Settings

A sample configuration file for the device simulator is shown in Listing 3-1. It consists of the header section (defining the number of devices) and a set of device sections (which provide the configuration for the network bindings and behavior module).

Listing 3-1. *Device Simulator Configuration File*

```
<?xml version="1.0" encoding="utf-8" ?>
<profile>
<section name="NumberOfDevices">
    <entry name="DeviceCount">1</entry>
</section>
```

```
<section name="DeviceInformation_1">
<entry name="DeviceName">ContosoTestDevice</entry>
<entry name="ConnectionType">TCPIP</entry>
<entry name="IpAddress">0.0.0.0</entry>
<entry name="PortNumber">6666</entry>
<entry name="ProviderId">Contoso</entry>
<entry name="NotificationDataFile">ContosoNotificationConfig.xml</entry>
<entry name="DeviceTranslatorAssemblyPath">
     Microsoft.Rfid.Test.ContosoDeviceTranslator.dll
</entry>
<entry name="DeviceTranslatorConfigFile"></entry>
</section>
</profile>
```

Modification of this file allows configuration of multiple simulated readers with varying setups (depending on the targeted scenario—i.e., number of readers, network paths, etc.). Exercise 3-2 shows you how to modify the simulator for two devices.

■ **Note** The `0.0.0.0` IP address in the preceding file means "Use all available IP addresses."

Exercise 3-2. Modifying the Simulator for Two Devices

This exercise will demonstrate how to modify the device simulator to start multiple simulated devices, and make these devices available to BizTalk RFID.

1. Start a console by clicking Start ➤ All Programs ➤ Accessories ➤ Command Prompt.
2. Change the working directory to the BizTalk RFID Services device simulator directory by entering the `cd` command shown here:

   ```
   C:\>cd "\Program Files\Microsoft BizTalk RFID\Samples\Device Service

    Provider\Contoso\ContosoEndToEnd\ContosoDeviceSimulator"
   ```

3. Create a copy of the `ContosoSimulatorConfig.xml` file and name it `ContosoTwoReader.xml`. Modify the contents of this file to match those shown in Listing 3-2. The sections to change are the device name and the network binding (i.e., both readers cannot bind to the same address and port).

Listing 3-2. *ContosoTwoReader.xml Contents*

```
<?xml version="1.0" encoding="utf-8" ?>
<profile>
<section name="NumberOfDevices">
    <entry name="DeviceCount">2</entry>
</section>

<section name="DeviceInformation_1">
<entry name="DeviceName">ContosoTestDevice</entry>
<entry name="ConnectionType">TCPIP</entry>
<entry name="IpAddress">0.0.0.0</entry>
<entry name="PortNumber">6666</entry>
<entry name="ProviderId">Contoso</entry>
<entry name="NotificationDataFile">ContosoNotificationConfig.xml</entry>
<entry name="DeviceTranslatorAssemblyPath">
     Microsoft.Rfid.Test.ContosoDeviceTranslator.dll
</entry>
<entry name="DeviceTranslatorConfigFile"></entry>
</section>

<section name="DeviceInformation_2">
<entry name="DeviceName">ContosoTestDeviceToo</entry>
<entry name="ConnectionType">TCPIP</entry>
<entry name="IpAddress">0.0.0.0</entry>
<entry name="PortNumber">6667</entry>
<entry name="ProviderId">Contoso</entry>
<entry name="NotificationDataFile">ContosoNotificationConfig.xml</entry>
<entry name="DeviceTranslatorAssemblyPath">
     Microsoft.Rfid.Test.ContosoDeviceTranslator.dll
</entry>
<entry name="DeviceTranslatorConfigFile"></entry>
</section>
</profile>
```

4. Start the device simulator using the new configuration file (`ContosoTwoDevices.xml`) by executing this command:

```
"%RFIDINSTALLDIR%\bin\devicesimulator.exe" -c -f ContosotwoDevices.xml
```

5. Check to ensure that the device simulator starts up with two simulated devices by checking the output for devices bound to both ports 6666 and 6667, as shown in Figure 3-3.

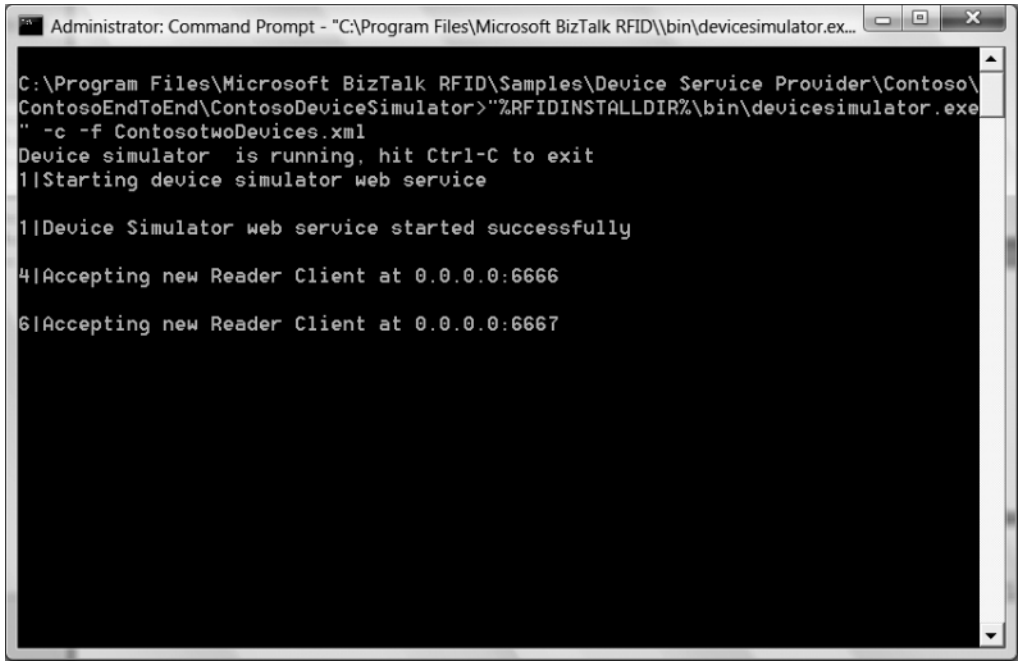


Figure 3-3. *Simulator running two devices*

Configuring Notifications

A separate configuration file configures the behavior of the simulator in the context of which events get raised by the simulator (i.e., which tags it "reads"). A sample configuration file for the `ContosoDeviceTranslator` behavior module (the default) is displayed in Listing 3-3.

