Xbee to Xbee Communication

Blake Frantz

ECE 480

Team 8

4/5/13

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Introduction:

With the electronics world changing everyday, new products being developed every hour and the virtual and Internet world becoming more complex, the communication between electronic devices is now gaining the spotlight. Microprocessors are becoming more complex and are integrated in almost every electronic device on the market today. These microprocessors are enabling the addition of wifi capabilities, allowing many of the new products to have full on board data transferring or Internet access. One of the simplest ways that data can be transferred wirelessly was with the introduction of the Xbee by Digi in 2005. This technology has thus been refined and is a simple, cost effective way of connecting wireless capabilities to a microprocessor or microcontroller.

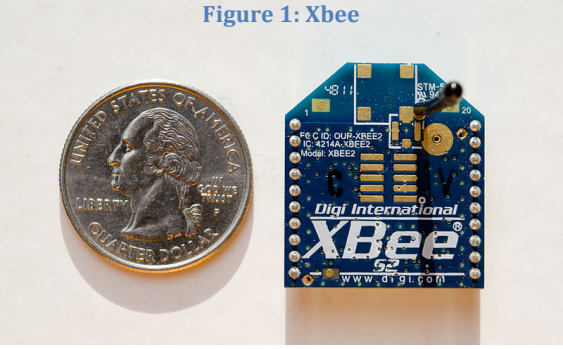


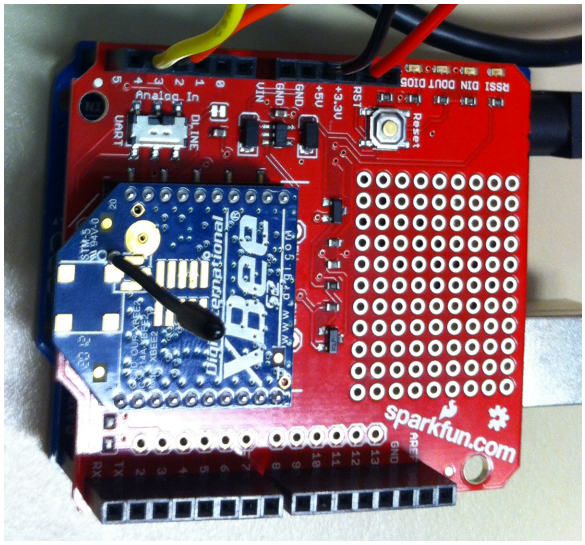
Figure 1: Xbee

Background:

Two main models of the Xbee were initially introduced—the higher power and much higher cost 100mV Xbee-PRO and the lower cost 1 mV Xbee. The Xbee has now been developed into more than 70 different varieties with different antennas, power types, and capabilities. Many of these modules are very application specific and this list can be narrowed down to around 10 practical versions of the Xbee technology. The Xbee can be utilized with a minimum of four connections; ground, power (3.3V), data in and data out (also known as UART). A version of the Xbee's called the Programmable Xbee has an additional onboard processor for user's code. The Programmable Xbee and a new surface mount version of the Xbee radios were both introduced in 2010. These models are small and compact, making them very desirable for many applications. Xbee's are currently able to both send and receive data whether this data is analog or digital and can be integrated with many different software platforms including; matlab, processing and labview to name a few.

Application:

Figure 2: Xbee mounted on Xbee Shield



Xbee communication can be used in many different ways for various applications. The way that the Xbee technology will be used in out teams application will be using the data transferring capabilities from one Xbee docked on an Arduino microcontroller to another Xbee connected to a computer. The model of Xbee that the team chose to use is the Xbee2. The Xbee2 is a standard Xbee that is inexpensive, easy to use, small in size and capable of both transmitting and receiving data simultaneously. The Xbee2 has many features that the team thought to be the most beneficial. The main reason that the team chose the Xbee2 is because of its capability to be docked directly on an Xbee shield which can be then connected to the Arduino board without any soldering. (This is shown in Figure 2) This is an extremely important aspect as soldering such small components can cause many problems. Another important feature of the Xbee2 was its high baud rate capabilities. This was important because a high baud rate allows for constant streaming of data, which is an important detail of our project scope.

