

Sensitive Buildings

Instructor: Rob Faludi

Plan for Today

- Imagining Sensitive Buildings: 4 last presentations
- ZigBee Addressing
- firmware updates
- basic configuration
- pair exercise
- Jim Korein
- Readings & Assignments

Imagining Sensitive Buildings

- 4 last presentations

Sharing the Class

- Discussion of proper public face for the class

ZigBee Addressing

ZigBee Coordinator

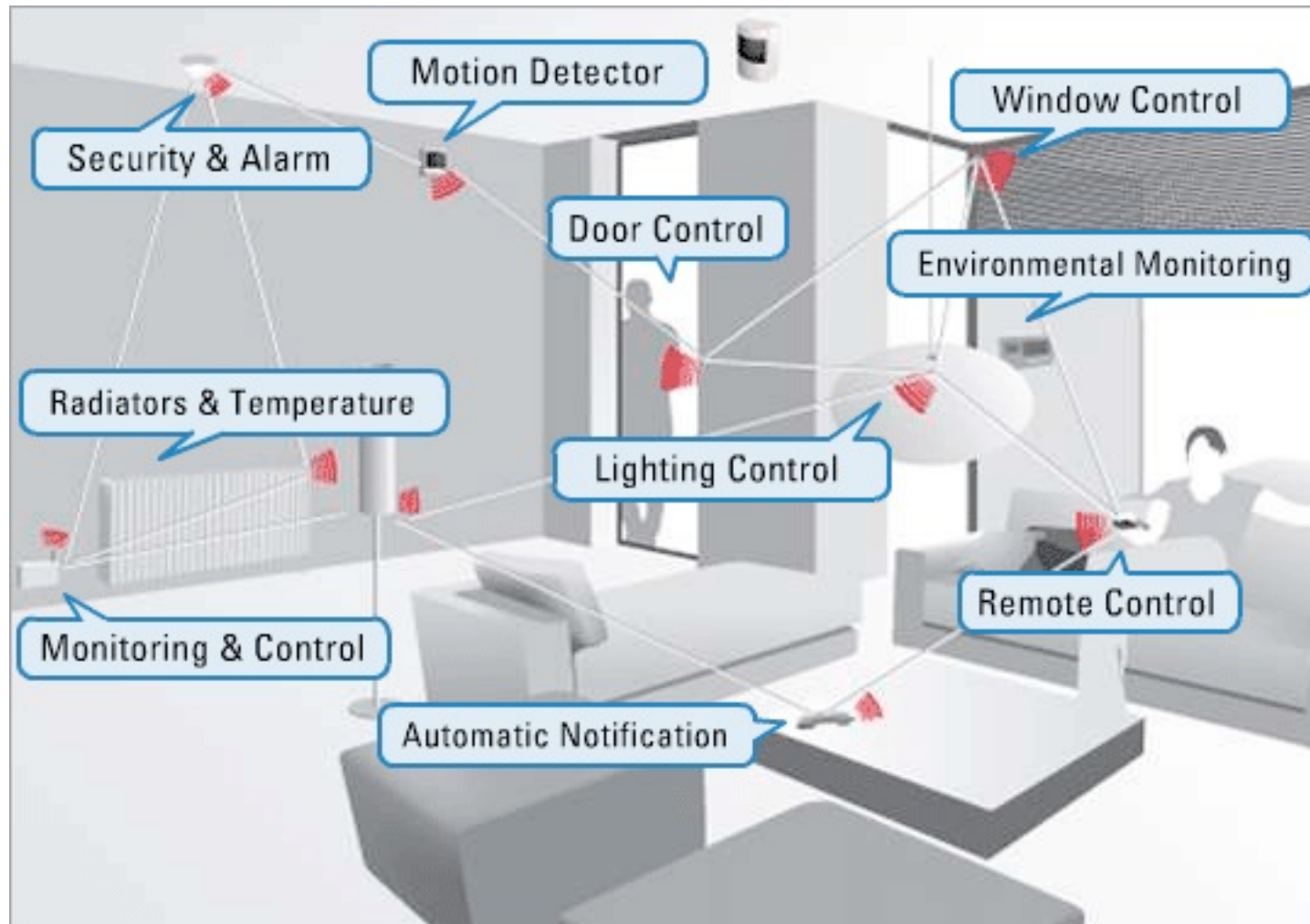
- Every ZigBee network must have a coordinator
- There can only be one coordinator
- Coordinator selects channel and PAN ID
- End devices and routers can then join the PAN
- Typically mains-powered
- Coordinator's 16-bit address is always 0

