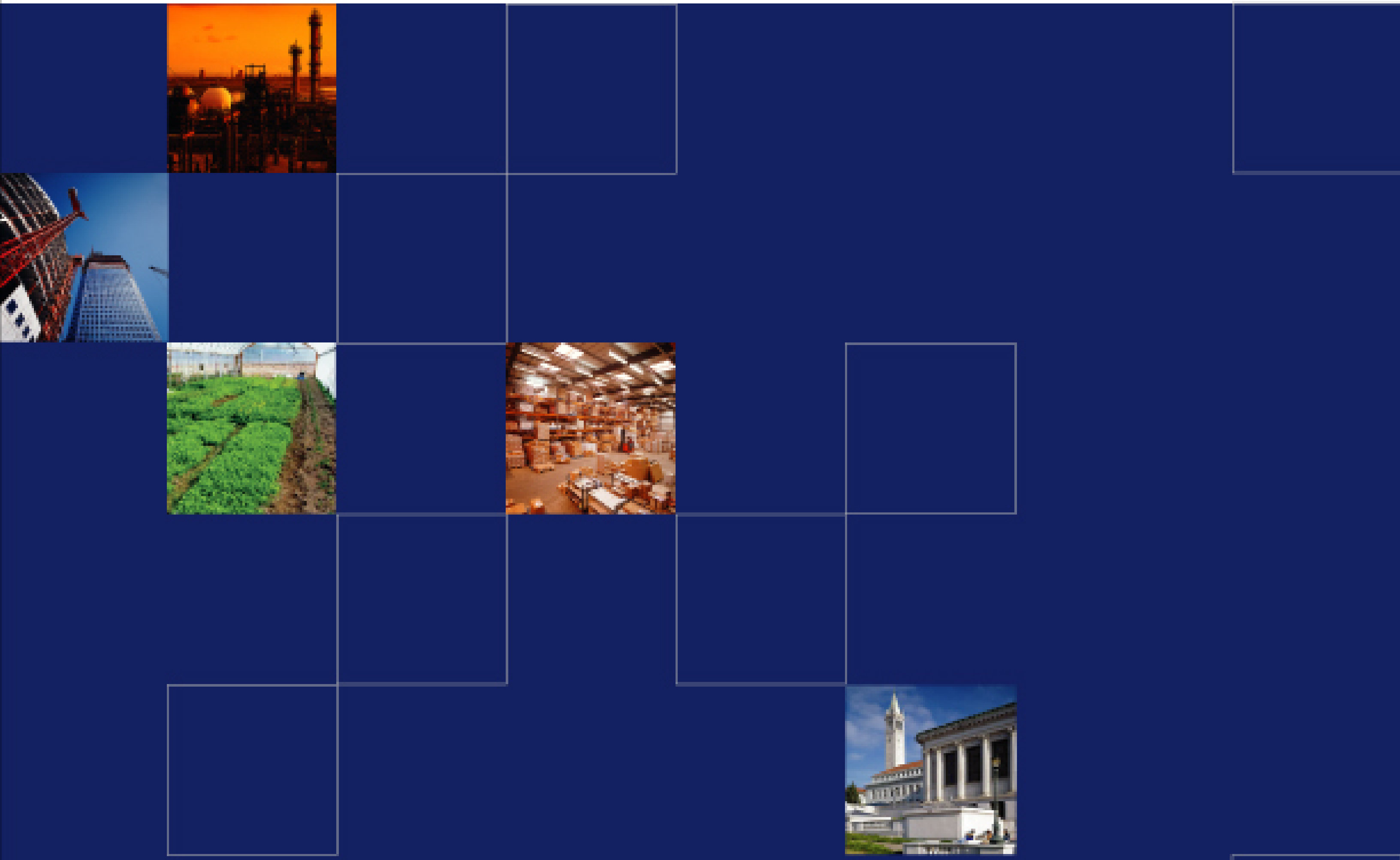
Crossbow

MoteConfig User’s Manual

Revision B, March 2007

PN: 7430-0112-01



www.xbow.com

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About This Document

The following annotations have been used to provide additional information.

🔈 NOTE

Note provides additional information about the topic.

☑ EXAMPLE

Examples are given throughout the manual to help the reader understand the terminology.

⚐ IMPORTANT

This symbol defines items that have significant meaning to the user

💣 WARNING

The user should pay particular attention to this symbol. It means there is a chance that physical harm could happen to either the person or the equipment.

The following paragraph heading formatting is used in this manual:

1 Heading 1

1.1 Heading 2

1.1.1 Heading 3

This document also uses different body text fonts (listed in Table 0-1) to help you distinguish between names of files, commands to be typed, and output coming from the computer.

Table 0-1. Font types used in this document.

Font Type	Usage
Courier New Normal	Sample code and screen output
Courier New Bold	Commands to be typed by the user
Times New Roman Italic	TinyOS files names, directory names
Franklin Medium Condensed	Text labels in GUIs

1 Introduction

1.1 MoteConfig

MoteConfig is a Windows-based GUI utility for programming Motes. This utility provides an interface for configuring and downloading pre-compiled *XMesh*/TinyOS firmware applications onto Motes. MoteConfig allows the user to configure the Mote ID, Group ID, RF channel and RF power. The user can also enable the over-the-air-programming feature present on all *Xmesh* - based firmware. High-power and low-power *Xmesh* applications are available for each sensor board and platform manufactured by Crossbow as part of the MoteView install (see section 2.3).

Table 1-1. Pre-compiled XMesh applications for different platforms

Board Model	Binary file name	Platforms				
		MICA2 315 433 915	MICAZ 2400	M9100	M2100	M2110
MTS boards						
MTS101	*XMTS101_<platform>_<mode>.exe*	✓	✓			
MTS300CA	*XMTS300CA_<platform>_<mode>.exe*	✓	✓			
MTS300CB	*XMTS300CB_<platform>_<mode>.exe*	✓	✓	✓	✓	✓
MTS310CA	*XMTS310CA_<platform>_<mode>.exe*	✓	✓			
MTS310CB	*XMTS310CB_<platform>_<mode>.exe*	✓	✓			
MTS400	*XMTS400_<platform>_<mode>.exe*	✓	✓	✓	✓	✓
MTS410	*XMTS410_<platform>_<mode>.exe*	✓	✓			
MTS420	*XMTS420_<platform>_<mode>.exe*	✓	✓	✓	✓	✓
MTS420CC	*XMTS420CC_<platform>_<mode>.exe*	✓	✓	✓	✓	✓
MTS450	*XMTS450_<platform>_<mode>.exe*	✓	✓	✓	✓	✓
MDA boards						
MDA100CA	*XMDA100CA_<platform>_<mode>.exe*	✓	✓			
MDA100CB	*XMDA100CB_<platform>_<mode>.exe*	✓	✓	✓	✓	✓
XBW-DA100CA	*XBW-DA100CA_<platform>_hp.exe*		✓			
XBW-DA100CB	*XBW-DA100CB_<platform>_hp.exe*		✓			
MDA300	*XMDA300_<platform>_<mode>.exe*	✓	✓	✓	✓	✓

MDA300P	*XMDA300p_<platform>_<mode>.exe*	✓	✓	✓	✓	✓
MDA320	*XMDA320_<platform>_<mode>.exe*	✓	✓	✓	✓	✓
XBW-DA325	*XBW-DA325_<platform>_hp.exe*		✓			
Base Station (common to all sensor boards)						
XMeshBase_<platform>_<mode>.exe		✓	✓	✓	✓	✓

<platform> = 315, 433, 915 (for MICA2), 2400 (for MICAz), or M9100, M2100, M2110

<mode> = hp or lp. hp = high power mesh networking. lp = low-power mesh networking via low-power listening and time synchronized data transmissions.

Table 1-2. Pre-compiled MICA2DOT XMesh Applications

MICA2DOT Mote (MPR5x0, x = 0, 1, or 2)	
Board Model	**Binary file name**
MTS boards	
MTS510	*XMTS510_xxx_<mode>.exe*
MDA boards	
MDA500	*XMDA500_xxx_<mode>.exe*
Base Station (common to all boards)	
XMeshBase_Dot_xxx_<mode>.exe	

xxx = 315, 433, or 915. <mode> = hp or lp. hp = high power mesh networking. lp = low-power mesh networking via low-power listening and time synchronized data transmissions.

Table 1-3. Pre-compiled MSP XMesh applications

MSP410 Mote Security Package	
MSP410_433_base.exe	To be used on an MPR410 MICA2 Mote connected to the base station
MSP410_433_hp.exe	For the MSP410 Mote

Table 1-4. Pre-compiled MEP XMesh applications

MEP410 Mote Environmental Package	
MEP410_433_<mode>.exe	For the MEP410 and an MPR410 MICA2 Mote when assigned a node ID of 0 ("base node").
MEP510 Mote Environmental Package	
MEP510_433_<mode>.exe	For the MEP510 and an MPR510 MICA2DOT Mote when assigned a node ID of 0 ("base node").

<mode> = hp or lp. hp = high power mesh networking. lp = low power mesh networking via low-power listening and time synchronized data transmissions.

1.2 Over – The – Air – Programming (OTAP)

The Over-The-Air-Programming (*OTAP*) feature allows users to reprogram a *Mote* over a wireless channel. *OTAP* allows one or more *Motes* in the *XMesh* network to receive new firmware images from *XServe* (via the *XOtap* service).

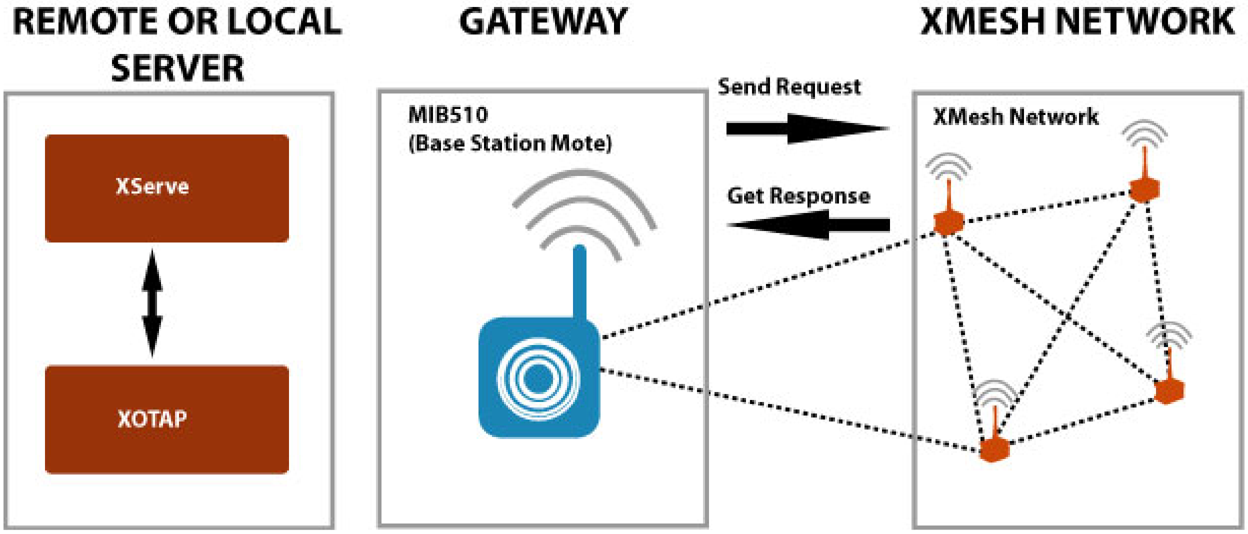


Figure 1-1: XOTAP Architecture

Each mote has a 512kB external non-volatile flash separated into 4 slots. These slots have a default size of 128 kB. Slot 0 is reserved for the OTAP image. Slots 1, 2 and 3 can be used for user-specified firmware.