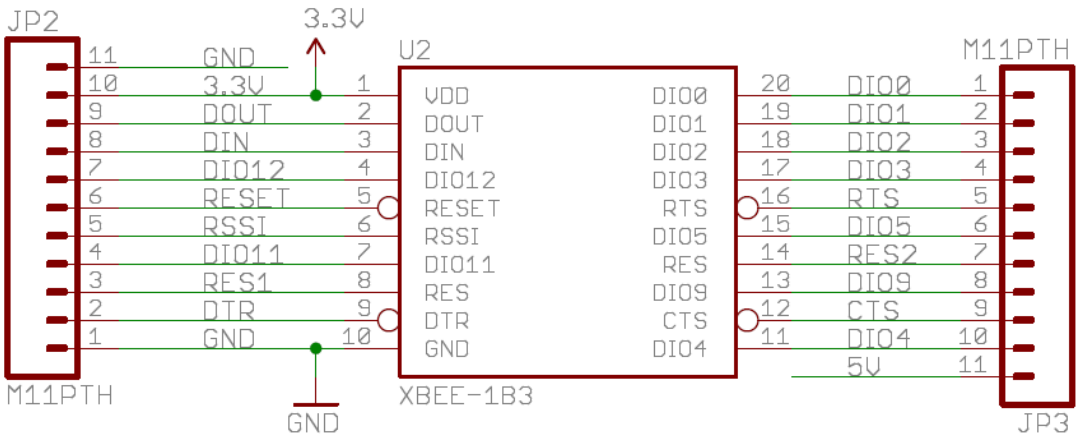


Figure 3: Xbee Schematic

Setting Up Xbee's:

To the everyday electronics user, dealing with wireless connections and doing anything more than plugging in electronics can be a bit worrisome. The Xbee by Digi come pre-programmed to simply work out of the box with default settings that may or may not be ideal for your application. This is not a problem. Using a few simple steps, the Xbee's can be modified to work in many different ways. The user is able to modify the mode that the Xbee's work in (these will be mentioned later), the baud rate and many more.

Step 1. Installing the Software:

Like most new electronic devices, product software is necessary to unlock, use or modify the features of the product. With Xbee's this is no different. Digi has provided an easy to use software program that allows the user to modify the functionality of the Xbee. After purchasing and receive your Xbee's, your package should include a CD that needs to be installed on your computer. If your package does not include a software CD, you can download the software off of the Digi website (the link can be found on the reference page at the end of the document). After inserting the CD follow the simple built in steps to install the software (the software is titled X-CTU). Selecting a simple and easy to find place to save the software icon is a key aspect of the installation process (recommended saving the program to your desktop). To make the setup process of your Xbee's it is recommended that two different computer's be used. This will later be useful to confirm that the Xbee's are both communicating with one another and that the signals are being transferred correctly.

Step 2. Connecting the Xbee's to the Computers

Figure 4: Xbee Explorer



Connecting the Xbee's to the computers is a step that Digi has not overlooked. With the usage of one of the most common connecting cables on the market: the USB to microUSB. All computers come equipped at least one USB port that will be the main connection utilized by the Xbee. The Xbee come equipped with a microUSB port that is directly on the Xbee printed circuit

board itself. Using the supplied black USB to microUSB cables connect your Xbee's to the computers. Another way of connecting the Xbee's to the computer is via an Xbee explorer. This is a simple device that allows the docking of the Xbee to a printed circuit board that connects directly to the USB port of the computer.

Step 3. Running the X-CTU Program

The next step in setting up your own Xbee to Xbee communication in running the X-CTU program that you installed in step one and doing a few pre-setup steps to figure out which ports or drives your Xbee's are connected to. First off we need to run the X-CTU program that is installed. Simply click the X-CTU icon (shown in Figure 5) and the simple to navigate display window will open (also shown). With the program now up and running the next step is to figure out which ports on your computers the Xbee's are connected to. Navigating to computer port display can do this. Take note of which ports the Xbee's are connected to as this will be necessary for the later setup of the Xbee's.