ZigBee Router

- Non-coordinator routers are optional to ZigBee networks
- Typically mains-powered
- Many can be on each PAN
- Issues a beacon request on startup to locate channel and PAN
- Routers can communicate with any device on the network
- Stores packets for sleeping end devices
- 16-bit address assigned by coordinator

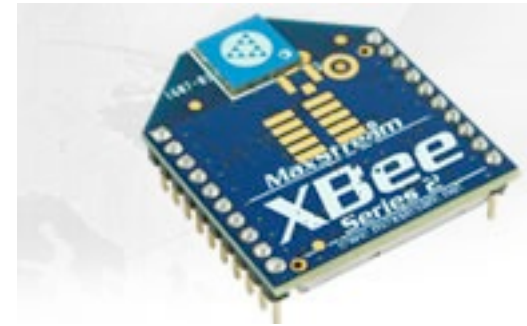
ZigBee End Device

- Optional to ZigBee networks
- Typically battery-powered
- Many can be on each PAN
- Issues a beacon request on startup to locate channel and PAN
- End devices can only communicate directly with their parent
- 16-bit address assigned by coordinator



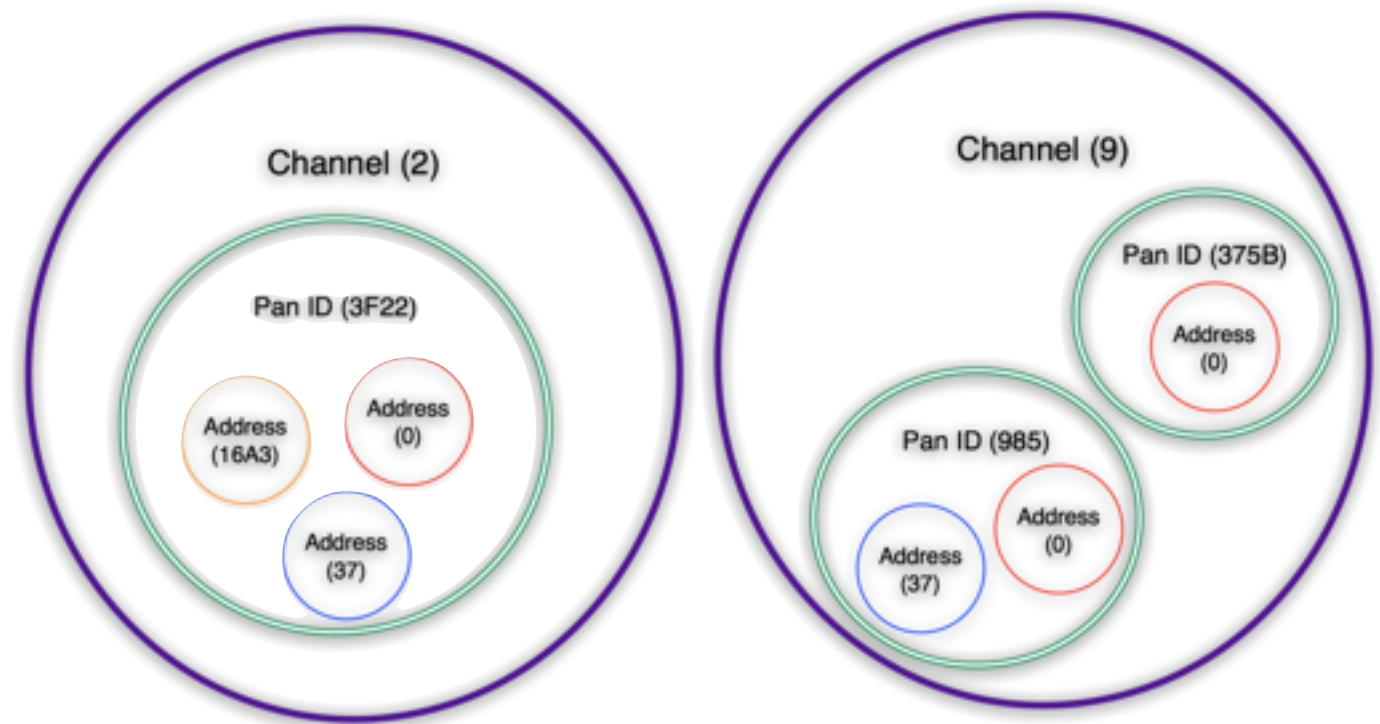
XBee ZB

- Coordinator Firmware
 - for AT commands or API
- Router and End Device Firmware
 - for AT commands or API
- ...so 6 different firmware combinations (you'll always use 2 at the same time)
- and two power levels, regular and Pro
- and 4 antennas! whip, chip, U.FL and RPSMA.