Listing 3-3. *ContosoTwoReader.xml Contents*

```
<?xml version="1.0" encoding="utf-8" ?>
<profile>
<section name="Notification">
    <entry name="TimePeriod">10000</entry>
    <entry name="Distribution">EXPONENTIAL</entry>
    <entry name="NotificationErrorRate">0</entry>
    <entry name="WaitAfterNotification">1000</entry>
    <entry name="InitialDelay">100</entry>
    <entry name="Duplicate_Elimination_Time">0</entry>
    <entry name="InfiniteNotification">FALSE</entry>
```

```
    <entry name="ContinuousDataSection">1</entry>
    <entry name="DiscreteDataSection">0</entry>
</section>
<section name="Continuous Data Section 1">
    <entry name="StartingData">1000</entry>
    <entry name="TotalData">10000</entry>
    <entry name="TagType">1</entry>
    <entry name="TagData">SampleTagData</entry>
    <entry name="TagSource">Antenna1</entry>
    <entry name="DelayTime">1</entry>
</section>
</profile>
```

Following are some of the key sections that configure how notifications are sent:

`TimePeriod`: The minimum time (in milliseconds) between two tag events

`InitialDelay`: The time delay before posting the first tag

`Duplicate_Elimination_Time`: The minimum time delay between posting a tag event and posting another tag event with the same tag ID

`InfiniteNotification`: If set to `true`, allows tags to be sent continuously

`Distribution`, `NotificationErrorRate`, and `WaitAfterNotification` are not meant to be end user configurable. Do not modify these variables.

Notifications can be configured in either a discrete or a continuous set. The primary continuous configuration variables are as follows:

`StartingData`: The initial tag ID. Subsequent tag IDs will increment from this value.

`TotalData`: The total number of tags to send. If `InfiniteNotification` is set to `true`, after this number of tag events has been raised, the cycle will start again.

`TagType`: The numeric tag type used in the raised events.

`TagData`: The starting tag data field. Subsequent tag data values will increment from this value.

`TagSource`: The "source" (or antenna) from which these events will be raised.

Exercise 3-3 presents an example of modifying the simulator behavior.

Exercise 3-3. Modifying the Simulator Behavior

This exercise will demonstrate how to modify the device simulator to send a specific sequence of tag events.

1. Create a copy of the `ContosoNotificationConfig.xml` file and name it `ContosoNotificationConfig.bak`.
2. Edit the `ContosoNotificationConfig.xml` file and modify the contents as shown in Listing 3-4. This adds a second source (`Antenna2`), which will raise tag events with a different tag type and starting ID.

Listing 3-4. *ContosoTwoReader.xml Contents*

```
<?xml version="1.0" encoding="utf-8" ?>
<profile>
<section name="Notification">
    <entry name="TimePeriod">10000</entry>
    <entry name="Distribution">EXPONENTIAL</entry>
    <entry name="NotificationErrorRate">0</entry>
    <entry name="WaitAfterNotification">1000</entry>
    <entry name="InitialDelay">100</entry>
    <entry name="Duplicate_Elimination_Time">0</entry>
    <entry name="InfiniteNotification">TRUE</entry>
    <entry name="ContinuousDataSection">2</entry>
    <entry name="DiscreteDataSection">0</entry>
</section>
<section name="Continuous Data Section 1">
    <entry name="StartingData">1000</entry>
    <entry name="TotalData">10000</entry>
    <entry name="TagType">1</entry>
    <entry name="TagData">SampleTagData</entry>
    <entry name="TagSource">Antenna1</entry>
    <entry name="DelayTime">1</entry>
</section>
<section name="Continuous Data Section 2">
    <entry name="StartingData">5000</entry>
    <entry name="TotalData">10000</entry>
    <entry name="TagType">2</entry>
    <entry name="TagData">SampleTagData</entry>
    <entry name="TagSource">Antenna2</entry>
    <entry name="DelayTime">1</entry>
</section>
</profile>
```

You'll use the file from Listing 3-4 in subsequent exercises (since events aren't raised until a connection is made from BizTalk RFID, the results of this exercise won't be apparent until Exercise 3-5).

Creating a Device in BizTalk RFID

Now that we've established a simulated device to which to connect, the next step is to configure BizTalk RFID to recognize and connect to that device. This will take part in two stages: adding the (Contoso) simulator provider (Exercise 3-4) and adding that device to BizTalk RFID (Exercise 3-5).

Exercise 3-4. Adding the Simulator Provider

This exercise will demonstrate how to register the Contoso simulator provider with BizTalk RFID (this is not done by default during installation).

1. Start RFID Manager by clicking Start ➤ All Programs ➤ Microsoft BizTalk RFID ➤ RFID Manager.
2. Expand the computer name and click Device Providers. Right-click Device Providers to bring up the context menu, and click New Provider, as shown in Figure 3-4.