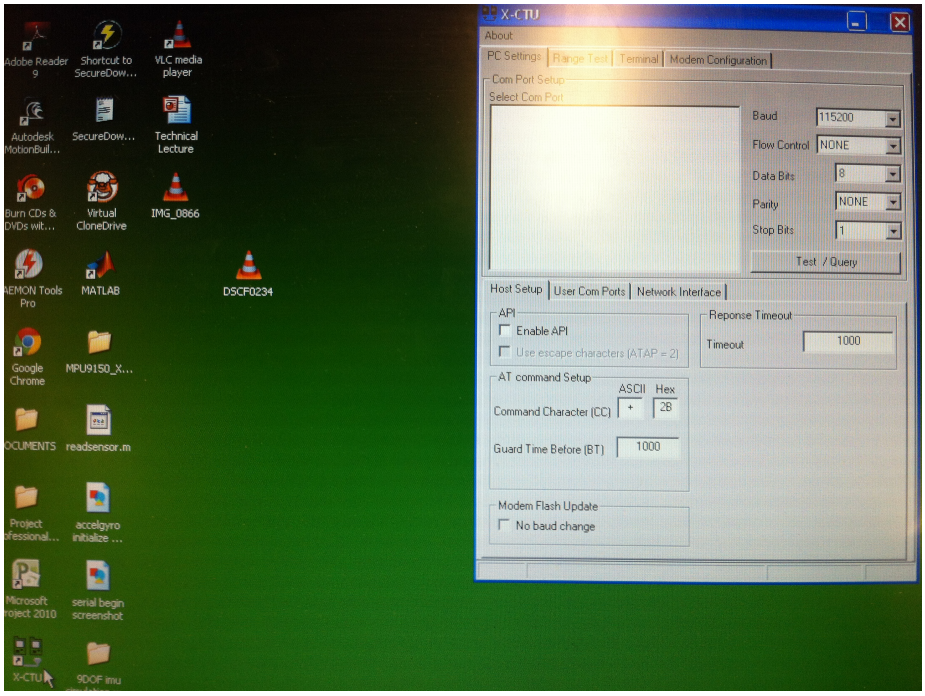


Figure 5: X-CTU Program Window

Step 4. Configuring the Xbee's:

To the everyday user of electronics, the configuring of any device can get complicated and often steers people from optimizing their products for their application. Digi has developed the X-CTU program to counter this fear. With a few simple clicks the Xbee's can be setup to optimize their capabilities. The first thing that you need to do is navigate to the modem configuration tab at the top of the window. From this tab there are a few choices that need to be made. First under the modem Xbee tab, scroll through and select the version of Xbee that you are using. The mode that the Xbee will operate in can also be selected under the Function Set tab, however for most applications the default, transparent (AT) option will be best. The next and probably the most important choice that the user needs to make is the baud rate setting of the Xbee's. The baud rate is the frequency that data is transmitted and received from the Xbee's. To adjust the baud rate of the Xbee's scroll down the window until your reach Serial Interfacing and from there the baud rate can be selected from its own drop down tab. Make sure that both of the Xbee's you are using have the same baud rate or the data will fail to be received in the form that it was transmitted. After selecting the type, mode and baud rate of your Xbee's simple click the Write button near the top left of the X-CTU program window to save and upload your changes to the Xbee's. With the new settings uploaded to the Xbee's there are only a few more steps until the Xbee's are ready to use.

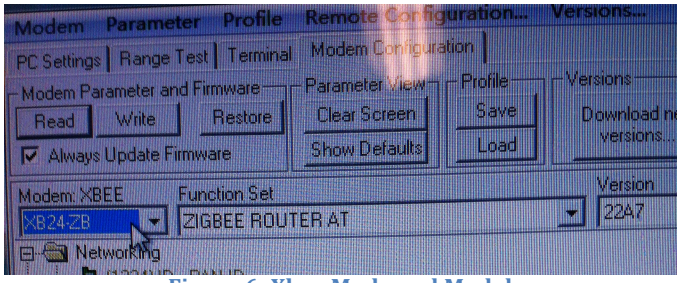
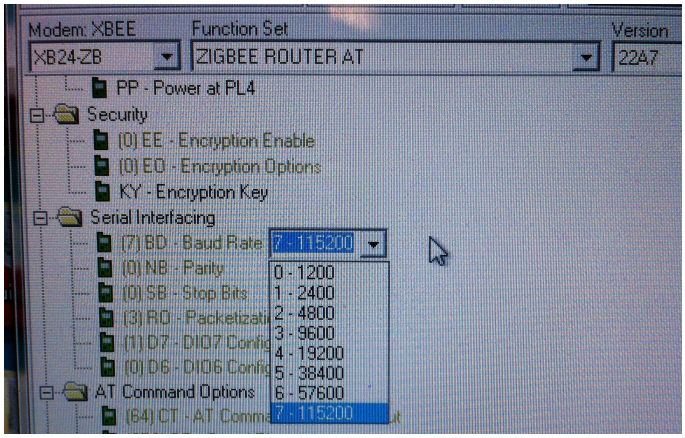


Figure 6: Xbee Mode and Model

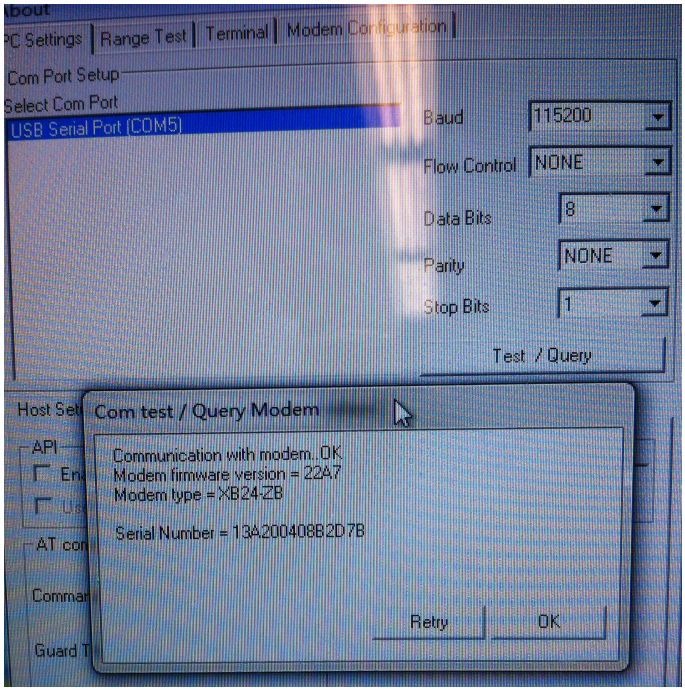
Figure 7: Xbee baud rate



Step 5. Confirming the Xbee's are Working:

With the complicated step of configuring the Xbee's now finished we need to make sure that the Xbee's are working as we expect. Thanks to Digi, this step cannot get any easier. Navigate to the PC Settings tab on the X-CTU window; from here you will see the Xbee's connected to the computer under the Select Comp Port window. Confirming that the Xbee's are connected to the correct comp ports (this was accomplished in step 3) simply click on the Test/Query button on the right half of the screen. If all goes as expected a window will pop up confirming that the Xbee is working and the message "Communication with Modem. OK" will be displayed.

Figure 8: Com Test and Query Window



Step 6. Xbee to Xbee Communication:

The final step in setting up an Xbee to Xbee communication network requires running a few simple codes to confirm the previous five steps are working properly. Navigate to the terminal window of the X-CTU program on both computers (this will of course be blank). Type "+++" (in blue) in the blank window to send code to the Xbee to make sure that it is receiving data. The Xbee will then respond with the message "OK" (Blue- user, Red- Xbee). Next type "ATNI" to display the function of each Xbee. One of the Xbee's will function as your coordinator and the other as your router. Next we need to check to confirm that the serial and destination addresses are correct. Typing "ATSH", "ATSL", "ATDH" and "ATDL" will display all of the addresses of each of the Xbee's. These are confirmed by looking at the serial number of each of the Xbee's found on the Test/Query confirmation window. With all of the addresses being as we expect, the Xbee's are correctly communication and sending data to one another. Typing any message, which in turn will be displayed on the terminal window of the opposing Xbee, can test this.

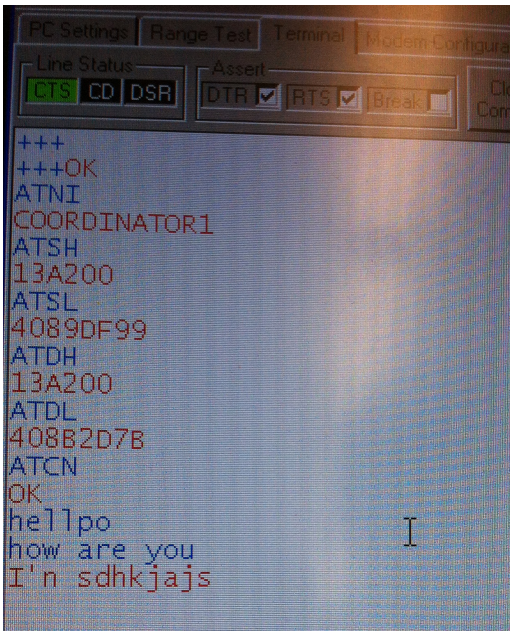


Figure 9: Coordinator Xbee Terminal Window

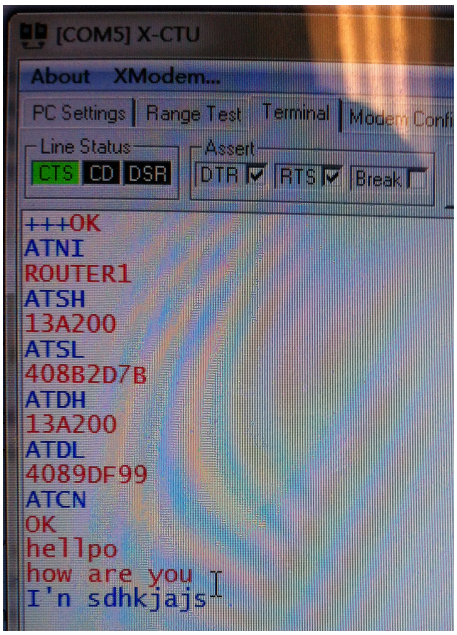


Figure 10: Router Xbee Terminal Window

Conclusion:

Setting up an Xbee to Xbee communication network may at first seem like a complicated task but is really just a few simple steps. Installing the necessary software, connecting the Xbee's to the computers, configuring the Xbee's and then simply testing the system are to only steps that a user needs to complete. The Xbee to Xbee communication network can be very versatile and is used in many different electronic applications today.

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