During the *OTAP* process, the server sends a command to the Mote to reboot into the *OTAP* image (slot 0). A user-specified firmware image is broken up into fragments and transmitted to the *Mote* and stored into Slot 1, 2 or 3. The server can send a message to transfer the newly uploaded firmware into the program flash and reboot the *Mote*.

The following components are required for OTAP to work:

- Xserve and XOtap running on the server
- Firmware applications that include the XOTAPLiteM component (this is automatically included when the firmware is built with Xmesh)
- The mote needs to have pre-configured with a bootloader in the program flash, and the OTAP image in slot 0 of the external flash. Both of these conditions are met by selecting **OTAP enable** during the MoteConfig download process outlined in Section 4.

2 Installation

2.1 Supported Platforms

MoteConfig is supported on the following operating systems:

- *Windows XP Home*
- *Window XP Professional*
- *Windows 2000 with SP4*

2.2 PC Interface Port Requirements

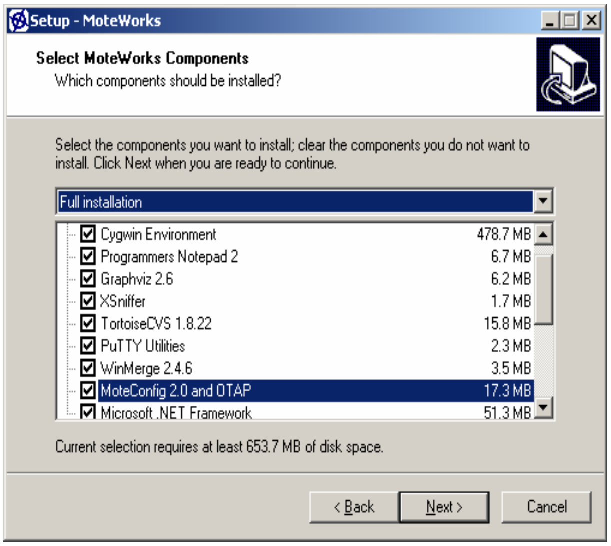
The gateway platform used in the base station determines the PC interface port required by *MoteConfig*.

1. For a **MIB510** serial gateway: an RS-232 serial port.
2. For a **MIB520** USB gateway: a USB port.
3. For a **MIB600** Ethernet gateway: A wired Ethernet or 802.11 wireless card (if the MIB600 is on a LAN with wireless access).
4. For a **Stargate** server: A wired Ethernet, an 802.11 wireless card (if the Stargate has a wireless modem or is on a LAN with wireless access), or a cellular modem for wireless Internet access.

2.3 Installation Steps

MoteConfig is shipped as a component of *MoteView* and *MoteWorks*:

1. *MoteConfig* is automatically installed with *MoteView*. Refer to the *MoteView Users Manual* for additional details.
2. *MoteConfig* is an optional component in the *MoteWorks* installer. Make sure that **MoteConfig 2.0 and OTAP** item is selected as shown in Figure 2-1.



Setup - MoteWorks

Select MoteWorks Components

Which components should be installed?

Select the components you want to install; clear the components you do not want to install. Click Next when you are ready to continue.

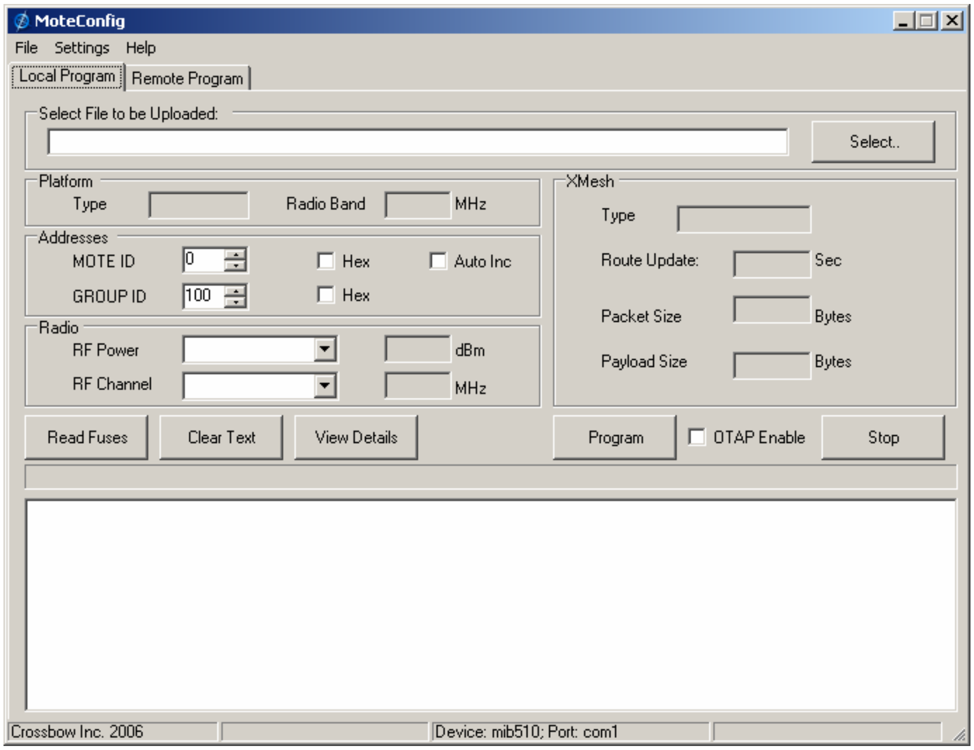
Full installation

☑ Cygwin Environment	478.7 MB
☑ Programmers Notepad 2	6.7 MB
☑ Graphviz 2.6	6.2 MB
☑ XSniffer	1.7 MB
☑ TortoiseCVS 1.8.22	15.8 MB
☑ PuTTY Utilities	2.3 MB
☑ WinMerge 2.4.6	3.5 MB
☑ MoteConfig 2.0 and OTAP	17.3 MB
☑ Microsoft .NET Framework	51.3 MB

Current selection requires at least 653.7 MB of disk space.

Figure 2-1: MoteConfig 2.0 and OTAP – MoteWorks Installer

3 Starting MoteConfig



MOTE ID 0

GROUP ID 100

Device: mib510; Port: com1

Figure 3-1: MoteConfig Application GUI

If *MoteConfig* was installed using the *MoteView* installer, use the following steps:

- Open *MoteView1.4C* by either clicking on the shortcut located on the Desktop, or by going to *Start* > *Programs* > *Crossbow* > *MoteView 1.4C.*
- Press the **Program Mote** button (🛠) on the *MoteView* toolbar to spawn the *MoteConfig* GUI as shown in Figure 3-1

If *MoteConfig* was installed using the *MoteWorks* installer

- Click on the shortcut located on the Desktop, or select *Start* > *Programs* > *Crossbow* > *MoteConfig 2.0.*

4 Local Programming

The **Local Program** tab is used to upload firmware onto the Motes via the gateway.

IMPORTANT: To program motes correctly, set up the hardware as follows:

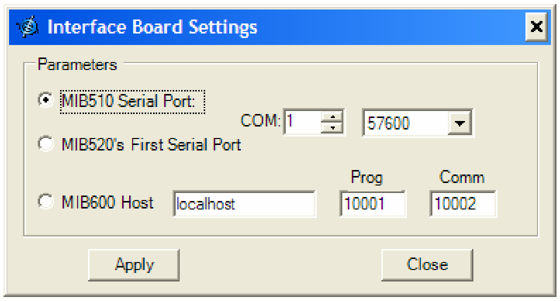
1. The gateway should be powered and connected to the PC via a serial, USB or Ethernet port.
2. If using the MIB510, the SW2 switch should be in the "OFF" position.
3. The motes should be firmly attached to the gateway.
4. The motes should be turned off before the programming.

4.1 Settings

Click on *Settings* > *Interface Board...* to select the correct gateway and port settings.

NOTE: The default baud rate for the MICA2 and MICAz is 57600. The default baud rate for the MICA2DOT is 19200.

Figure 4-1 shows the **Interface Board Settings** for a **MIB510** on COM 1.



Interface Board Settings

Parameters

● MIB510 Serial Port:

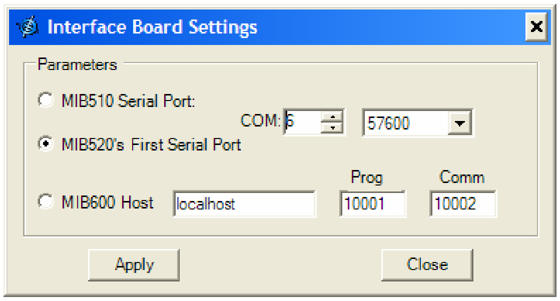
○ MIB520's First Serial Port

COM: 1 57600

○ MIB600 Host localhost Prog 10001 Comm 10002

Figure 4-1: MIB510 Gateway Settings

For information on port assignment on MIB programming boards refer Appendix A. The MIB520 virtual COM port drivers will install two sequential ports on the PC. The low-numbered port is used for programming and the high-numbered port is used for communication. Figure 4-2 shows the **Interface Board Settings** for a **MIB520** that has created COM 6 and 7 on the PC. In this example, COM 6 must be selected as the serial port.



Interface Board Settings

Parameters

○ MIB510 Serial Port:

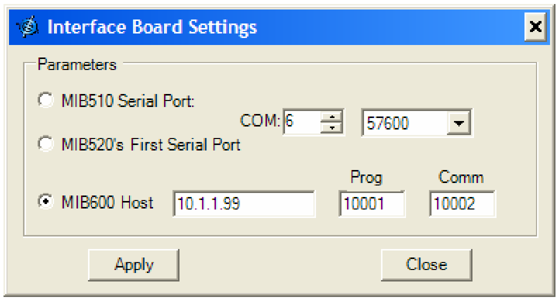
● MIB520's First Serial Port

COM: 6 57600

○ MIB600 Host localhost Prog 10001 Comm 10002

Figure 4-2: MIB520 Gateway Settings

Figure 4-3 shows the **Interface Board Settings** for a **MIB600** on the same LAN as the PC with an assigned IP address of 10.1.1.99.