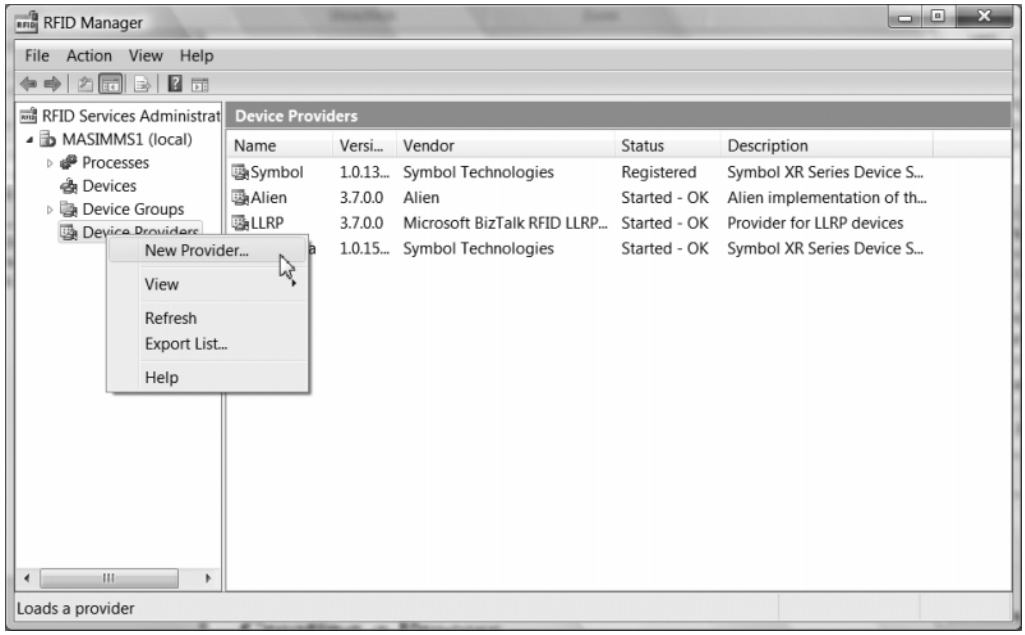


Figure 3-4. *Adding a provider in RFID Manager*

3. From the New Provider dialog, fill in the name field with the value **Contoso**.
4. Click the Browse button and navigate to the `C:\Program Files\Microsoft BizTalk RFID\bin` directory. Select the `Microsoft.Rfid.ContosoDeviceProvider.dll` file.
5. Click the Register button to load the provider into BizTalk RFID. The New Provider dialog should now resemble Figure 3-5. Note the ability to configure settings at a provider level (however, the Contoso provider contains many "fake" configuration properties simply for the sake of demonstrating how to implement such properties).
6. Ensure that the "Start the provider" check box is checked.

7. Click OK to finish adding the provider. It should now be visible in the list of registered providers. Note that the other providers loaded in Figure 3-4 are not available out of the box. This screenshot was taken on a machine with several real device providers already loaded.

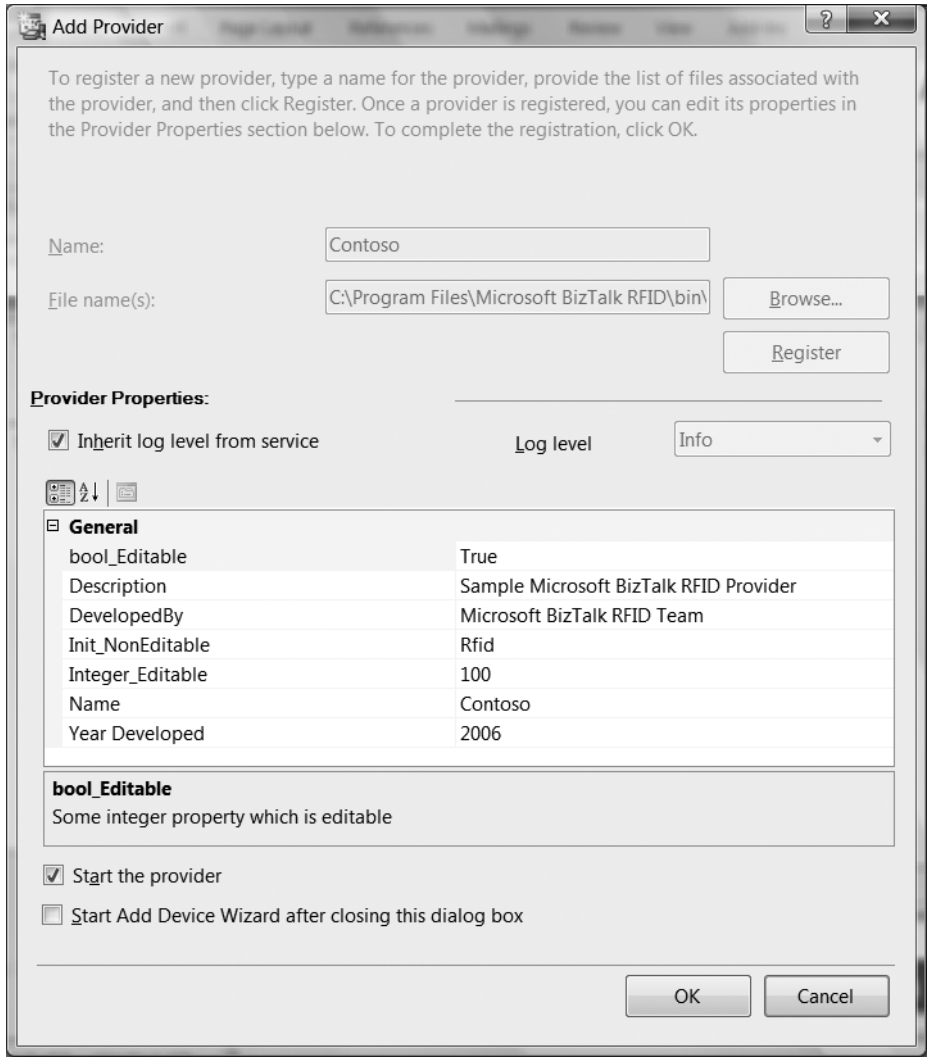


Figure 3-5. *Adding the new Contoso provider*

Exercise 3-5. Creating a Device in BizTalk RFID

This exercise will demonstrate how to add a device in BizTalk RFID.

1. Ensure that the simulator is running and bound to port 6666 (as per Exercise 3-1).
2. Start RFID Manager by clicking Start ➤ All Programs ➤ Microsoft BizTalk RFID ➤ RFID Manager.
3. Expand the computer name and click Devices. Right-click Devices, and then click New Device from the context menu, as shown in Figure 3-6.

