**Internet of Things**

**- a study of sensor networks, architecture and design of protocol layers**

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This document focuses on the steps required to build 3 projects:

1. Chat Application between two XBee radios.
2. Door Bell Application using two XBee radios, a switch and a buzzer.
3. Building a ZigBee network, capturing XBee packets and encapsulating the message into a TCP/IP packet to send it to a server over the internet.

**Project 1: Chat Application**

We created a project that focuses on communication between two XBee’s and creating a small chat application. We would be required to make one XBee as the coordinator node and the other as the router node. Both of them can be configured accordingly to setup a communication between them.

**Components required for the project:**

1. One XBee radio, configured as a ZigBee Coordinator AT.
2. One XBee radio, configured as a ZigBee Router AT.
3. Two XBee USB adapter boards or arduino or either of them.
4. Two computers, each running a serial terminal program, or one computer running two different serial terminal programs. Using two computers is less confusing, so we would prefer that.
5. Software required: Tera Term (Windows) or Cool Term (MAC OS)

**How to interface an XBEE with your PC/Laptop?**

There are 3 ways we can interface an XBEE:

1. Use an USB to serial port Adapter to interface the XBEE
2. Use an USB to serial port Adapter and Arduino to interface the XBEE
3. Use an Arduino along with a breakout board interfaced with the XBEE

**Steps (Using an USB to serial port Adapter to interface the XBEE):**

1. Download XCTU software used for discovering XBEE’s connected to the computer. (<http://docs.digi.com/display/XBeeArduinoCodingPlatform/Downloading+and+installing+XCTU>)
2. Download FTDI drivers to connect the adapter. (<https://learn.sparkfun.com/tutorials/how-to-install-ftdi-drivers/windows---quick-and-easy>)

# Connect the XBEE to the Adapter. Connect the adapter to the computer using a USB 2.0 Cable- A-Male to Mini-B.

# Open XCTU and click on discover radio modules.

# Select the respective port to scan and port parameter settings to discover the XBEE module.

# Select the discovered XBEE to configure and click on add device.

# Configure the XBEE according to the requirements through the settings section in XCTU.

# If XCTU fails to discover the XBEE, we need to reset it.

# Connect pin 5 (Reset) and pin 10 (Ground) through a male-to-male jumper wire.

# The XBEE is now reset properly. Select discover radio modules again.

# How to create the application?

# Coordinator:

# Connect the coordinator XBee to the Laptop

# Open XCTU and discover the XBee to check if it has been connected.

# Note down the MAC address of the XBee (to use for the code for router).

# Download and open Tera Term terminal.

# Set the Port, Pan ID and the destination address of the router XBee.

# Here are the set of commands you can use:

# +++

# Output on terminal: OK

# ATID 2001 (Sets the PAN ID)

# Output on terminal: OK

# ATDH 0013A300 (Sets the destination address high)

# Output on terminal: OK

# ATDL 43023E45 (Sets the destination address low)

# Output on terminal: OK

# ATWR (Writes your changes to your firm)

# Output on terminal: OK

# Router:

# Connect the router XBee to the Laptop/ PC

# Open XCTU and discover the XBee to check if it has been connected.

# Note down the MAC address of the XBee (to use for the code for coordinator).

# Download and open Tera Term terminal.

# Set the Port, Pan ID and the destination address of the coordinator XBee.

# Here are the set of commands you can use:

# +++

# Output on terminal: OK

# ATID 2001 (Sets the PAN ID)

# Output on terminal: OK

# ATDH 0013A300 (Sets the destination address high)

# Output on terminal: OK

# ATDL 43023E45 (Sets the destination address low)

# Output on terminal: OK

# ATWR (Writes your changes to your firm)

# Output on terminal: OK

# Let’s Chat!!

# This is the final stage. If everything is set up properly, the text that you type in the serial terminal program on the first computer will be relayed to the second computer and appear on its serial terminal screen as well.

# The message is sent from one XBee radio to the other XBee radio via RF signal. The terminals decode the packet and display the messages on the terminal.

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