Interface Board Settings

Parameters

○ MIB510 Serial Port:

COM: 6 | 57600

○ MIB520's First Serial Port

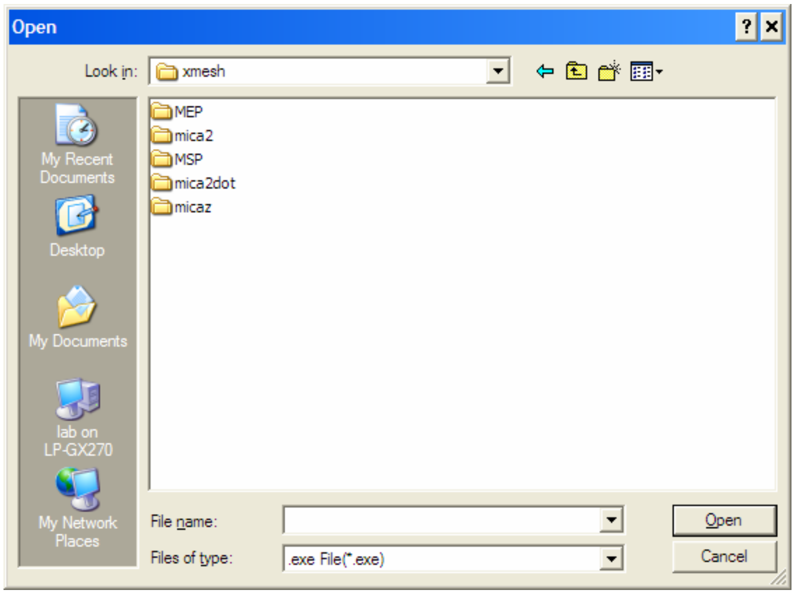
● MIB600 Host 10.1.1.99 | Prog: 10001 | Comm: 10002

Figure 4-3: MIB600 Gateway Settings

4.2 Programming

The pre-compiled XMesh applications installed with MoteView are located in *C > Program Files > Crossbow > MoteView > Xmesh*.

Press the **Select** button to open a file browser as shown in Figure 4-4. Navigate to the folder that corresponds to your Mote processor/radio board, radio frequency (for MICA2 and MICA2DOT) and sensor board type.



Open

Look in: xmesh

MEP
mica2
MSP
mica2dot
micaz

File name:

Files of type: .exe File(*.exe)

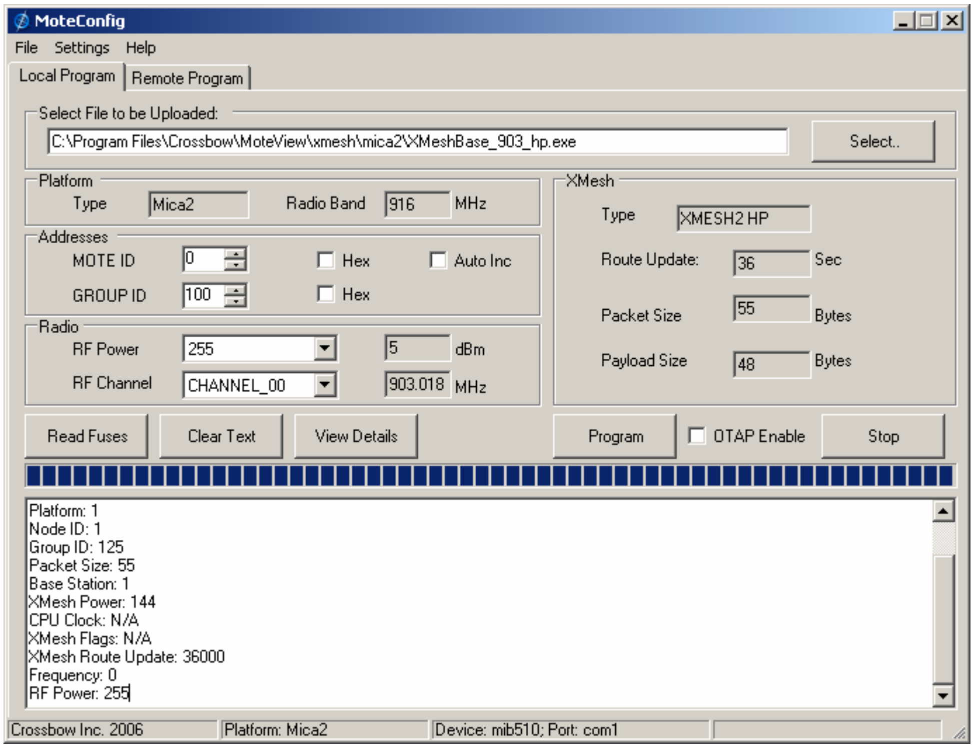
Figure 4-4: File Browser for selecting XMesh applications.

Low-power and high-power applications have been included for most sensor boards.

Note that the MEP and MSP node firmware is located in separate named folders.

◀ **NOTE:** The base station mote must be programmed with *XMeshBase_xxx.exe.*

After an application has been selected, the binary scan feature built into *MoteConfig* will display the default parameters programmed into the application (see Figure 4-5).



Select File to be Uploaded: C:\Program Files\Crossbow\MoteView\xmesh\mica2\XMeshBase_903_hp.exe

Platform
Type: Mica2
Radio Band: 916 MHz

Addresses
MOTE ID: 0
GROUP ID: 100

Radio
RF Power: 255 | 5 dBm
RF Channel: CHANNEL_00 | 903.018 MHz

XMesh
Type: XMESH2 HP
Route Update: 36 Sec
Packet Size: 55 Bytes
Payload Size: 48 Bytes

```
Platform: 1
Node ID: 1
Group ID: 125
Packet Size: 55
Base Station: 1
XMesh Power: 144
CPU Clock: N/A
XMesh Flags: N/A
XMesh Route Update: 36000
Frequency: 0
RF Power: 255
```

Crossbow Inc. 2006 | Platform: Mica2 | Device: mib510; Port: com1

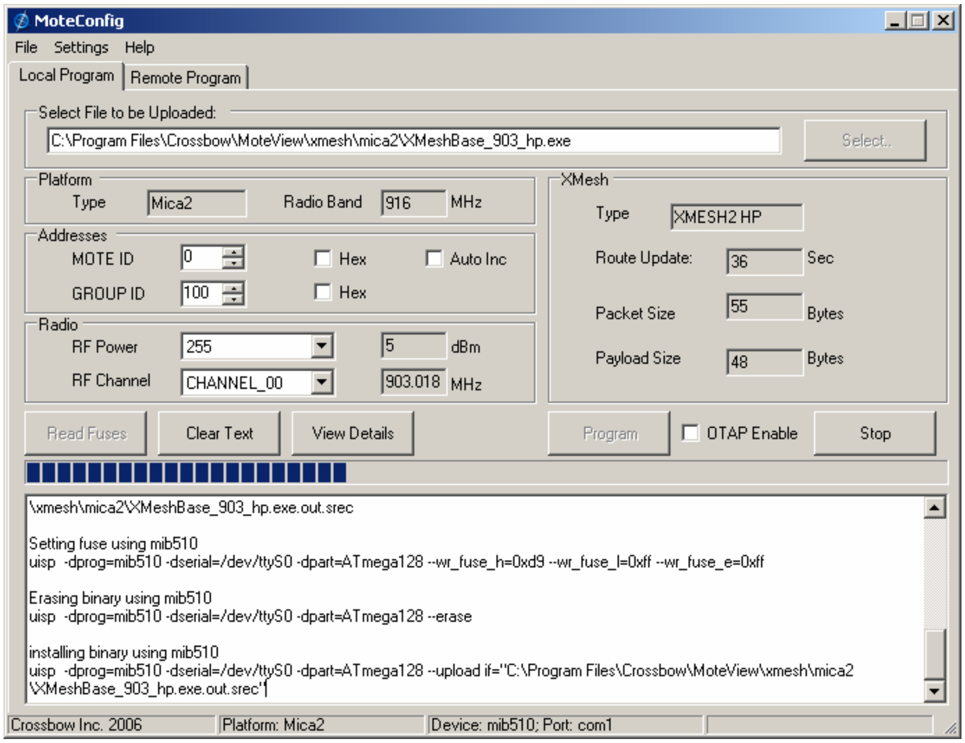
Figure 4-5: Binary Scan Result of an XMeshBase application

These default parameters can be overwritten by the user by specifying the desired **MOTE ID**, **GROUP ID**, **RF Power**, and **RF Channel.**

◀ **NOTE:** The base station mote must be programmed with a Mote ID of 0. Remote nodes must be programmed with a non-zero Mote ID.

Press the **Program** button to download the selected firmware and configuration into the mote, as shown in Figure 4-6.

The **Stop** button can be used to cancel a firmware download in progress.



Select File to be Uploaded: C:\Program Files\Crossbow\MoteView\xmesh\mica2\XMeshBase_903_hp.exe

Platform
Type: Mica2
Radio Band: 916 MHz

Addresses
MOTE ID: 0 ☐ Hex ☐ Auto Inc
GROUP ID: 100 ☐ Hex

Radio
RF Power: 255 5 dBm
RF Channel: CHANNEL_00 903.018 MHz

XMesh
Type: XMESH2 HP
Route Update: 36 Sec
Packet Size: 55 Bytes
Payload Size: 48 Bytes

```
\xmesh\mica2\XMeshBase_903_hp.exe.out.srec

Setting fuse using mib510
uisp  -dprog=mib510 -dserial=/dev/ttyS0 -dpart=ATmega128 --wr_fuse_h=0xd9 --wr_fuse_l=0xff --wr_fuse_e=0xff

Erasing binary using mib510
uisp  -dprog=mib510 -dserial=/dev/ttyS0 -dpart=ATmega128 --erase

installing binary using mib510
uisp  -dprog=mib510 -dserial=/dev/ttyS0 -dpart=ATmega128 --upload if="C:\Program Files\Crossbow\MoteView\xmesh\mica2
\XMeshBase_903_hp.exe.out.srec"
```

Crossbow Inc. 2006 | Platform: Mica2 | Device: mib510; Port: com1

Figure 4-6: MoteConfig programming in progress

The table below describes the advanced options available in the *MoteConfig* GUI.

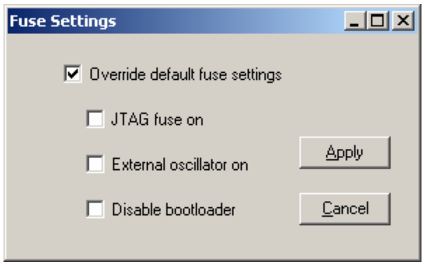
Table 4-1. Advanced Options

Advanced Options	Description
Hex	Enables users to specify the ID as a hexadecimal value
Auto Inc	Increments the mote ID by 1 after a mote has been programmed
OTAP Enable	Allows users to enable a mote for OTAP (refer to section 5)

4.3 Fuse Settings

MoteConfig allows users to overwrite the default fuse settings of the *ATmega128* processor. The fuses are an internal set of software switches within the *ATmega128* that enable certain functions.