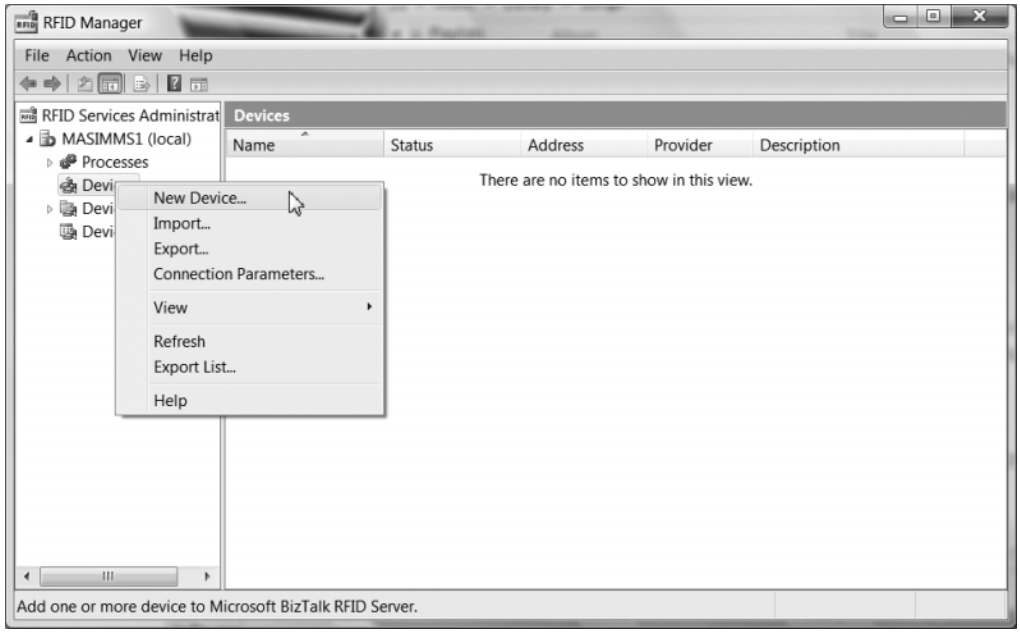


Figure 3-6. *Starting the New Device dialog*

4. From the Add Device wizard, ensure that the Add Single Device radio button is selected, and then click Next.
5. From the list of available providers, click Contoso to highlight it. Click Next to proceed to the next step.
6. As shown in Figure 3-7, type in the loopback address **127.0.0.1** and a port number of **6666** in the appropriate fields. Click Next.
7. From the Add Device to a Group dialog, click Next. At this stage, you will leave the simulated device in the default device group (also known as the *root device group*).
8. On the Authentication dialog, leave the username and password empty, and click Next.
9. Provided that the simulator is running and the network information is correct, the Properties dialog should resemble the one depicted in Figure 3-8. Click Next to proceed to the final step.

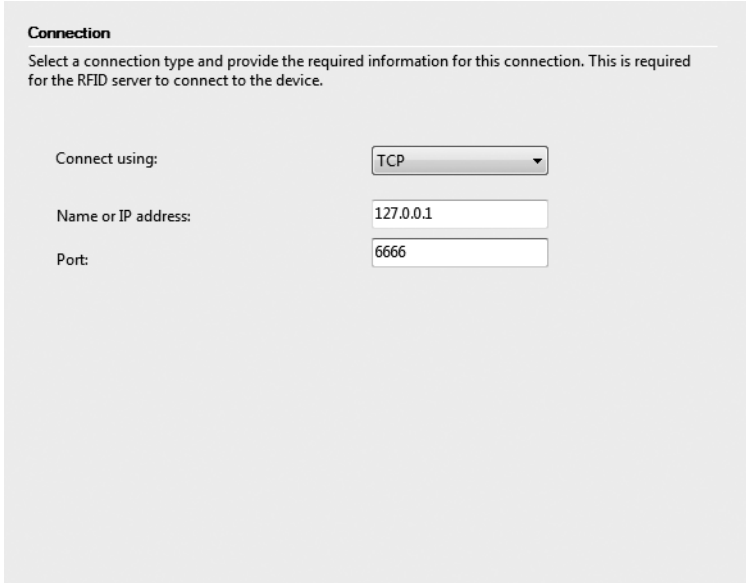


Figure 3-7. *Configuring connection information*

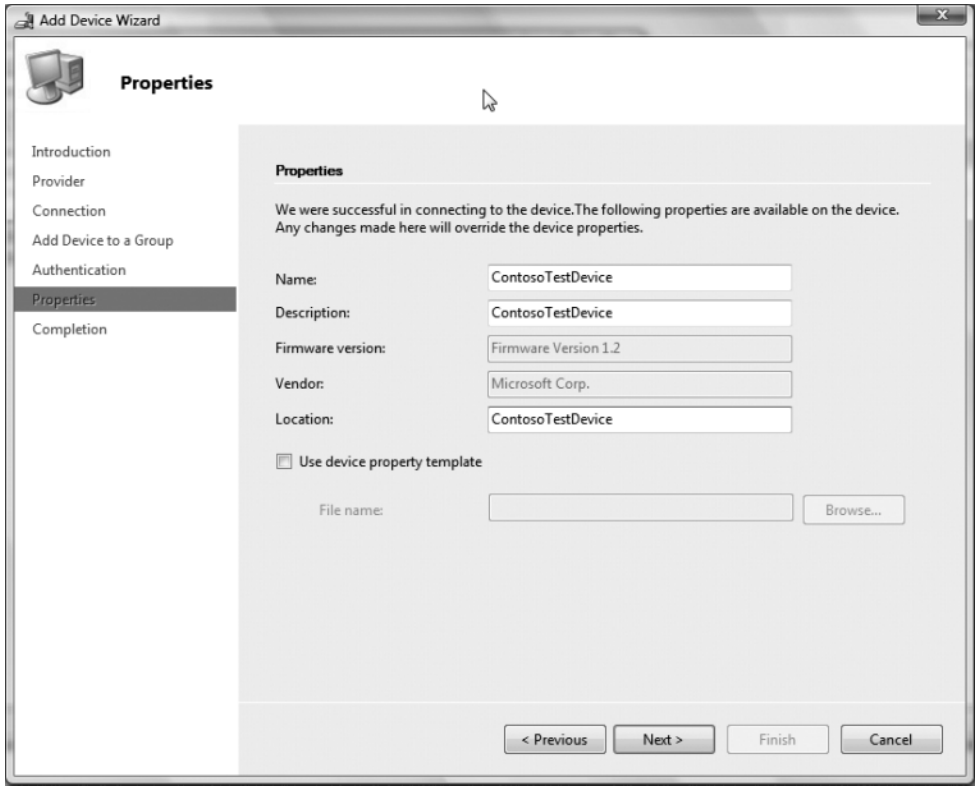


Figure 3-8. *Successful connection*

10. From the Completion dialog, click Finish to complete the process of adding the device. The device should now be visible in the Devices list in RFID Manager, as shown in Figure 3-9.

