# Introduction

In this module, we'll get an overview of the different protocols and where they can fit into your design. Then we'll do a short lab so we can get the blood moving.

# Learning Objectives

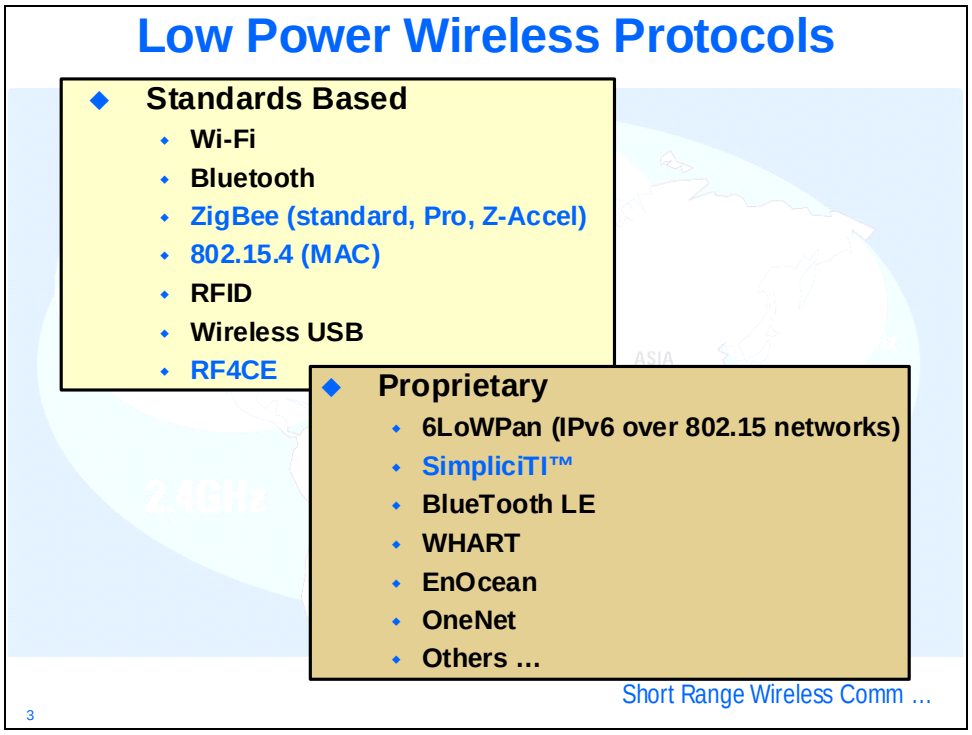
- Global Frequencies
- TI Solutions
- Roadmap
- SimpliciTI
- 802.15.4
- TI-MAC
- ZigBee
- Z-Accel

