Wireless Connectivity Solutions
For the Internet of Things

Wirelessly connecting everywhere.
Agenda

Internet of Things Wireless Solutions

1. What is the Internet of Things
2. TI’s Portfolio
3. Zoom in products – ZigBee, WiFi, BT4.0, Sub 1GHz
4. How to get started
“Internet of Things” Connecting Everything

GSMA predicts there could be 24 billion connected devices by 2020
The “Internet of Things”
Three Major Hubs

- **Mobile Hub**
  - Bluetooth®
  - Bluetooth low energy

- **Wi-Fi Access Point**
  - Wi-Fi

- **Mesh Gateway**
  - ZigBee®
  - 6LoWPAN
  - 802.15.4
  - Sub-1GHz

*GSMA expects the number of total connected devices to increase from approximately 9 billion today, to more than 24 billion in 2020.*
The industry’s broadest wireless connectivity portfolio:

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<th>Supported standards</th>
<th>Satellite</th>
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Red = SimpleLink family of self-contained, wireless connectivity solutions
Choosing the Right Technology for You

**Range**

- BLE
- Zigbee
- RF4CE
- Sub-1GHz
- WiFi

**Throughput**

- BLE
- Zigbee
- RF4CE
- Sub-1GHz
- Bluetooth
- 2.4GHz Prop

**Typical power source**

- Li-ion
- AAA
- Coin Cell

**Typical Topology**

- Mesh
- Star
- P2P

- Zigbee
- Prop Sub 1GHz, Prop 2.4Ghz
- WiFi, Bluetooth
- RF4CE
Why ZigBee?

- ZigBee Compliant Platform
  - IEEE 802.15.4 PHY and MAC
  - ZigBee is a Mesh network, security and application layer functions
  - TI ZigBee development kits are based on ZigBee Compliant Platforms

- ZigBee Compliant Product
  - Product based on a ZigBee Compliant Platform
  - Can use the ZigBee name and logo
  - Can co-exist with other ZigBee systems
  - Interoperable if a public profile is used
# ZigBee Solution from TI

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<th>SoC</th>
<th>Co-processor</th>
<th>Dual-chip</th>
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<td>small footprint, high integration, low cost</td>
<td>flexible, easy to use and reduced time to market</td>
<td>ultra low power or high performance</td>
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## Application
- CC2530 (51 Core)
- CC2538 (M3 core)

## Protocol stack
- Any Processor (e.g. MSP430 or Stellaris ARM)

## Radio
- CC2520

## RF front end (optional)
- CC2590 / CC2591
CC2538 - Powering IoT

Powerful, scalable and flexible:

- Powerful 32-bit ARM Cortex-M3 MCU
- Up to 512 KB Flash and 32 KB RAM
- 2.4GHz IEEE 802.15.4-2006 compliant RF transceiver
- Very low power consumption RX / TX: 19mA / 24 mA
- Interface support: USB, 2x SPI, 2x UART, I2C, 32 GPIO
- 125°C operation for reliability in high-temp environments
- Robust blocking and selectivity
Why Wifi?

• Over 2.5 billion WiFi units deployed in the market today;
  1 billion units/year projected starting in 2011
• Easiest connection to the Internet
  Native to IP and TCP
• Full house coverage
• Using 2.4Ghz – unlicensed frequency, used globally
What is SimpleLink™ WiFi?

- Universal IP connectivity enabled everywhere
- The fastest way to connect an existing application to a Wifi router and the internet
- Self contained wifi solution with TCP, UDP and IP on a single chip
- Only 6Kb Flash, 3Kb Ram needed

Video: SimpleLink connects your product to the internet

Wi-fi connect your application!
SimpleLink™ WiFi from TI

Smart Config
Smart Wifi pairing for embedded devices

New Smart Config feature enables a device without screen or i/o to pair with a WiFi access point using standard Wifi mechanisms.

Development kits
For MSP430, Stellaris and other MCUs

Connect your product to a WiFi access point in a day!

Wifi code examples
Only a few kB of code required!
Source code available!

- **Basic WiFi application**: Tx/Rx UDP, ping
- **Sensor application**: Log temp and accelerometer data
- **Home automation**: Adjust temperature via Twitter
- **Data logger**: Show sensor data over time

Certified modules
Wifi, FCC/IC, ETSI tested modules

- **TI Module:**
- **Wilink-tech Module:**
Why Bluetooth?