Select *Settings* > *Fuse Defaults…* to open the dialog box shown in Figure 4-7. Check **Override default fuse settings** to modify the available fuse options. These options are:


Fuse Settings

☑ Override default fuse settings

□ JTAG fuse on

□ External oscillator on

□ Disable bootloader

Figure 4-7: Fuse Settings Dialog

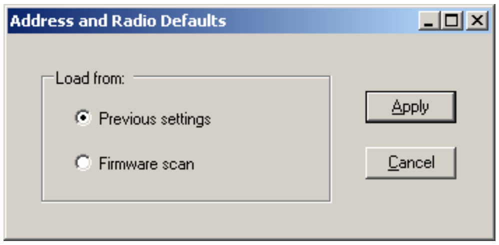
- **JTAG fuse on** activates the JTAG debug mode for the *ATmega128*. When enabled, the processor draws ~3 mA. By default, this fuse is turned off for all *XMesh* apps.
- **External oscillator on** forces the firmware app to use an external oscillator for its timer. When enabled, the processor draws more current. By default, this fuse is disabled for low power *XMesh* apps and enabled for high power *XMesh* apps.
- **Disable bootloader** will prevent the *Mote* from executing the boot loader code on reboot. By default, the bootloader is enabled for *Xmesh* apps to provide *OTAP* functionality.

WARNING

To avoid damaging your mote, please ensure that there is an external oscillator on your board before setting "External oscillator on".

4.4 Address and Radio Defaults

The default behavior associated with setting the **Group ID**, **RF Power** and **RF Channel** for each node can be changed from the Address and Radio Defaults dialog shown in Figure 4-8. This can be opened be selecting *Settings > Address and Radio Defaults …*


Address and Radio Defaults

Load from:

● Previous settings

○ Firmware scan

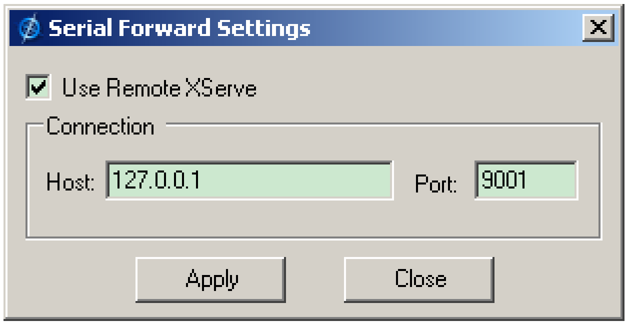
Figure 4-8: Address and Radio Defaults Dialog

When a new firmware application is **selected**, the default values for the **Group ID**, **RF Power** and **RF Channel** will**:**

- remain unchanged (from the **previous settings**)
- be replaced by values read from the firmware application (using the **firmware scan**)

4.5 Remote XServe Connection

This setting is used when performing OTAP over a remote Xserve connection (i.e. an Xserve running on a Stargate). Set the remote Xserve's IP address and port as shown in Figure 4-9.



☑ Use Remote XServe

Host: 127.0.0.1

Port: 9001

Figure 4-9: Remote XServe Connection Settings

5 Over-The-Air-Programming (OTAP)

The Over-The-Air-Programming (*OTAP*) feature allows users to reprogram a *Mote* over a wireless channel. *OTAP* allows one or more *Motes* in the *XMesh* network to receive new firmware images from *XServe* (via the *XOtap* service).

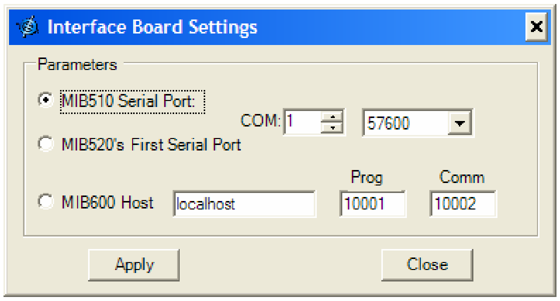
◀ **NOTE:** *OTAP* is currently available only when the Motes are programmed with high power firmware (i.e. XMTS310CB_433_hp.exe).

5.1 OTAP Enable

◀ **NOTE:** This step can be skipped for packaged kit customers. The remote nodes are loaded with OTAP-enabled firmware at the factory.

Before *Motes* can be programmed over the air, they must be prepared by enabling the boot-loader and loading the OTAP image into slot 0. This procedure is outlined in the following steps:

1. From *Settings>Interface Board …* select the appropriate interface board and specify the correct COM port number.



Interface Board Settings

Parameters

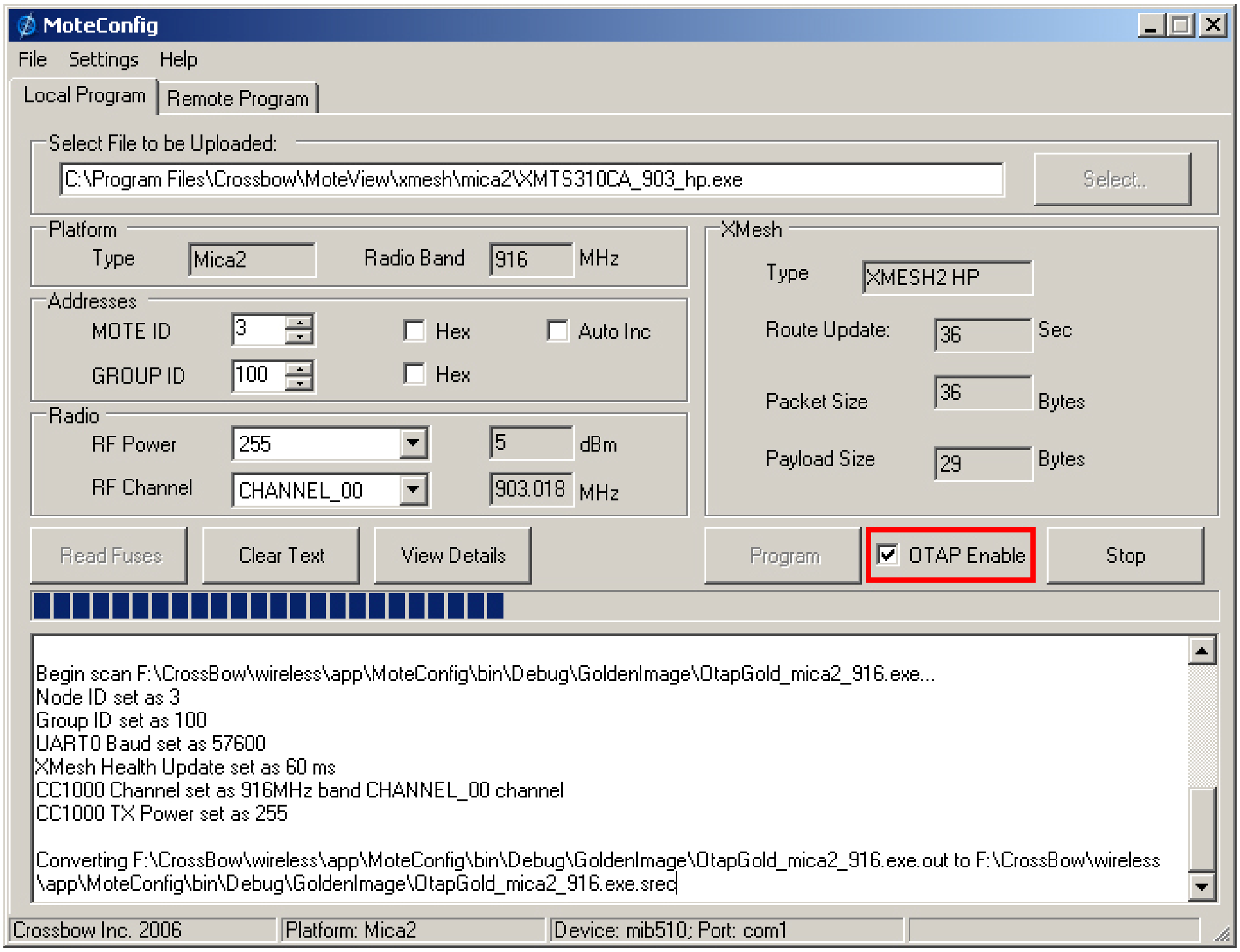
● MIB510 Serial Port: COM: 1 57600

○ MIB520's First Serial Port

○ MIB600 Host localhost Prog 10001 Comm 10002

Figure 5-1: Programming Interface Board Settings

2. Switch to the **Local Program** tab and click **Select** to browse to an *XMesh* application. Choose the appropriate **MOTE ID**, **GROUP ID**, **RF Power**, and **RF Channel**. Make sure that **OTAP Enable** box is checked. Click **Program**.



Select File to be Uploaded: C:\Program Files\Crossbow\MoteView\xmesh\mica2\XMTS310CA_903_hp.exe

Platform
Type: Mica2
Radio Band: 916 MHz

Addresses
MOTE ID: 3 □ Hex □ Auto Inc
GROUP ID: 100 □ Hex

Radio
RF Power: 255 5 dBm
RF Channel: CHANNEL_00 903.018 MHz

XMesh
Type: XMESH2 HP
Route Update: 36 Sec
Packet Size: 36 Bytes
Payload Size: 29 Bytes