*** another wasted opportunity ***

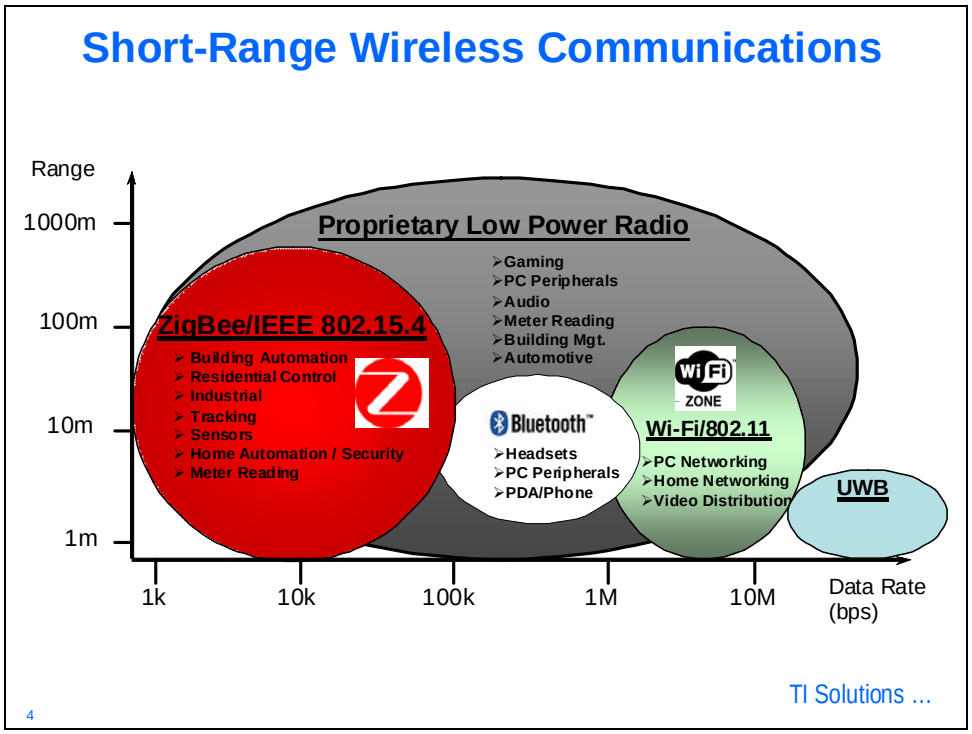
# Module Topics

*** use only this page for doodling ***

# Frequencies and Protocols



# Short Range Communication



# TI Solutions and Roadmap

## TI Solutions

| | SimpliciTI™ | RF4CE | TI-MAC | ZigBee | Z-Accel |
|---|---|---|---|---|---|
| **Frequency** | 1GHz & 2.4GHz | 2.4GHz | 2.4GHz | 2.4GHz | 2.4GHz |
| **Standards Based?** | No | Yes (802.15.4) | Yes (802.15.4) | Yes (802.15.4) | Yes (802.15.4) |
| **# of nodes** | 2 - ~30 | 2-10's | 2 - ~100 | 2 – 100's | 2 – 100's |
| **Interop with 3rd parties** | No | Yes (if desired) | No | Yes (if desired) | Yes (if desired) |
| **Cost/ Complexity** | lowest | lower | lower | highest | higher |
| **Code Size** | <8K | <64K | ~25K | 75K+ | ~4K on host MCU |


Roadmap ...

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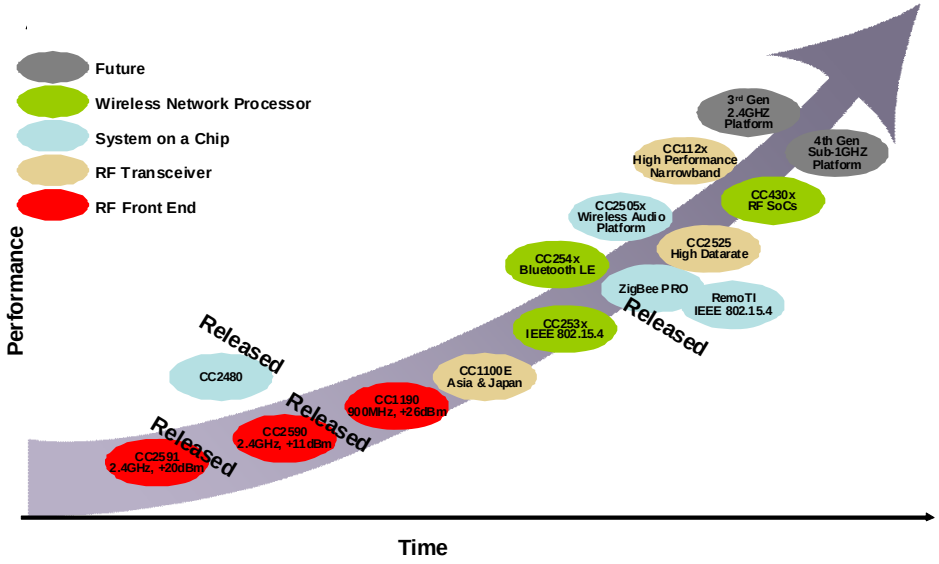
## Low Power RF Roadmap




SimpliciTI ...

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# SimpliciTI

## SimpliciTI™

- Available platforms
  - CC1101, CC111x (1GHz) + MSP430
  - CC2500, CC2520 (2.4GHz) + MSP430
  - CC2430, CC251x, CC2530 (2.4GHz) SoC
- Low power, Low data rate (~100kb/s)
- Peer to Peer and/or Star with Range Extender
- 6 Simple API's
- Open Source Code
- No license, No fees

SimpliciTI™


802.15.4 ...