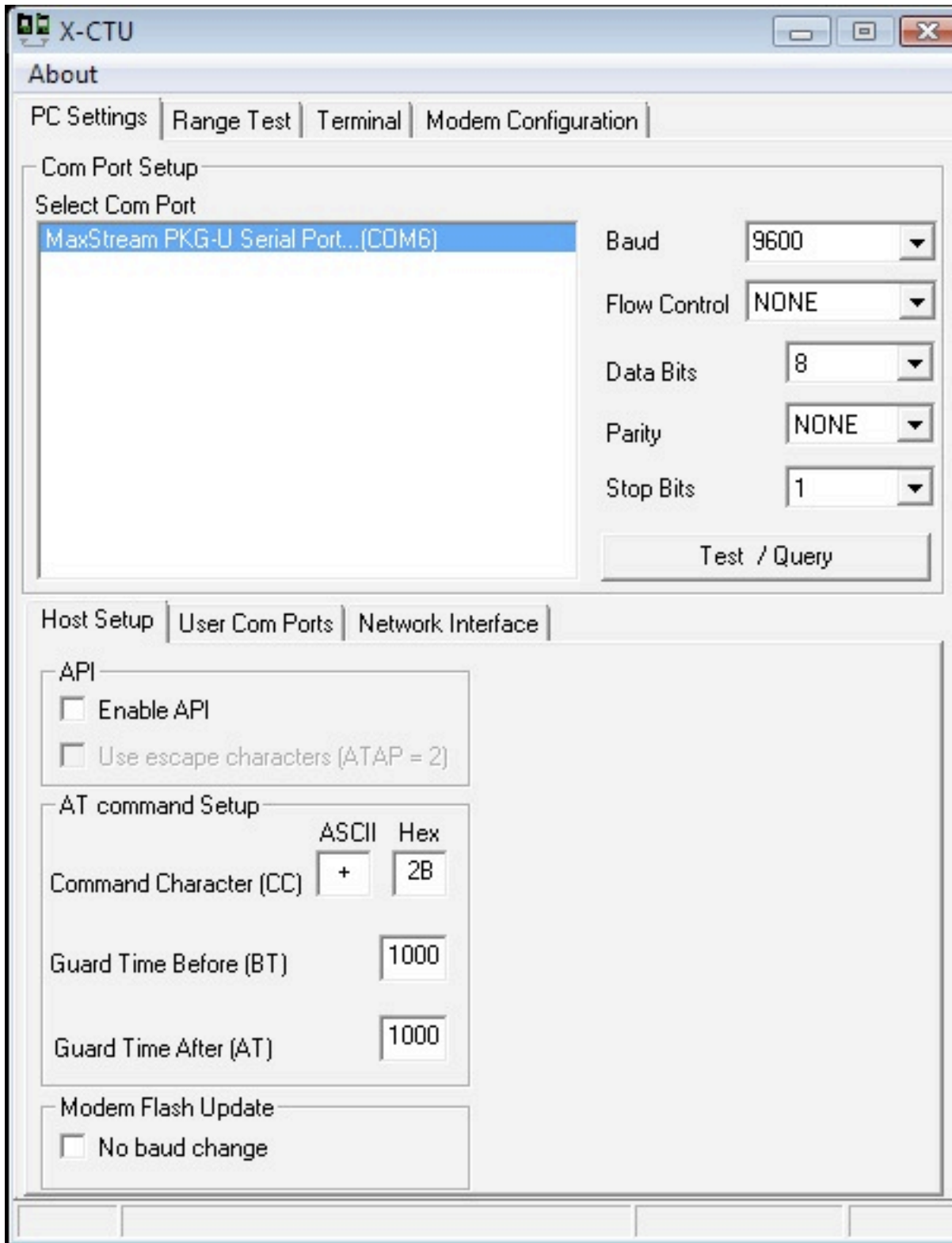


Addressing Basics

- channels
- PAN ID
- 64 bit addresses, aka serial numbers
- 16 bit addresses
- Node Identifier & Node Discovery
- endpoints & clusters



Firmware Updates



X-CTU

About

PC Settings | Range Test | Terminal | Modem Configuration

Com Port Setup

Select Com Port

MaxStream PKG-U Serial Port...(COM6)

Baud 9600

Flow Control NONE

Data Bits 8

Parity NONE

Stop Bits 1

Test / Query

Host Setup | User Com Ports | Network Interface

API

Enable API

Use escape characters (ATAP = 2)

AT command Setup

	ASCII	Hex
Command Character (CC)	+	2B

Guard Time Before (BT) 1000

Guard Time After (AT) 1000

Modem Flash Update

No baud change

X-CTU [COM6]

Remote Configuration

PC Settings | Range Test | Terminal | Modem Configuration

Modem Parameters and Firmware: Read Write Restore
Parameter View: Clear Screen Show Defaults
Profile: Save Load
Versions: Download new versions...

Always update firmware

Modem: XBEE Function Set: ZIGBEE COORDINATOR AT Version: 2041

XB24-ZB

- Networking
 - (0) ID - PAN ID
 - (1FFE) SC - Scan Channels
 - (3) SD - Scan Duration
 - (0) ZS - ZigBee Stack Profile
 - (FF) NJ - Node Join Time
 - OP - Operating PAN ID
 - OI - Operating 16-bit PAN ID
 - CH - Operating Channel
 - NC - Number of Remaining Children
- Addressing
 - (0) DH - Destination Address High
 - (FFFF) DL - Destination Address Low
 - () NI - Node Identifier
 - (1E) NH - Maximum Hops
 - (0) BH - Broadcast Radius
 - (FF) AR - Many-to-One Route Broadcast Time
 - (30000) DD - Device Type Identifier
 - (3C) NT - Node Discovery Backoff
 - (0) NO - Node Discovery Options

Getting modem type....OK
Modem's firmware not updated
Setting AT parameters..OK
Write Parameters...Complete

COM6 9600 8-N-1 FLOW:NONE XB24-ZB Ver.2241

X-CTU [COM6]

Remote Configuration

PC Settings | Range Test | Terminal | Modem Configuration

Modem Parameters and Firmware | Parameter View | Profile | Versions

Read | Write | Restore | Clear Screen | Save | Download new versions...
Show Defaults | Load