☑ OTAP Enable

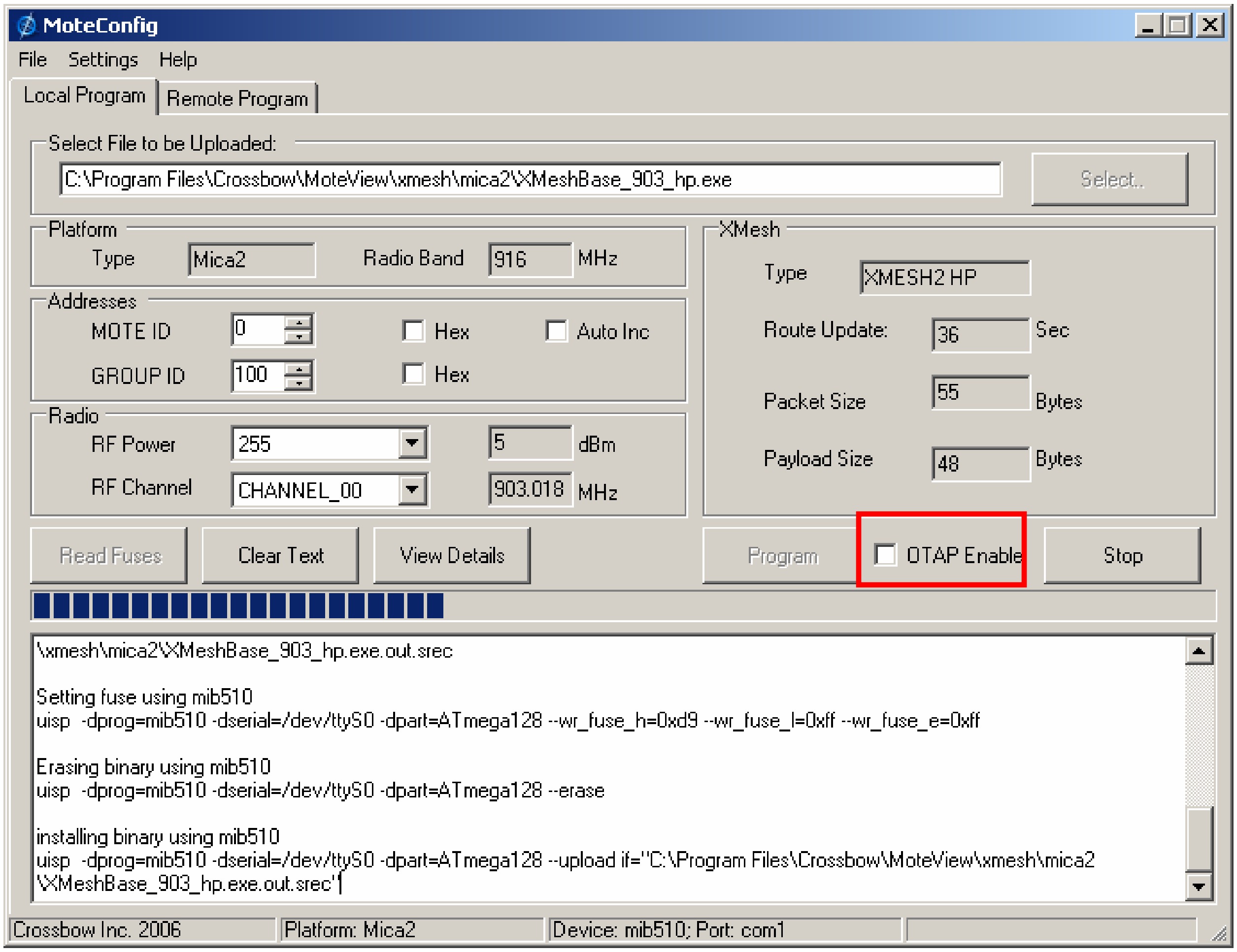
```
Begin scan F:\CrossBow\wireless\app\MoteConfig\bin\Debug\GoldenImage\OtapGold_mica2_916.exe...
Node ID set as 3
Group ID set as 100
UART0 Baud set as 57600
XMesh Health Update set as 60 ms
CC1000 Channel set as 916MHz band CHANNEL_00 channel
CC1000 TX Power set as 255

Converting F:\CrossBow\wireless\app\MoteConfig\bin\Debug\GoldenImage\OtapGold_mica2_916.exe.out to F:\CrossBow\wireless
\app\MoteConfig\bin\Debug\GoldenImage\OtapGold_mica2_916.exe.srec
```

Crossbow Inc. 2006 | Platform: Mica2 | Device: mib510; Port: com1

Figure 5-2: Programming the *OTAP* - enabled *XMTS310CA* application

3. Repeat Step 2 for all the nodes in the network. When the bootloader has successfully installed, the LEDs will count up twice when the node is switched "on".

4. Program the base station Mote with the *XMeshBase* application and set Note ID to 0. For the base firmware the **OTAP Enable** box should be unchecked.



Select File to be Uploaded: C:\Program Files\Crossbow\MoteView\xmesh\mica2\XMeshBase_903_hp.exe

Platform
Type: Mica2
Radio Band: 916 MHz

Addresses
MOTE ID: 0 □ Hex □ Auto Inc
GROUP ID: 100 □ Hex

Radio
RF Power: 255 5 dBm
RF Channel: CHANNEL_00 903.018 MHz

XMesh
Type: XMESH2 HP
Route Update: 36 Sec
Packet Size: 55 Bytes
Payload Size: 48 Bytes

□ OTAP Enable

```
\xmesh\mica2\XMeshBase_903_hp.exe.out.srec

Setting fuse using mib510
uisp  -dprog=mib510 -dserial=/dev/ttyS0 -dpart=ATmega128 --wr_fuse_h=0xd9 --wr_fuse_l=0xff --wr_fuse_e=0xff

Erasing binary using mib510
uisp  -dprog=mib510 -dserial=/dev/ttyS0 -dpart=ATmega128 --erase

installing binary using mib510
uisp  -dprog=mib510 -dserial=/dev/ttyS0 -dpart=ATmega128 --upload if="C:\Program Files\Crossbow\MoteView\xmesh\mica2
\XMeshBase_903_hp.exe.out.srec"
```

Crossbow Inc. 2006 | Platform: Mica2 | Device: mib510; Port: com1

Figure 5-3: Programming the *XMeshBase* application onto the base station.

5.2 Over-the-Air-Programming

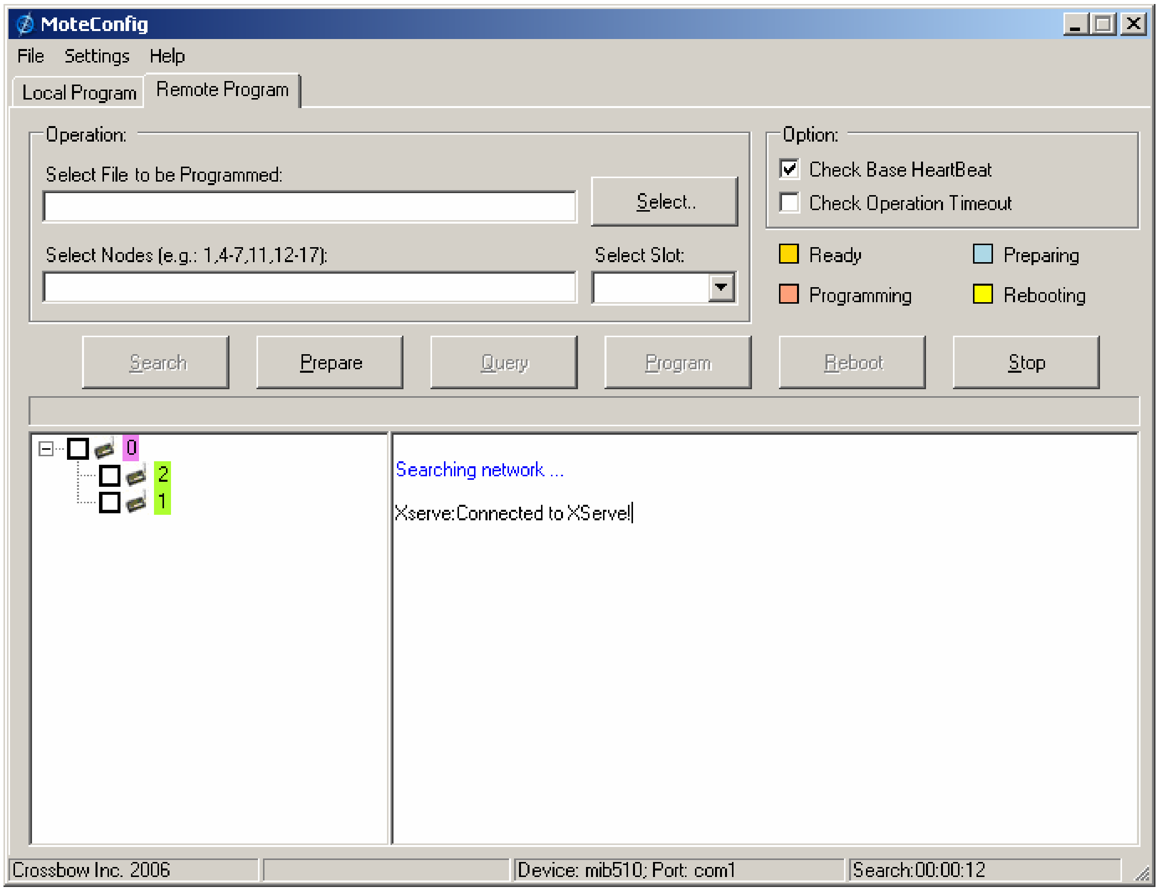
Once all the *Motes* are OTAP-enabled, use the following procedure to program them over a wireless channel.

> **NOTE:** Please make sure that the Mote battery power is above 2.6V before starting the OTAP procedure.

1. Connect the base node to the PC interface board and turn on the remote nodes that were prepared as shown in section 5.1.

2. Switch to the **Remote Program** tab.

3. Click on the **Search** button to start up *XServe* and listen for remote nodes. The *Motes* found within the network will be displayed in the tree-view control as shown in Figure 5-4.



☑ Check Base HeartBeat

☐ Check Operation Timeout

```
Searching network ...

Xserve:Connected to XServe!
```

Crossbow Inc. 2006 | Device: mib510; Port: com1 | Search:00:00:12

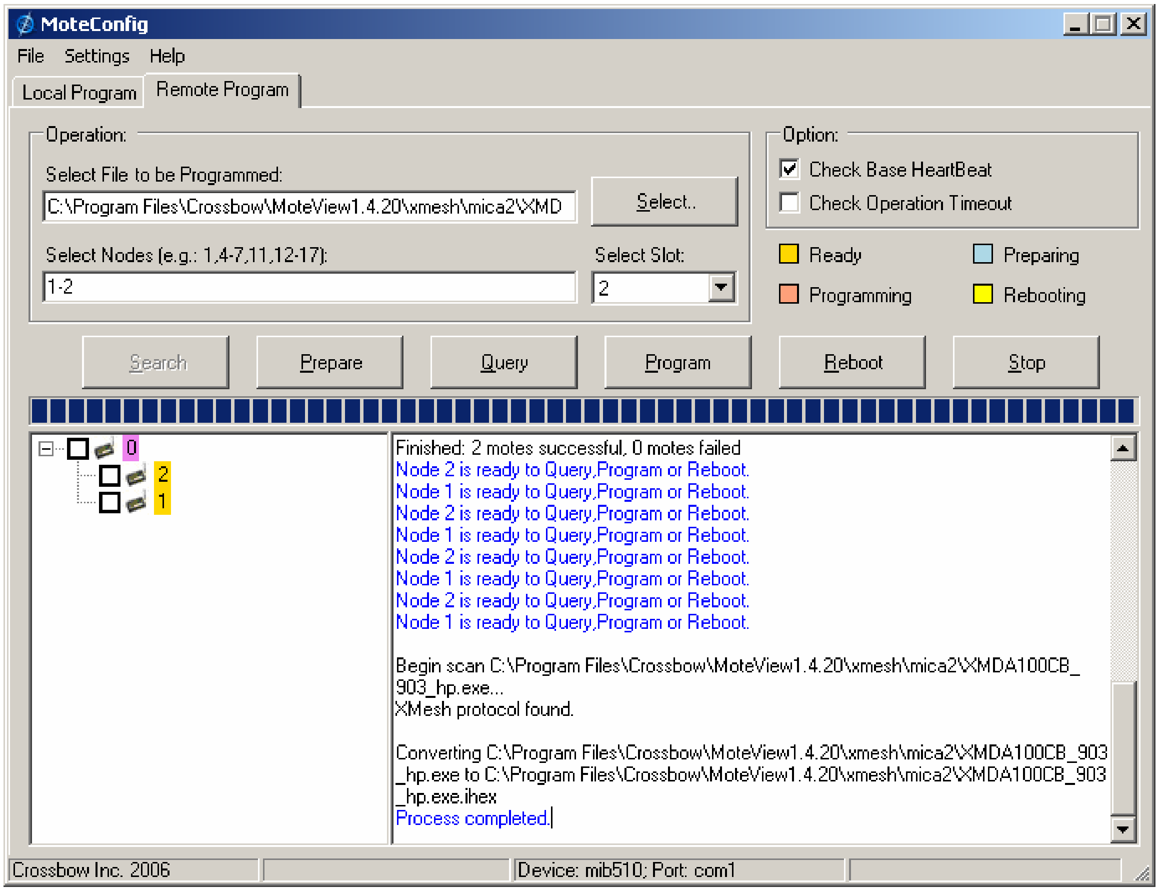
Figure 5-4: Searching for nodes within the mesh network.