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# IEEE 802.15.4 and TI-MAC

## IEEE 802.15.4

- Specifies the physical and MAC for low data-rate, wireless personal area networks
- Intended to allow ultra low power consumption nodes
- Physical limit of 250 kb/s, but much lower in practice
- Predefined modulation types and frequencies
- TI 802.15.4 devices operate on 2.4GHz
- ZigBee is built on top of this standard

TI-MAC ...

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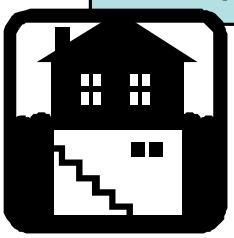
## TI-MAC

- Available platforms
  - CC2420/CCs520 (2.4GHz) + MSP430
  - CC2430/1, CC2530 (2.4GHz) SoC
- Low power, Low data rate (~100kb/s)
- Peer to Peer or Star
- Acknowledgements provided
- No license, No fees
- Requires unique IEEE address



ZigBee ...

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# ZigBee

## Z-Stack

- Available platforms
  - CC2420/CCs520 (2.4GHz) + MSP430
  - CC2430/1, CC2530 (2.4GHz) SoC
- Low power, Low data rate (~100kb/s)
- Self forming and repairing mesh networking
- MAC and APP level acknowledgements
- Interoperability possible
- ZigBee.org membership required
- Compliance testing required
- Unique IEEE address required

Mesh Networking ...

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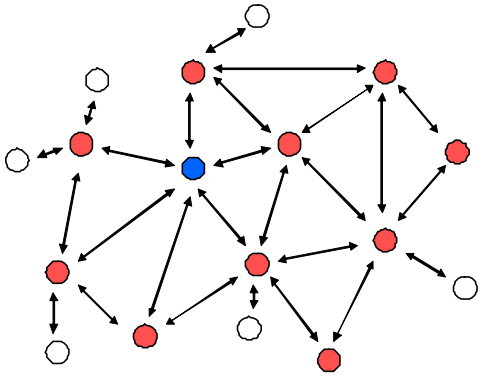
## ZigBee™ – Mesh Network Elements



- ZigBee **Coordinator**
  Starts the Network
  Routes packets
  Example: Heating Central
  (mains powered)
- ZigBee **Router**
  Routes packets but can
  have additional function
  Example: Light
  (mains powered node)
- ZigBee **End Device**
  Sleeps most of the time
  Can be battery powered
  Does not route
  Example: Light switch

Z-Accel ...

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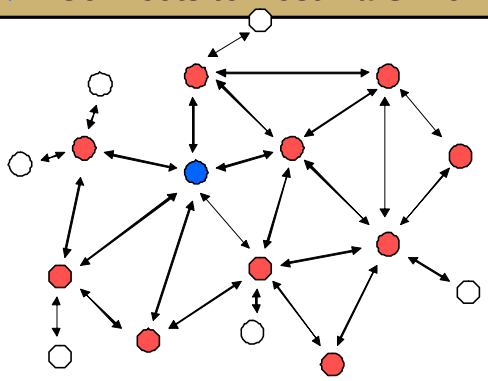
# Z-Accel and the ZigBee Alliance

## Z-Accel

- Available platforms
  - CC2480 (2.4GHz) + MCU
- Embedded ZigBee solution … Network Processor
- Preprogrammed with ZigBee 2006
- Connects to Host via SPI or UART



ZigBee Alliance …

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## ZigBee Alliance

**"The ZigBee Alliance is an association of companies working together to enable reliable, cost-effective, low-power, wirelessly networked monitoring and control products based on an open global standard"**
Source: ZigBee Alliance homepage

**Promoters of the ZigBee alliance are:**
**TI, Ember, Freescale, Honeywell, Mitsubishi Electric, Motorola, Philips, Huawei, Itron, Cellnet+Hunt, Schneider Electric, STMicro, Samsung, Siemens and Tendril**