Always update firmware

Modem: XBEE | Function Set: ZIGBEE ROUTER AT | Version: 2241

XB24-ZB

- (0) ID - PAN ID
- (1FFE) SC - Scan Channels
- (3) SD - Scan Duration
- (0) ZS - ZigBee Stack Profile
- (FF) NJ - Node Join Time
- (0) JV - Channel Verification
- (0) JN - Join Notification
- (0) OP - Operating PAN ID
- (FFFF) OI - Operating 16-bit PAN ID
- (0) CH - Operating Channel
- (C) NC - Number of Remaining Children
- Addressing
 - (0) DH - Destination Address High
 - (0) DL - Destination Address Low
 - () NI - Node Identifier
 - (1E) NH - Maximum Hops
 - (0) BH - Broadcast Radius
 - (FF) AR - Many-to-One Route Broadcast Time
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Getting modem type...OK
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COM6 | 9600 8-N-1 FLOW:NONE | XB24-ZB Ver:2241

X-CTU

- Coordinator
- Router
- Both AT command mode
- resets
- about API configurations

Basic Configuration

Download and Install Software & Drivers

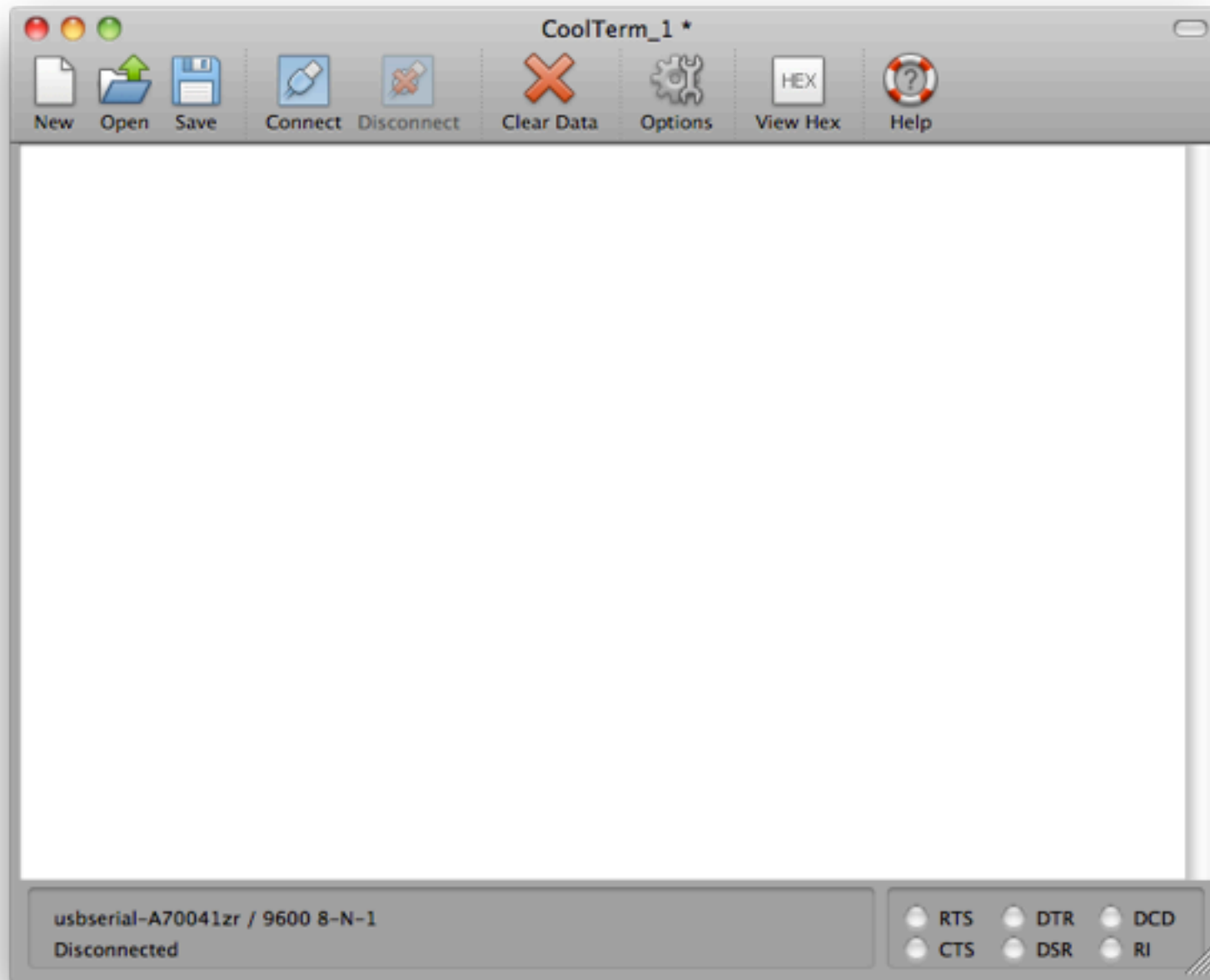
- Download & install the FTDI USB drivers:
<http://www.ftdichip.com/Drivers/VCP.htm>
- Download the CoolTerm:
<http://freeware.the-meiers.org/>