◀ **NOTE:** The base node will periodically blink with a magenta background. This indicates that heartbeat packets sent by the base firmware are being received by the PC. This verifies that the base station has been correctly configures.

4. The Motes can now be rebooted to the OTAP image (OtapGold.exe) by selecting nodes from the tree-view control and pressing the **Prepare** button. Nodes can also be selected by entering their ID's into the **Select Nodes** textbox. During this process, the **Prepare** button will be disabled and the selected node will turn blue.

NOTE: The node ID's entered in the **Select Nodes** textbox override the node selection in the tree-view control.

When the nodes have rebooted into the OTAP image, their background color will turn gold as shown in Figure 5-5.



Select File to be Programmed: C:\Program Files\Crossbow\MoteView1.4.20\xmesh\mica2\XMD

Select Nodes (e.g.: 1,4-7,11,12-17): 1-2

Select Slot: 2

☑ Check Base HeartBeat

☐ Check Operation Timeout

🟨 Ready 🟦 Preparing

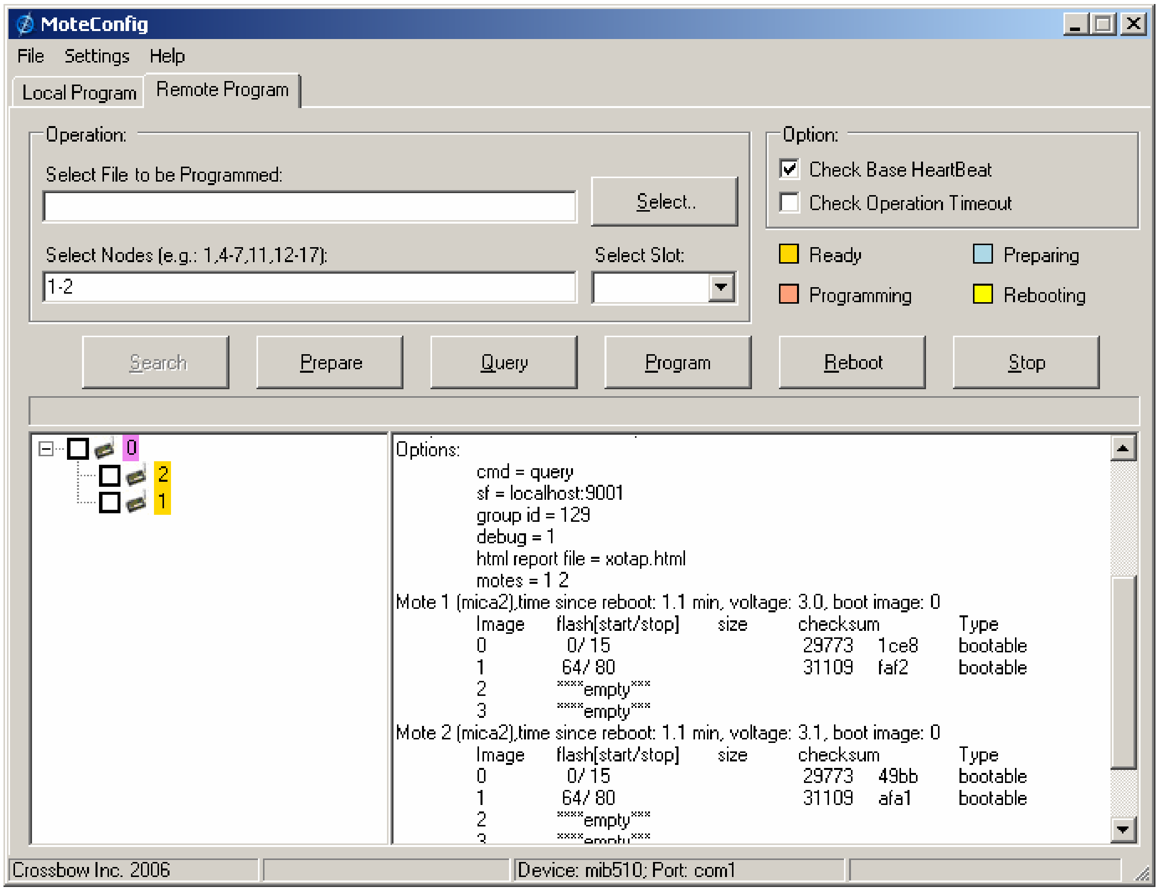
🟧 Programming 🟨 Rebooting

```
Finished: 2 motes successful, 0 motes failed
Node 2 is ready to Query,Program or Reboot.
Node 1 is ready to Query,Program or Reboot.
Node 2 is ready to Query,Program or Reboot.
Node 1 is ready to Query,Program or Reboot.
Node 2 is ready to Query,Program or Reboot.
Node 1 is ready to Query,Program or Reboot.
Node 2 is ready to Query,Program or Reboot.
Node 1 is ready to Query,Program or Reboot.

Begin scan C:\Program Files\Crossbow\MoteView1.4.20\xmesh\mica2\XMDA100CB_
903_hp.exe...
XMesh protocol found.

Converting C:\Program Files\Crossbow\MoteView1.4.20\xmesh\mica2\XMDA100CB_903
_hp.exe to C:\Program Files\Crossbow\MoteView1.4.20\xmesh\mica2\XMDA100CB_903
_hp.exe.ihex
Process completed.
```

Crossbow Inc. 2006 | Device: mib510; Port: com1

Figure 5-5: Nodes are running the OTAP image.

5. When the nodes are running the OTAP image,
   a) The **Query** button allows users to see the available slots and their contents on each mote as shown in Figure 5-6.



Select File to be Programmed:

Select Nodes (e.g.: 1,4-7,11,12-17): 1-2

Select Slot:

☑ Check Base HeartBeat

☐ Check Operation Timeout

```
Options:
            cmd = query
            sf = localhost:9001
            group id = 129
            debug = 1
            html report file = xotap.html
            motes = 1 2
Mote 1 (mica2),time since reboot: 1.1 min, voltage: 3.0, boot image: 0
            Image     flash[start/stop]     size       checksum          Type
            0           0/ 15                           29773    1ce8    bootable
            1          64/ 80                           31109    faf2    bootable
            2         ****empty***
            3         ****empty***
Mote 2 (mica2),time since reboot: 1.1 min, voltage: 3.1, boot image: 0
            Image     flash[start/stop]     size       checksum          Type
            0           0/ 15                           29773    49bb    bootable
            1          64/ 80                           31109    afa1    bootable
            2         ****empty***
            3         ****empty***
```

Crossbow Inc. 2006

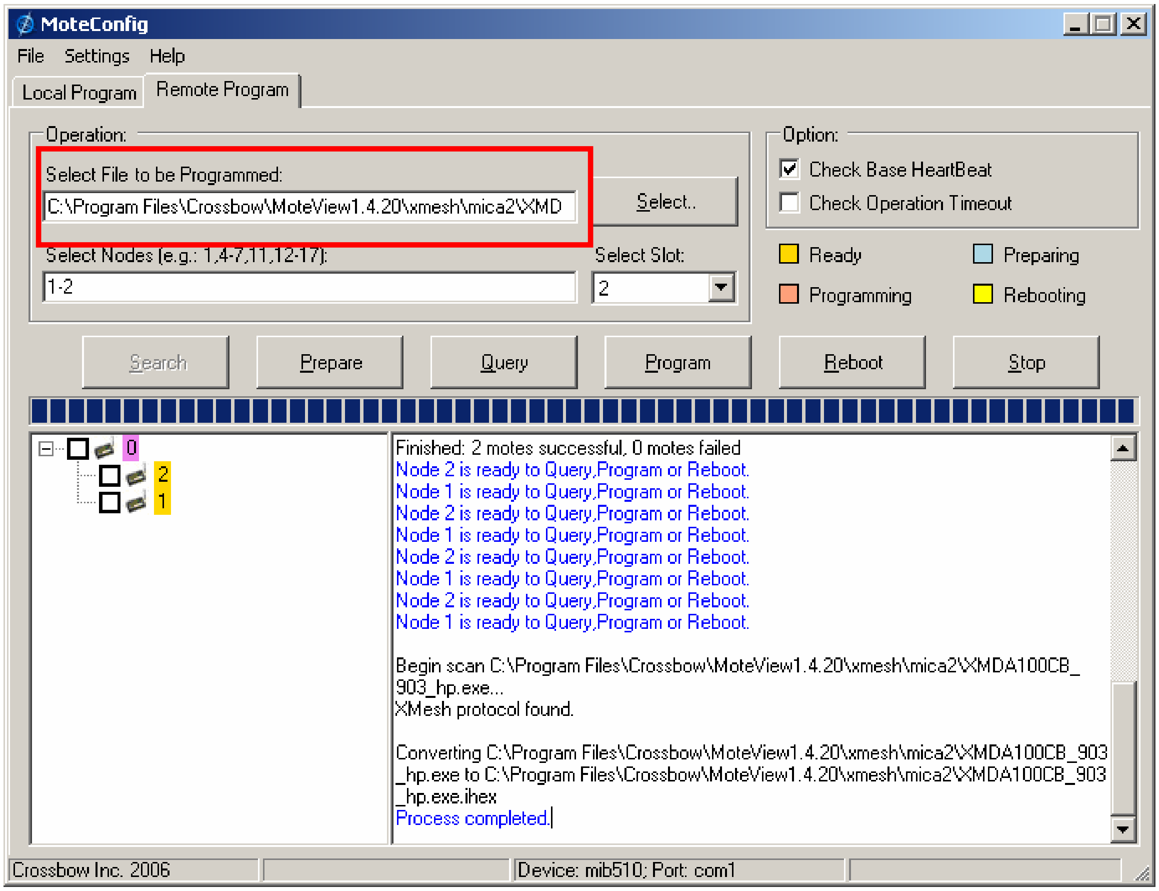
Device: mib510; Port: com1

Figure 5-6: Nodes being queried for information.

b) The **Program** button can be used to load firmware images into a selected slot on one or more selected nodes using the following procedure

1. Select the firmware application, as shown in Figure 5-7
2. Specify the slot to store the firmware application
3. Choose the nodes by checking the nodes in the tree-view or by entering the node ID's in the **Select Nodes** textbox
4. Press **Program**

⚠ **WARNING:** If nodes are specified in the **Select Nodes** textbox, the OTAP operations will only occur on these nodes; the nodes checked on the tree-view will be ignored. The **Select Nodes** textbox is an advanced feature and should be used with care.