**The alliance has over 275 members**

For further information please see: *www.zigbee.org*

Lab Time …

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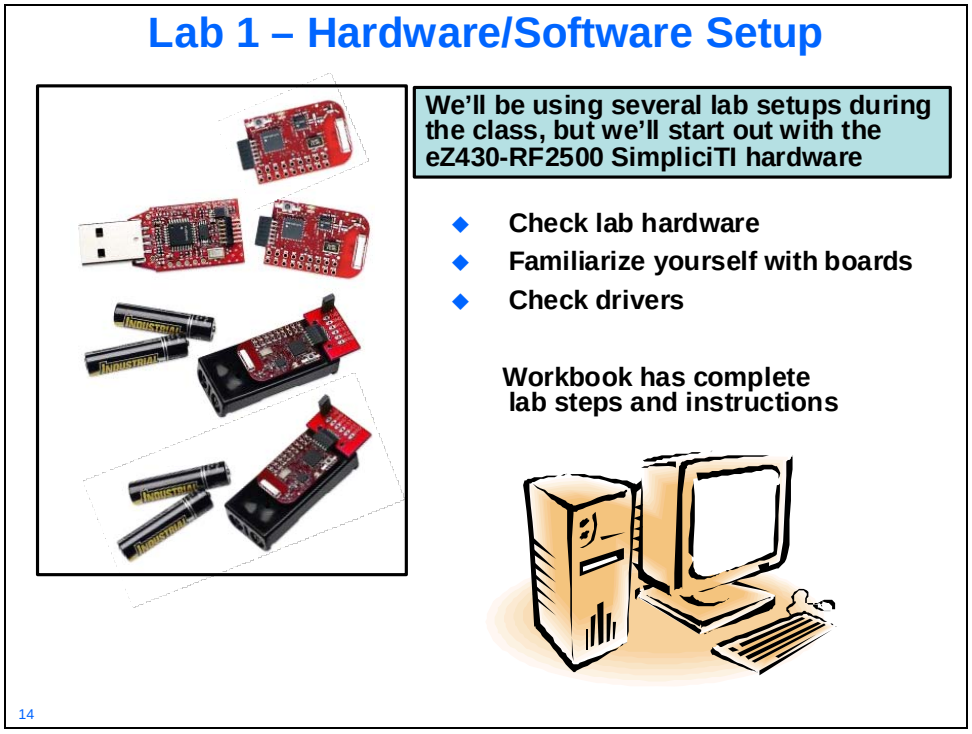
*** making wireless stuff is way cool ***

# Lab1 – Hardware/Software Setup

## Description:

We've been sitting too long already … it's time to get up and do some work. Let's check out the hardware and software needed to do the first few labs.



## Hardware list:

- ✓ 3 eZ430-RF2500 Target Boards
- ✓ 2 Battery Modules
- ✓ 4 AAA Batteries
- ✓ 1 eZ430-RF2500 Emulator Board
- ✓ 1 USB Extender Cable

## Software list:

- ✓ IAR Embedded Workbench for MSP430 version 4.11D

(You will find shortcuts for the above application on the desktop)

# Procedure

## *Check out the Hardware*

1. **Identify the boards**

   You should have a single **Emulator Board** in front of you. It looks like:

   You'll also find three **Target Boards** in the pile:

   Along with two **Battery Modules** with their batteries:


   The pictured Battery Modules are the old style with the target board located over the batteries when connected. The problem was, even though this provided some much needed mechanical support, the configuration caused the RF range to, frankly, stink. So be careful when the boards are connected … they're pretty fragile.

2. **Connect the Extender Cable and Emulator**

   The **Emulator Board** too, is pretty fragile if it's connected directly to the USB port with no support. Connect the **USB Extender Cable** to an open USB port and bring the other end around onto your work surface. Connect the **Emulator Board** to the other end of the cable and arrange the board so that the emulation port connecter pins are on top, like in the photo above. When you plug in the **Emulator Board**, you should hear the reassuring Windows sound (bah-bump), indicating the board has been sucessfuly recognized.

3. **Check Battery Module Jumpers**

   The **Battery Modules** may have the power jumper either on the top or the bottom of the module. Make sure that the **jumper** is only connected to **one of the pins** for safekeeping. This will disconnect power for later when we connect the **Target Boards**. If a jumper is loose or missing, ask your instructor for a new one.

4. **Examine the Target Boards**

   Take a close look at the **Target Boards**. Note the position of the **switch** on the board. In order to press it, you'll have to provide some support to the bottom of the board. The LED's are right next to the switch; the **green LED** is nearest the edge of the board and the **red LED** is right below it.

5. **All Done**

   Leave all the boards on the work surface, we'll need them in the next lab.


You're done