Other Serial Terminal Options:

settings: 9600 baud, 8 bits, no parity, one stop bit, no flow control

- X-CTU: <http://www.digi.com/support/productdetl.jsp?pid=3352&osvid=57&tp=4&s=316>
- Z-Term: <http://homepage.mac.com/dalverson/zterm/>
- HyperTerm: Windows Start Menu, Accessories, Communication
- Screen: Terminal program on the Mac (or Linux)

Open CoolTerm



Set Connection Options

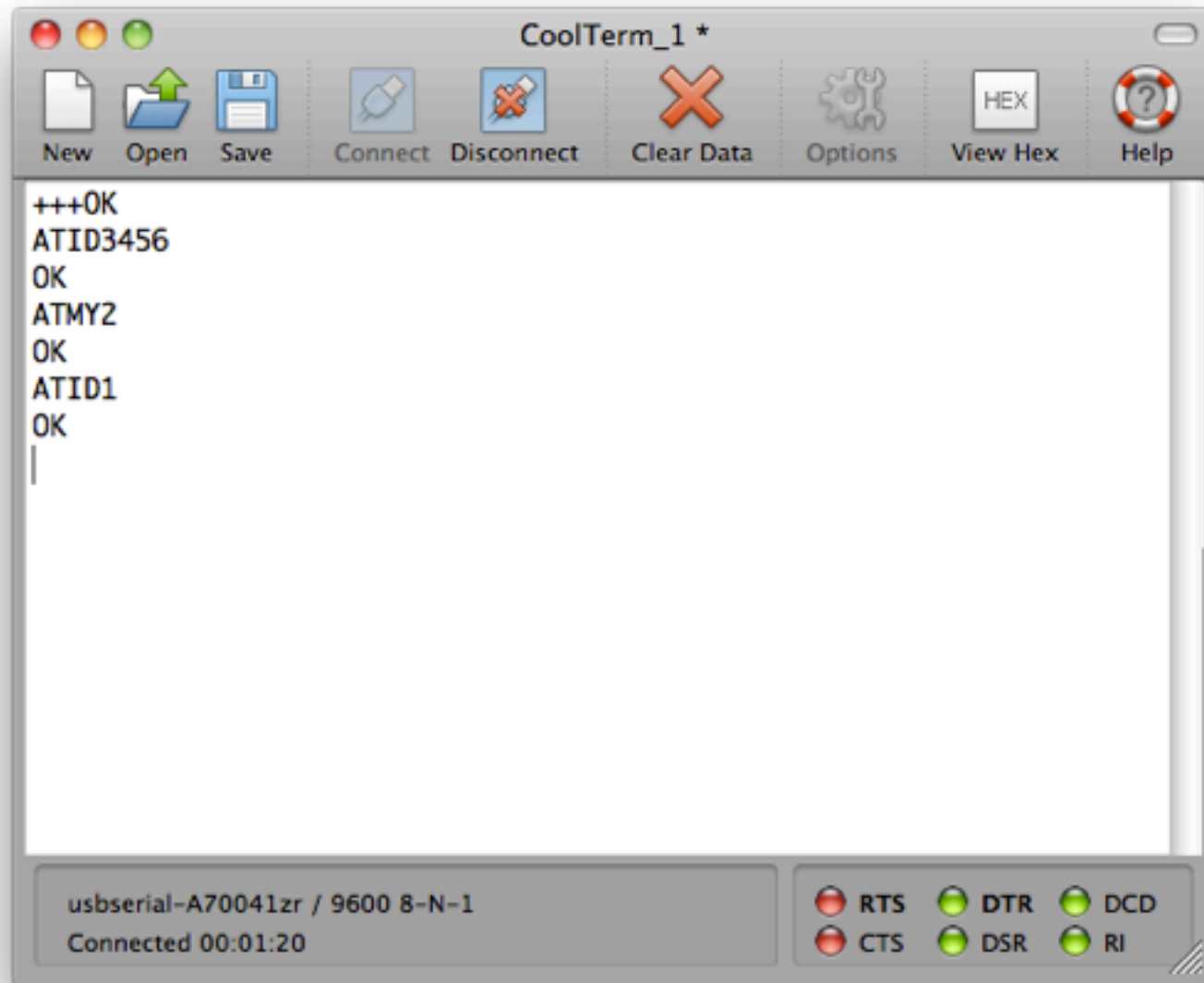
The image shows a configuration dialog box for a serial connection. It is divided into four main sections:

- Serial Port Options:** Contains dropdown menus for Port (usbserial-A70041zr), Baudrate (9600), Data Bits (8), Parity (none), and Stop Bits (1). It also has checkboxes for Flow Control: CTS, DTR, and XON.
- Terminal Options:** Contains checkboxes for Local Echo (checked), Convert Non-printable Characters (ASCII View) (checked), and Handle Backspace Character (unchecked). It also has radio buttons for Enter Key Emulation: CR+LF (selected), CR, and LF.
- Send String Options:** Contains a checkbox for Terminate 'Send String' Data (unchecked) and a text field for Termination String (Hex) containing 0D 0A.
- Special Options:** Contains checkboxes for Loop back received data (unchecked) and Ignore receive signal errors (unchecked).

At the bottom, there are four buttons: Re-Scan Serial Ports, Cancel, and OK.

Configure your radio with AT commands

- Configure your radio



Baud, Bits and Parity

- Baud rate: 9600
- Data bits: 8
- Stop bits: 1
- Parity: None
- Flow control: none for now...

Data Mode vs. Command Mode

- Idle Mode, transmit and receive data
- Command Mode, talk to the XBee itself
 - +++ *"Yo, XBee"*
 - AT *"Attention!"* (Hayes command set)
 - always press enter after AT commands
 - never press enter after +++

AT Commands

Some AT Commands

- AT -> OK
- ATDH, ATDL -> destination address hi/lo
- ATID -> personal area network ID
- ATCN -> end command mode
- ATWR -> write current configuration to firmware
- *ATMY* -> ~~my address~~ NOT SETTABLE FOR ZIGBEE

Pair Exercise

Create a Basic ZigBee Pair

- One coordinator and one router
- Use the 64-bit addresses for destinations
- ATNR will reset your network layer, useful if you join the wrong ID
- Remember, the radios work reliably, troubleshooting is mostly about figuring out what they're doing.

Jim Korein

- CEO of Omnispective Management Corporation, owner of 240 Central Park South
- He is a trained computer engineer
- Washington University in St. Louis
- Jim has worked as an engineer and managed a number of engineering departments, including a rapid prototyping firm based in the Twin Cities
- Fan of sensor networking and brave sponsor of this class

Readings and Assignments

- Readings
 - Building Wireless Sensor Networks, Chapter 2
- Assignments
 - Gather parts for doorbell exercises
 - Complete pairs exercise