Select File to be Programmed: C:\Program Files\Crossbow\MoteView1.4.20\xmesh\mica2\XMD

Select Nodes (e.g.: 1,4-7,11,12-17): 1-2

Select Slot: 2

☑ Check Base HeartBeat

☐ Check Operation Timeout

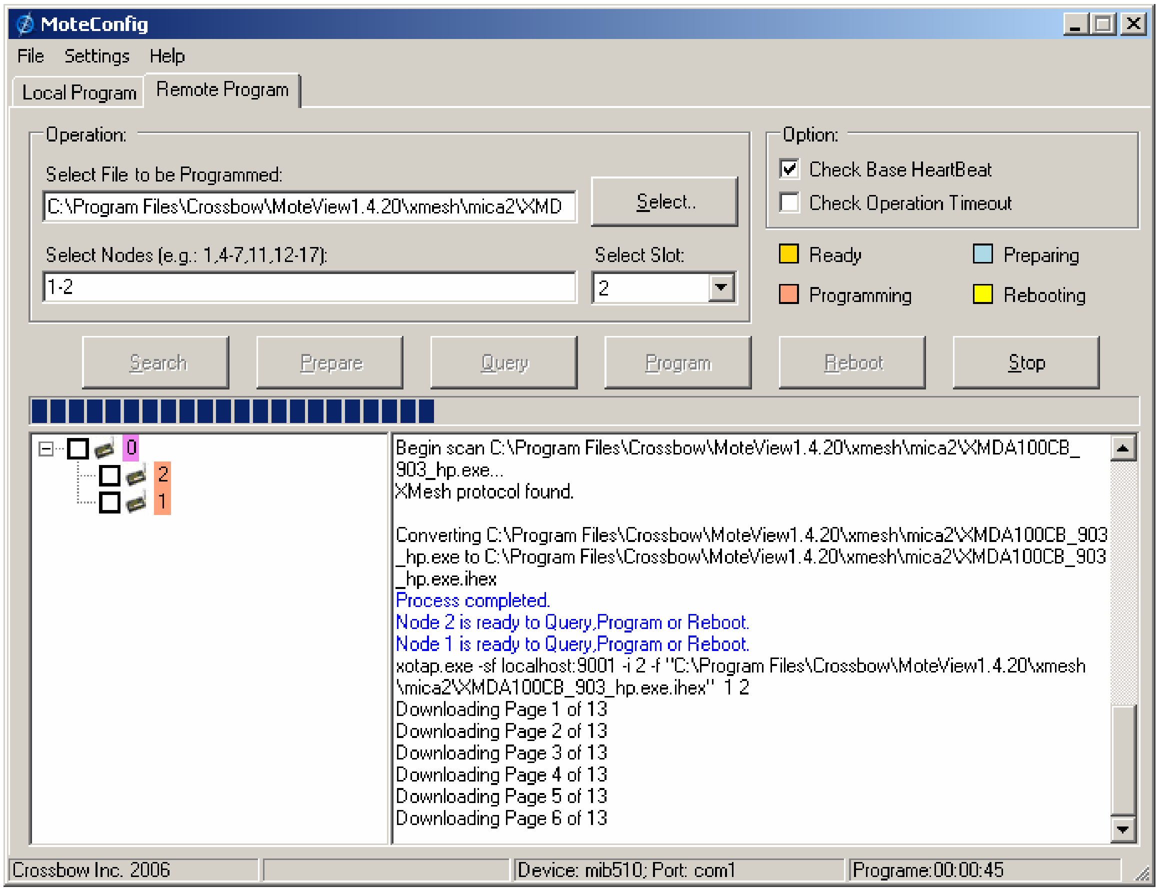
```
Finished: 2 motes successful, 0 motes failed
Node 2 is ready to Query,Program or Reboot.
Node 1 is ready to Query,Program or Reboot.
Node 2 is ready to Query,Program or Reboot.
Node 1 is ready to Query,Program or Reboot.
Node 2 is ready to Query,Program or Reboot.
Node 1 is ready to Query,Program or Reboot.
Node 2 is ready to Query,Program or Reboot.
Node 1 is ready to Query,Program or Reboot.

Begin scan C:\Program Files\Crossbow\MoteView1.4.20\xmesh\mica2\XMDA100CB_
903_hp.exe...
XMesh protocol found.

Converting C:\Program Files\Crossbow\MoteView1.4.20\xmesh\mica2\XMDA100CB_903
_hp.exe to C:\Program Files\Crossbow\MoteView1.4.20\xmesh\mica2\XMDA100CB_903
_hp.exe.ihex
Process completed.
```

Crossbow Inc. 2006

Device: mib510; Port: com1

Figure 5-7: Select an application for programming

During the OTAP process, the color of the selected nodes will turn gold as shown in Figure 5-8 and the status message area will display how the number of pages downloaded into the external flash. When the selected nodes have been successfully programmed, the node will turn gold once again.



Operation:

Select File to be Programmed: C:\Program Files\Crossbow\MoteView1.4.20\xmesh\mica2\XMD

Select Nodes (e.g.: 1,4-7,11,12-17): 1-2

Select Slot: 2

Option:

☑ Check Base HeartBeat

☐ Check Operation Timeout

🟨 Ready 🟦 Preparing

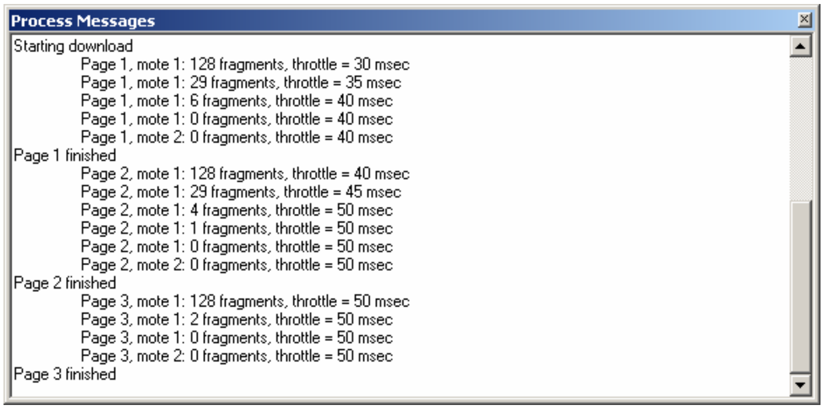
🟧 Programming 🟨 Rebooting

```
Begin scan C:\Program Files\Crossbow\MoteView1.4.20\xmesh\mica2\XMDA100CB_
903_hp.exe...
XMesh protocol found.

Converting C:\Program Files\Crossbow\MoteView1.4.20\xmesh\mica2\XMDA100CB_903
_hp.exe to C:\Program Files\Crossbow\MoteView1.4.20\xmesh\mica2\XMDA100CB_903
_hp.exe.ihex
Process completed.
Node 2 is ready to Query,Program or Reboot.
Node 1 is ready to Query,Program or Reboot.
xotap.exe -sf localhost:9001 -i 2 -f "C:\Program Files\Crossbow\MoteView1.4.20\xmesh
\mica2\XMDA100CB_903_hp.exe.ihex"  1 2
Downloading Page 1 of 13
Downloading Page 2 of 13
Downloading Page 3 of 13
Downloading Page 4 of 13
Downloading Page 5 of 13
Downloading Page 6 of 13
```

Crossbow Inc. 2006 | Device: mib510; Port: com1 | Programe:00:00:45

Figure 5-8: Programming the nodes in the network via XOTAP

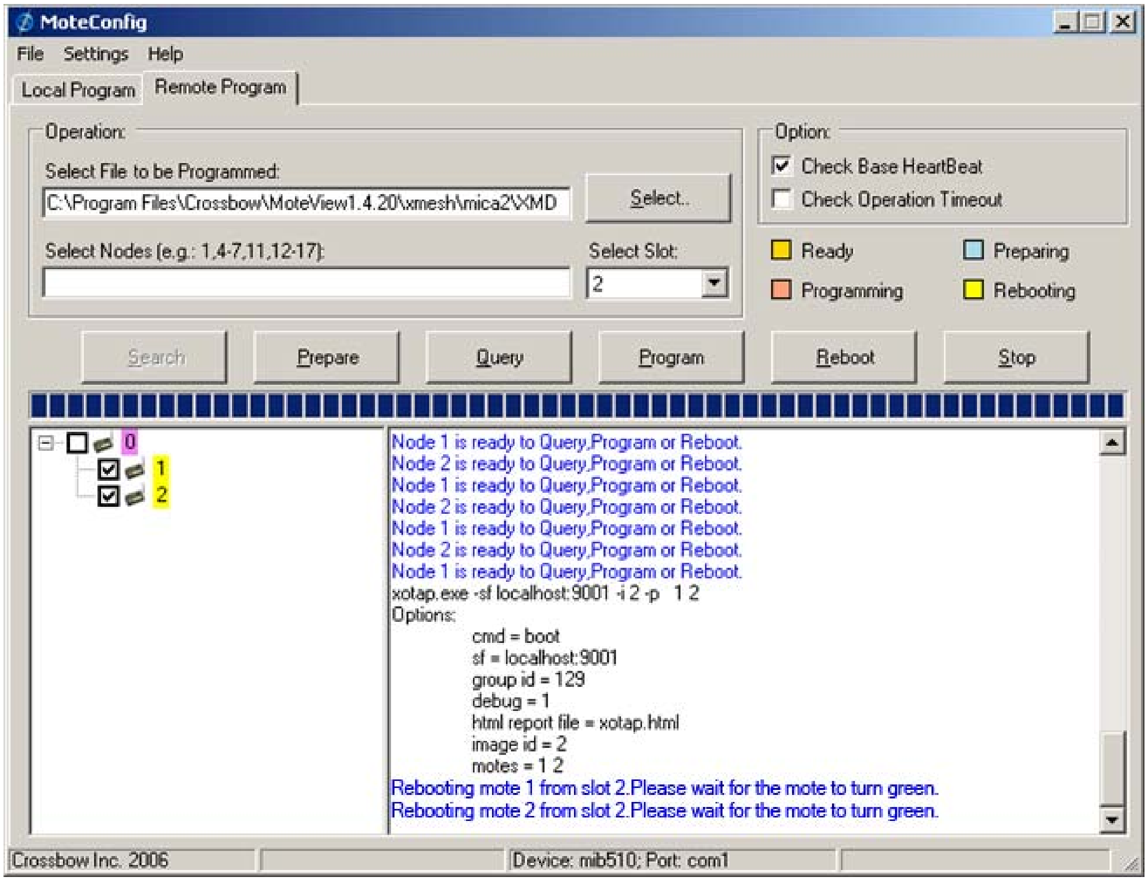
Open the **Process Messages** window (by clicking on *File > View Process Details…*) to trace all downloading steps as shown in Figure 5-9.



```
Starting download
        Page 1, mote 1: 128 fragments, throttle = 30 msec
        Page 1, mote 1: 29 fragments, throttle = 35 msec
        Page 1, mote 1: 6 fragments, throttle = 40 msec
        Page 1, mote 1: 0 fragments, throttle = 40 msec
        Page 1, mote 2: 0 fragments, throttle = 40 msec
Page 1 finished
        Page 2, mote 1: 128 fragments, throttle = 40 msec
        Page 2, mote 1: 29 fragments, throttle = 45 msec
        Page 2, mote 1: 4 fragments, throttle = 50 msec
        Page 2, mote 1: 1 fragments, throttle = 50 msec
        Page 2, mote 1: 0 fragments, throttle = 50 msec
        Page 2, mote 2: 0 fragments, throttle = 50 msec
Page 2 finished
        Page 3, mote 1: 128 fragments, throttle = 50 msec
        Page 3, mote 1: 2 fragments, throttle = 50 msec
        Page 3, mote 1: 0 fragments, throttle = 50 msec
        Page 3, mote 2: 0 fragments, throttle = 50 msec
Page 3 finished
```