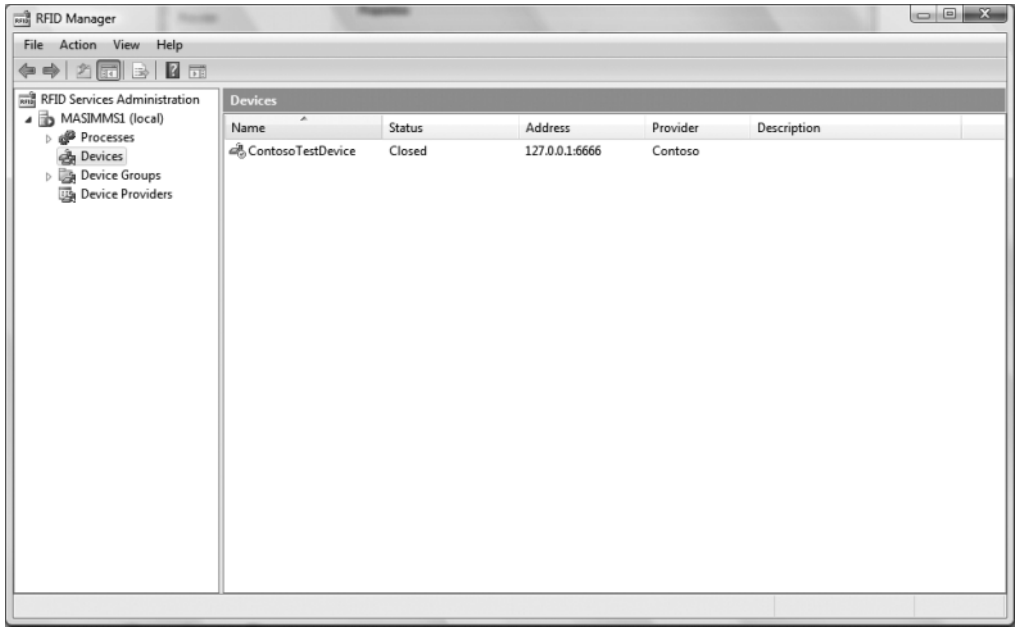


Figure 3-9. *Device added to BizTalk RFID*

Creating a Process

In the previous two sections, you set up the device simulator and created a device binding for it in BizTalk RFID. The final piece of setting up our first BizTalk RFID application involves binding the device into a process, and is explored in Exercise 3-6.

This will tell BizTalk RFID to automatically establish a connection to the device and store received tag events in a SQL Server database (using the `SqlServerSink` event handler).

Exercise 3-6. Creating a Process in BizTalk RFID

This exercise will demonstrate how to create a process in BizTalk RFID, and bind devices and event handlers to create an RFID application.

1. Ensure that the simulator is running and bound to port 6666 (as per Exercise 3-1).
2. Ensure that the simulated device is defined (as per Exercise 3-5).
3. Start RFID Manager by clicking Start ➤ All Programs ➤ Microsoft BizTalk RFID ➤ RFID Manager.

4. Expand the computer name and click Processes. Right-click Processes, and click New Process from the context menu.
5. From the New Process dialog, change the process name to HelloWorldRfid, the tag-processing mode to Reliable, and the description to My First RFID Application, as shown in Figure 3-10. Click OK to start the Bind wizard and map devices and event handlers into this process.

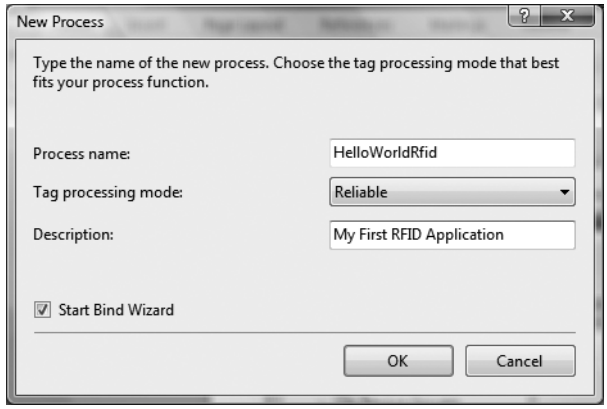


Figure 3-10. *Defining the process*

6. Click Next on the Bind wizard introduction dialog.
7. From the Bind Process to Logical Device dialog, click New. In the Logical Device Name dialog, type **MyLogicalDevice**. Click OK to close the dialog.
8. MyLogicalDevice should now be registered. Click its check box to enable that logical device, as shown in Figure 3-11. Click Next.