- Commonly used in cell phones, computers and cars
- Using 2.4GHz - unlicensed frequency - used globally
- Application throughput up to 2Mbps
- Used to transfer data or stream audio
Bluetooth Solution from TI

CC2560 - Mature & robust Bluetooth solution
2x Range – making it easy to use with great user experience
Provided with stack on MCU royalty free
Modules available for ease of design

Development resources for prototyping and development

Bluetooth Kit
MSP430 + CC2560
Supporting SPP Profile

Bluetooth module
With or Without Antenna

Bluetooth / BLE Kit
Coming soon…

CC2560-Based Bluetooth Transceiver

Hardware
Microcontroller
32 KHz Clock
UART
Battery

Software
Applications
Profiles
Bluetooth Stack
Operating System

Firmware
Low-level Protocols

Host/Controller Interface

26 MHz Clock
Filter
What is Bluetooth low energy?

- Low power: >1 year battery life on a coin cell
- Low data rate: Application throughput up to 100kbps
- Smartest way to connect your product to iOS devices and other BLE enabled smartphones, tablets and PCs

Many brand products on the market already!
Bluetooth Low Energy from TI

Most mature single-mode BLE solution: CC2541/CC2540

Development resources for prototyping and development

BLE Sensor kit
An app developer can access:
- IR temp sensor
- Humidity sensor
- Accelerometer
- Pressure sensor
- Magnetometer
- Gyroscope
- Pushbuttons, LEDs

Available in October

iOS app on appstore
Source code available!

BLE Key fob
More than 6000 sold!

Btool for BLE
device exploration

RF Packet Sniffer

USB stick
For PC connectivity

Power consumption estimator

Texas Instruments
Why Sub-1GHz RF?

- Longest RF transmission range, more than 10’s of kilometers (“Wide Area Networks”)
- Good range in urban environments
- Full-house coverage with a star topology network.
- Regulatory restrictions allowing the communication to be more robust (example: maximum 1% duty-cycle in the band)
- Popular applications: home security, home automation and automatic meter reading systems

Video: 25km range test in Cape Town, South Africa

Best technology for robust, long range wireless communications
Sub1-GHz RF solutions from TI

Value Line vs Performance Line

Value Line
- Development Kit!

Performance Line
- Development Kit!

CC110L transceiver
CC113L receiver
CC115L transmitter

CC1120 transceiver
CC1121 transceiver
CC1125 transceiver
CC1175 transmitter

Dev tools and software for eval, design and production test

SmartRF Studio
RF Packet Sniffer

New features for more robust and lower power RF links

DSP WaveMatch, no false or missed packets!
RX Sniff Mode, <3mA!
Sub 1Ghz Global Frequencies for your Product

- 315/915 MHz
  - USA

- 433 MHz
  - Europe
  - Asia
  - Africa

- 433/868 MHz
  - Europe
  - Asia
  - Africa

- 415/433 MHz
  - Japan

- 470 MHz
  - China

- 779 MHz
- 426 MHz
  - Japan

- 433 MHz
- 433 MHz
- 433 MHz

- 433 MHz
- 433 MHz

- 2.4 GHz

GLOBAL 433 MHz
## How to Get Started

**Use below resources and this training to understand technology & applications**

**Get a development kit & demo**

**Contact TI**

[www.ti.com/wireless](http://www.ti.com/wireless)

[WirelessChina@list.ti.com](mailto:WirelessChina@list.ti.com)

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<tr>
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<th>SimpleLink Wifi</th>
<th>Bluetooth Low Energy</th>
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<th>Sub1-GHz RF</th>
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<td>CC3000 FRAM EMK</td>
<td>CC2541DK-MINI kit</td>
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- BLE technology
- Bluetooth technology
- RF Value Line
- RF Performance Line
- ZigBee

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- www.ti.com/wiconforum
- BLE support forum
- BT support forum
- HW support forum
- ZigBee support forum

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See Our Demos

**SimpleLink™ WiFi – CC3000**

TI CC3000 + Sensors+ MSP430 + WiFi AP = Internet connected Sensors

**BLE – CC2541 – Wireless Sensors**

TI BLE Sensor Tag + iOS Reference App = Endless opportunities

**BLE – CC2541 – Wireless Game**

Race Car + 2541 PCB + RC Car App + iPhone = Lots of Fun

**Wireless Audio – CC8520**

Speaker + CC8520 + PC Filters = Wireless Active Speakers

**Sub 1Ghz – CC1120**

CC1120 DK + Embedded Easy RF link Test = Test how far you can go
Thank You

wirelesschina@list.ti.com