Figure 5-9: Trace all downloading steps

6. The final step is to **reboot** into a newly loaded image:
    1. Select the nodes to reboot
    2. Specify which slot to use
    3. Press **reboot**



Select File to be Programmed: C:\Program Files\Crossbow\MoteView1.4.20\xmesh\mica2\XMD

Select Nodes (e.g.: 1,4-7,11,12-17):

Select Slot: 2

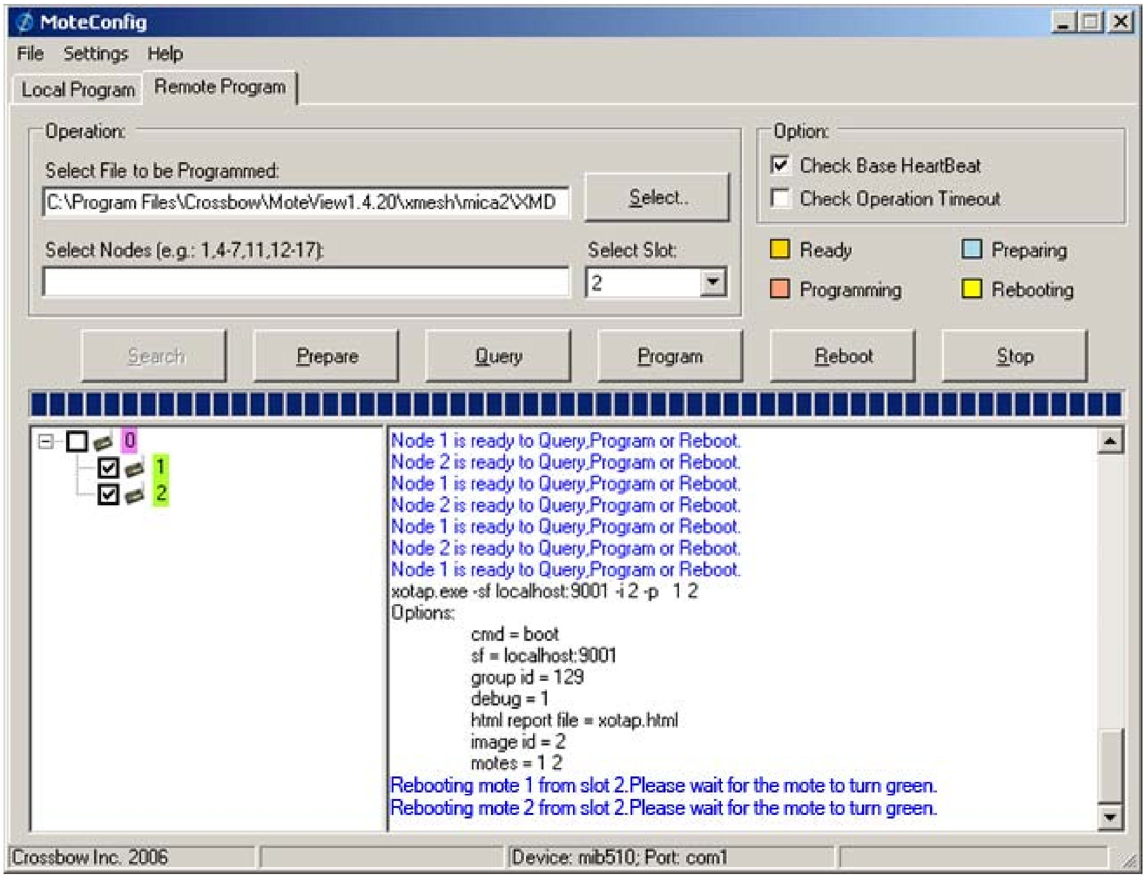
☑ Check Base HeartBeat

☐ Check Operation Timeout

```
Node 1 is ready to Query,Program or Reboot.
Node 2 is ready to Query,Program or Reboot.
Node 1 is ready to Query,Program or Reboot.
Node 2 is ready to Query,Program or Reboot.
Node 1 is ready to Query,Program or Reboot.
Node 2 is ready to Query,Program or Reboot.
Node 1 is ready to Query,Program or Reboot.
xotap.exe -sf localhost:9001 -i 2 -p  1 2
Options:
            cmd = boot
            sf = localhost:9001
            group id = 129
            debug = 1
            html report file = xotap.html
            image id = 2
            motes = 1 2
Rebooting mote 1 from slot 2.Please wait for the mote to turn green.
Rebooting mote 2 from slot 2.Please wait for the mote to turn green.
```

Figure 5-10: Rebooting the nodes

The selected nodes will turn green (as shown in Figure 5-11) when they have successfully rebooted, re-joined the wireless mesh and sent health packets to Xserve.



Select File to be Programmed: C:\Program Files\Crossbow\MoteView1.4.20\xmesh\mica2\XMD

Select Nodes (e.g.: 1,4-7,11,12-17):

Select Slot: 2

☑ Check Base HeartBeat

□ Check Operation Timeout

```
Node 1 is ready to Query,Program or Reboot.
Node 2 is ready to Query,Program or Reboot.
Node 1 is ready to Query,Program or Reboot.
Node 2 is ready to Query,Program or Reboot.
Node 1 is ready to Query,Program or Reboot.
Node 2 is ready to Query,Program or Reboot.
Node 1 is ready to Query,Program or Reboot.
xotap.exe -sf localhost:9001 -i 2 -p  1 2
Options:
            cmd = boot
            sf = localhost:9001
            group id = 129
            debug = 1
            html report file = xotap.html
            image id = 2
            motes = 1 2
Rebooting mote 1 from slot 2.Please wait for the mote to turn green.
Rebooting mote 2 from slot 2.Please wait for the mote to turn green.
```

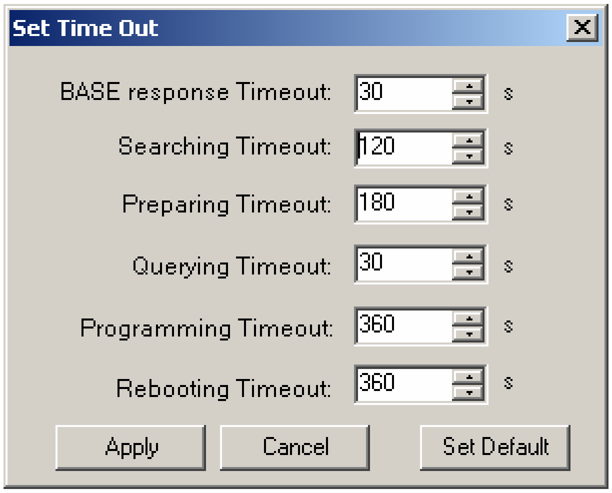
Crossbow Inc. 2006 | Device: mib510; Port: com1

Figure 5-11: Nodes have rebooted and joined the mesh

5.3 Advanced Options

Advanced Options	Description
Check Base Heartbeat	The application will display a warning message if the *xmeshbase* heartbeat packet is not received. This notifies the user that there is a problem with the base station hardware configuration, firmware, power or connectivity to the PC. This feature is **enabled** by default. The user can specify the timeout values in *Settings* > *OTAP Timeout…*
Check Operation Timeout	The application will detect the time elapsed by each OTAP operation and warn the user if an operation takes too long. If a timeout occurs, Xserve will shut down. This feature is **disabled** by default. The user can specify the timeout values in *Settings* > *OTAP Timeout…*

Click *Settings* > *OTAP Timeout…* to open the **Set Timeout** dialog shown in Figure 5-12. The default values were derived by testing with a small network of about 30 nodes. If your mesh network contains more than 30 nodes, please reset the relevant values or leave the timeout check disabled.



BASE response Timeout: 30 s

Searching Timeout: 120 s

Preparing Timeout: 180 s

Querying Timeout: 30 s

Programming Timeout: 360 s

Rebooting Timeout: 360 s

Figure 5-12: OTAP timeout settings

A. Port Assignment on MIB programming Boards

You may have to install the necessary drivers or assign ports for your MIB programming board. These are included on your WSN Kit CD.

- **MIB510 Serial Gateway –** No drivers are necessary if you are using a standard RS-232 serial port on the PC (typically COM1). The board is powered via the 5V DC wall adapter.

- **MIB520 USB Gateway** – Requires USB drivers included on the WSN Kit CD in the "**USB Drivers**" folder. The board is powered by the PC's USB port.
  1. When you plug a MIB520 into your PC for the first time, Windows detects and reports it as new hardware.
  2. Please select "Install from a list or specific location (Advanced)" and browse to the "**USB Drivers**" folder of the WSN Kit CD.
  3. The installer will guide you through the installation process. When the process completes, you will see two serial ports associated with the MIB520.
  4. Make a note of the two assigned COM ports using the Device Manager available at **Start > Control Panel > System > Hardware > Device Manager > Ports (COM & LPT).**

- **MIB600 Ethernet Gateway** – Requires IP address assignment using the Lantronix Device Installer included on the WSN Kit CD in the "**MIB600 Tools**" folder. The board can be powered by POE (Power-Over-Ethernet) or by using a 5V DC adapter.
  1. Install the Lantronix Device Installer (*Setup.exe*) from the "**MIB600 Tools**" folder of the WSN Kit CD.
  2. Connect the MIB600 to the network using RJ-45 Ethernet cable and supply power using the power supply that was included in the packaging. Make sure the Power Switch SW2 is in the "5V" position.
  3. Start the Device Installer from **Start > Programs > Lantronix > Device Installer > Device Installer.**
  4. Click on the Search button. The application will display a list of devices available on your local network along with their IP address and corresponding Hardware address.
  5. Match the hardware address of your MIB600 board (e.g., 00-20-4A-63-47-31) and make a note of the assigned IP address.

Crossbow

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