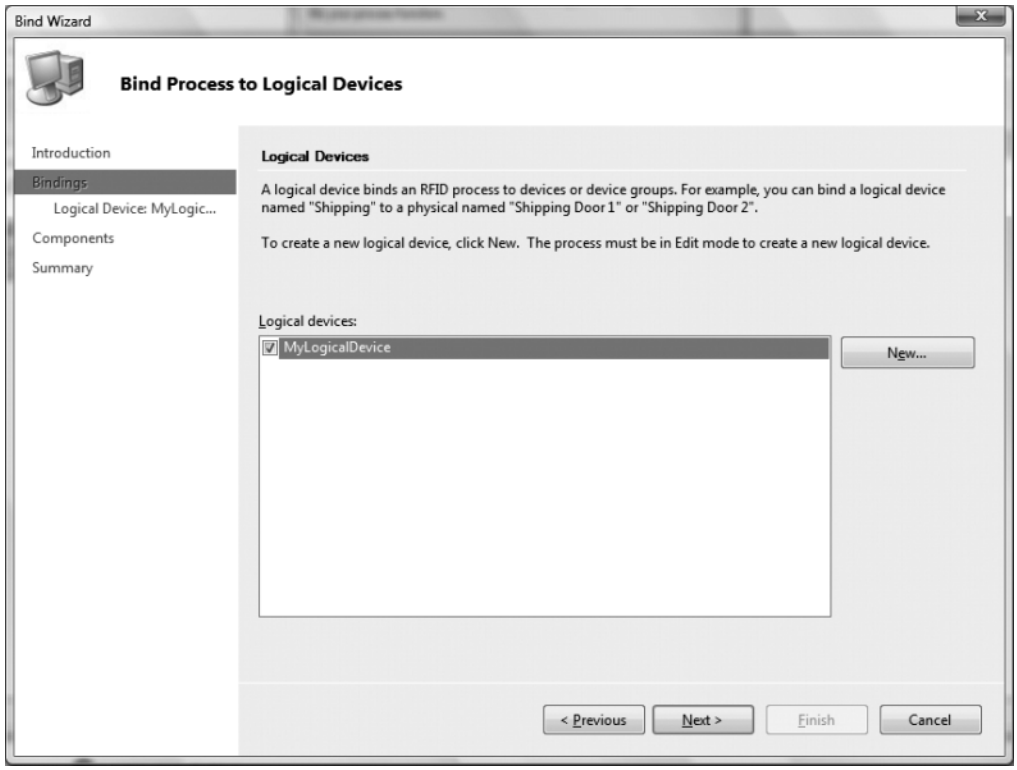


Figure 3-11. *Creating a logical device*

9. From the "Configure logical device – MyLogicalDevice" dialog, expand the ContosoTestDevice node to display the available sources. Click the ContosoTestDevice check box to bind it (and its child sources) to this process, as shown in Figure 3-12. Click Next.

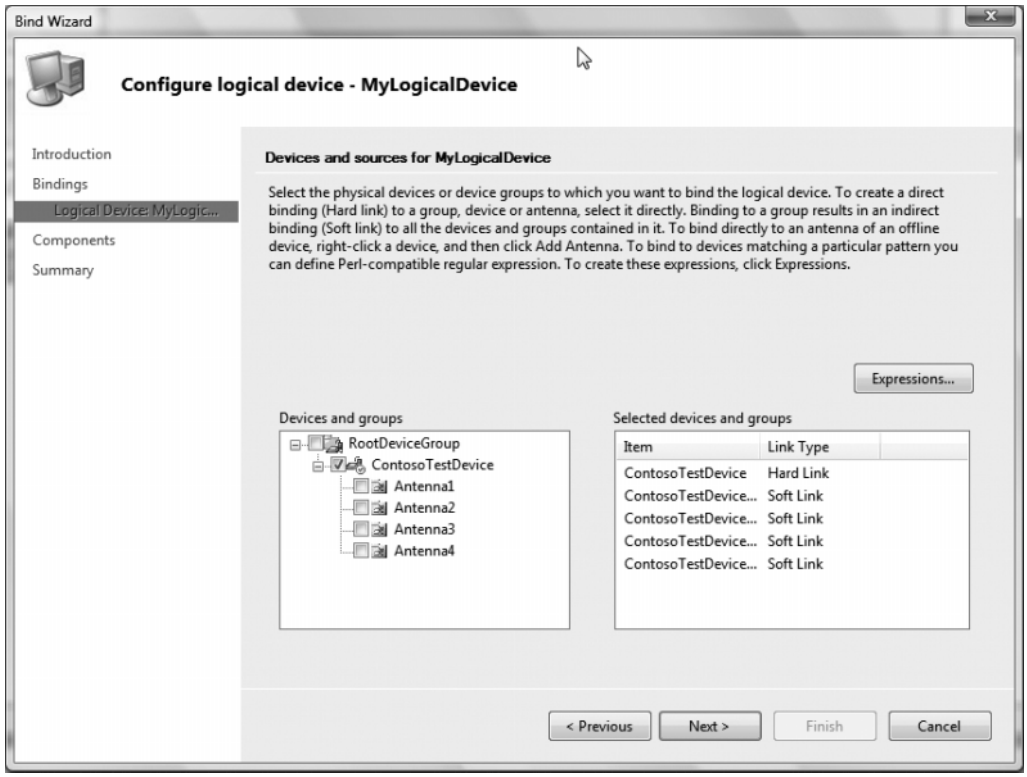


Figure 3-12. *Selecting devices and sources*

10. From the Configure Components dialog, click New Component. From the Add Component dialog, select the SQL Server Sink component and click Add, as shown in Figure 3-13.
11. From the Add Component Instance dialog, as shown in Figure 3-14, type in an instance name of **SqlSink**, and click OK.
12. Click Close on the Add Component dialog to finish configuring the `SqlServerSink` event handler. Click Next to proceed to the final step in the Bind wizard.
13. From the Summary of Changes dialog, as shown in Figure 3-15, click the "Start the process when I click Finish" check box. Click Finish to close the Bind wizard and start the process.

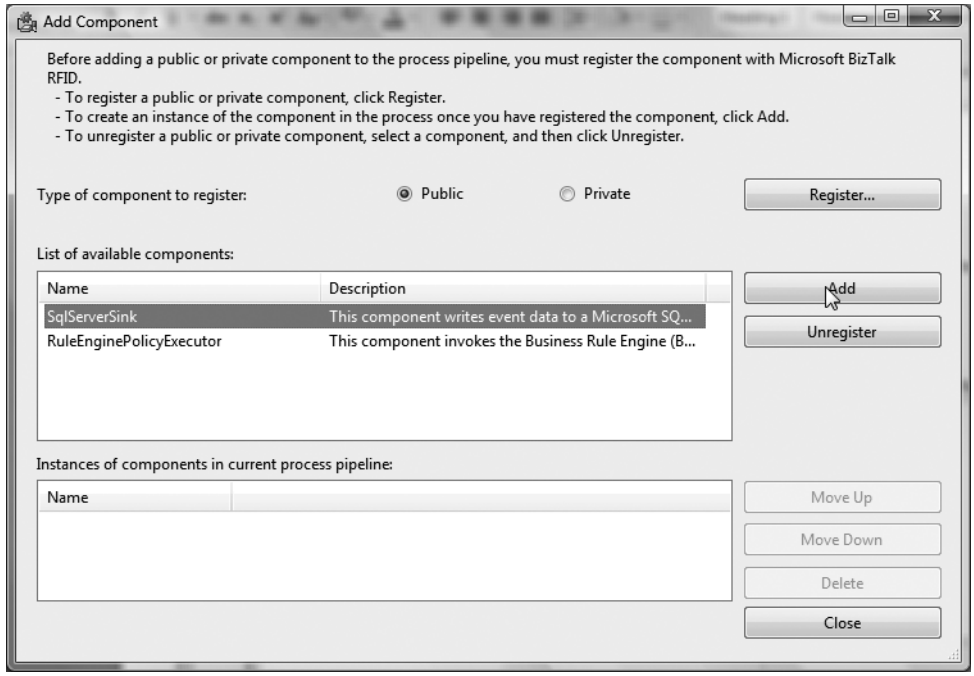


Figure 3-13. *Selecting the SqlServerSink component*

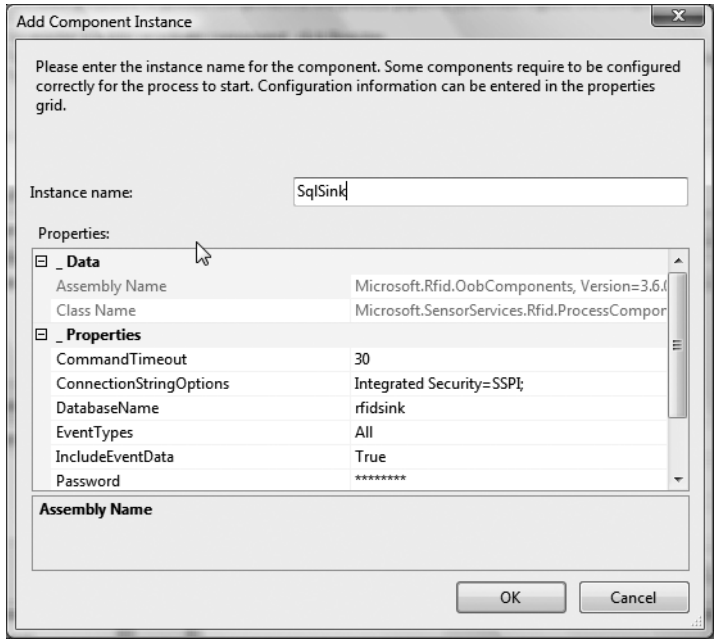


Figure 3-14. *Configuring the event handler*

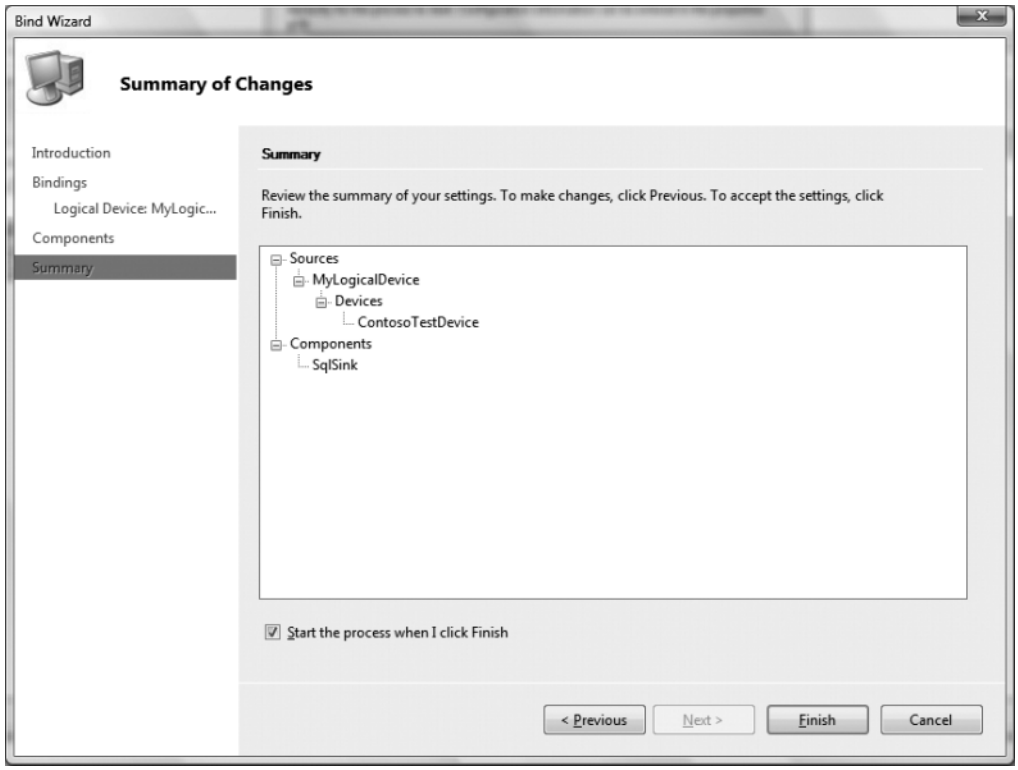
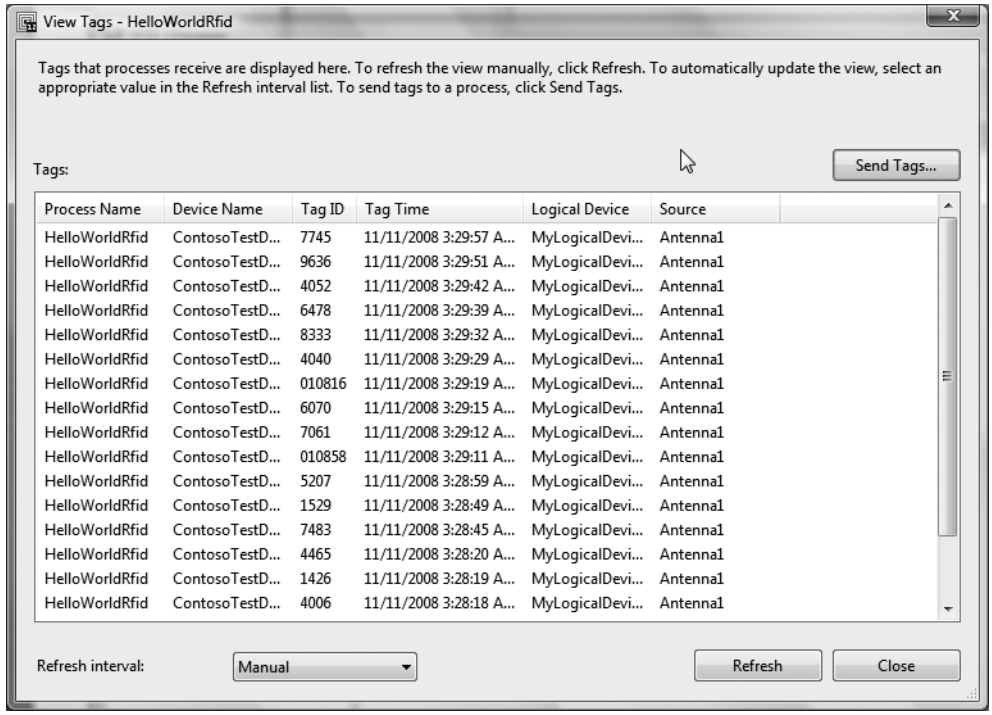


Figure 3-15. *Finalizing the Bind wizard*

14. The process should now be active, connected to the simulator, and receiving tags. To verify this, wait a few seconds, and right-click the HelloWorldRfid process. From the context menu, click View Tags. As shown in Figure 3-16, the tags pumped into the process by the simulator are visible. Note that your View Tags screen will not match exactly, as the tag IDs are randomly generated.



Process Name	Device Name	Tag ID	Tag Time	Logical Device	Source
HelloWorldRfid	ContosoTestD...	7745	11/11/2008 3:29:57 A...	MyLogicalDevi...	Antenna1
HelloWorldRfid	ContosoTestD...	9636	11/11/2008 3:29:51 A...	MyLogicalDevi...	Antenna1
HelloWorldRfid	ContosoTestD...	4052	11/11/2008 3:29:42 A...	MyLogicalDevi...	Antenna1
HelloWorldRfid	ContosoTestD...	6478	11/11/2008 3:29:39 A...	MyLogicalDevi...	Antenna1
HelloWorldRfid	ContosoTestD...	8333	11/11/2008 3:29:32 A...	MyLogicalDevi...	Antenna1
HelloWorldRfid	ContosoTestD...	4040	11/11/2008 3:29:29 A...	MyLogicalDevi...	Antenna1
HelloWorldRfid	ContosoTestD...	010816	11/11/2008 3:29:19 A...	MyLogicalDevi...	Antenna1
HelloWorldRfid	ContosoTestD...	6070	11/11/2008 3:29:15 A...	MyLogicalDevi...	Antenna1
HelloWorldRfid	ContosoTestD...	7061	11/11/2008 3:29:12 A...	MyLogicalDevi...	Antenna1
HelloWorldRfid	ContosoTestD...	010858	11/11/2008 3:29:11 A...	MyLogicalDevi...	Antenna1
HelloWorldRfid	ContosoTestD...	5207	11/11/2008 3:28:59 A...	MyLogicalDevi...	Antenna1
HelloWorldRfid	ContosoTestD...	1529	11/11/2008 3:28:49 A...	MyLogicalDevi...	Antenna1
HelloWorldRfid	ContosoTestD...	7483	11/11/2008 3:28:45 A...	MyLogicalDevi...	Antenna1
HelloWorldRfid	ContosoTestD...	4465	11/11/2008 3:28:20 A...	MyLogicalDevi...	Antenna1
HelloWorldRfid	ContosoTestD...	1426	11/11/2008 3:28:19 A...	MyLogicalDevi...	Antenna1
HelloWorldRfid	ContosoTestD...	4006	11/11/2008 3:28:18 A...	MyLogicalDevi...	Antenna1

Figure 3-16. *Viewing tags received in the process*

Conclusion

After reviewing the basics of RFID technology and BizTalk RFID, in this chapter you developed your first end-to-end application. Using RFID Manager to configure providers, devices, and processes, you captured a stream of information flowing from the RFID device simulator and captured it in a SQL Server database. The following list describes the key components of the end-to-end application developed in this chapter:

- RFID Manager is the primary graphical interface, used to configure providers, devices, and processes.
- BizTalk RFID ships with a basic simulator, the Contoso device simulator, which allows you to simulate basic scenarios involving one or more readers. The Contoso device simulator does not have a graphical interface, and is configured by modifying a pair of XML files.
- Device providers are the "drivers" of the BizTalk RFID world. In order to connect to a vendor's RFID hardware, you will first need a compatible provider for that hardware. Multiple providers (and multiple versions of a vendor's provider) can be run concurrently.
- BizTalk RFID devices consist of a device provider, transport information (such as the IP address and connection port), and credentials (typically a username and password).
- Device groups are used to associate physical readers matching a particular characteristic, such as management location or device type.
- Logical devices are used to associate physical readers with logical constructs, such as a location zone or entry portal (e.g., Dock Door A).
- BizTalk RFID processes combine a set of logical devices, which are composed of a set of physical devices and sources, with a set of event handler components that filter, shape, and forward tag events and other information received from the devices.

Building on the hands-on foundation of creating your first end-to-end application, the next chapter will dive into the features and functions of RFID Manager.

CASE STUDY: SIMPLE BUSINESS INTELLIGENCE THROUGH TAG TRACKING

Industry: Retail.

Overview: A high-cost-technology company tracks its inventory by collecting tag reads as merchandise leaves the store. Items over a certain price point have an RFID tag placed on them. As these items leave the store, either after purchase, after return to the manufacturer, or after theft, their tags are read and kept in a centralized database. Numerous reports are generated from this data, including a simple dashboard report that is kept on the screen at all times. This report enables the management and sales associates to make immediate decisions around real-time discounts available for customers. For example, if the report indicates that a certain number of items have left the store on any given day, sales associates can begin to offer larger discount incentives to sell additional items on that same day.

Results: With basic business intelligence available to the organization as a whole, employees can interact more intelligently with customers. Due to the high value of the items being sold, this RFID infrastructure pays for itself through increased sales performance based on visibility into inventory.