IoT drives Industry 4.0

物聯網與工業 4.0 發展趨勢與應用介紹

Jesse Wang, TI CMCU
jessewang@ti.com
Agenda

• Industry 4.0 & IoT
• How Wireless Is Relevant
• TI Wireless Connectivity
  – Portfolio
  – Easy Use: SimpleLink & SensorTag Example
• TI Launchpad and TI Designs
• TI Integrated Resources and Public in Website
A Typical IoT Application: Sensor-to-Cloud
30.7B connected devices by 2020, 75.4B by 2025

Top IoT concerns...

- Security
- Complex standards
- Required expertise
- Power consumption

Sources: IHS Markit and Bain & Company
Industry 4.0 or Industrial IoT for factory automation

Internet of Things

Industrial Internet Consortium

Industry 4.0

Consumer  Building  Industrial  Manufacturing

Real-time

Functional Safety

ABB Robotics: [https://www.youtube.com/watch?v=i9Vbh2mPG6M](https://www.youtube.com/watch?v=i9Vbh2mPG6M)
Industry 4.0 or Industrial IoT for factory automation

- **Industry 4.0** = a living network of machines, people and products enabling real-time optimization of the entire manufacturing flow.

- **Intelligent manufacturing**: Flow optimization and customization, asset tracking, predictive maintenance and real-time inventory optimization.

- Equipping machines and parts with **sensors** and **network connectivity** is the key step toward this vision. Data analytics and software platforms are also critical.

Reference: [TI blog industry 4.0](https://www.ti.com)
# The Top 6 Challenges

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Description</th>
<th>Texas Instruments Offerings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensing a complex environment</td>
<td>Innovative ways to sense and deliver information from the physical world to the cloud</td>
<td>TI offers sensing technology that addresses a wide variety of applications</td>
</tr>
<tr>
<td>Connectivity</td>
<td>Variety of wired and wireless connectivity standards are required to enable different application needs</td>
<td>TI has the industry’s broadest wireless and wired connectivity offering covering over 14 standards</td>
</tr>
<tr>
<td>Power is critical</td>
<td>Many IoT applications need to run for years over batteries and reduce the overall energy consumption</td>
<td>TI’s low power devices enable years of battery operation and harvested-powered devices</td>
</tr>
<tr>
<td>Security is vital</td>
<td>Protecting users' privacy and manufacturers' IP: detecting and blocking malicious activity</td>
<td>TI devices have built-in state-of-the-art hardware security technology</td>
</tr>
<tr>
<td>IoT is complex</td>
<td>IoT application development needs to be easy for all developers, not just to experts</td>
<td>TI’s IoT solutions encapsulate wireless and internet communication and make hardware and software design simple</td>
</tr>
<tr>
<td>Cloud is important</td>
<td>IoT applications require end-to-end solutions including cloud services</td>
<td>TI’s cloud ecosystem partners enable faster time to market of new products and services</td>
</tr>
</tbody>
</table>

IoT is an enabling technology

Building & Home Automation
- Wireless environmental sensor
- Wireless lighting
- Connected appliances
- Control panels
- Gateway
- Light control
- Smart lock
- Smart thermostat
- Video doorbell

Smart Cities
- Wireless grid communication
- Surveillance cameras
- Smart combiner box
- Smart meters
- Smart street lights
- Energy harvesting
- Grid automation
- Protection relay
- Renewables
- Drones

Smart Manufacturing
- Industrial communication
- Communication module
- CPU (PLC controller)
- Hydraulic valves
- Industry 4.0
- Pneumatic valves
- Portable monitor
- Process analytics
- Field transmitter
- Robotics

Wearables & Health Care
- Augmented reality and entertainment
- Wearable fitness & activity monitor
- Telehealth gateway and aggregation
- Wireless patient monitor
- Location and tracking
- Smart watches
- Fitness

Automotive
- Level 1 & 2 EV charging station
- Level 3 EV charging station
- Engine management
- Wire replacement
- Infotainment

Precision agriculture
- Power converters & chargers for agricultural equipment
- Cold chain tracking for refrigerated transport
- Sensors for agricultural equipment
- Drones

TI is delivering solutions for Factory Automation

- Programmable Logic Controller (PLC)
  - Analog Input Module
  - Analog Output Module
  - Communication Module
  - CPU (PLC Controller)
  - Digital Input Module
  - Digital Output Module
  - Special Function Module
  - Transducer Module
- Human Machine Interface (HMI)
  - Industrial Monitor
  - Portable Monitor
- Field Transmitter
  - Displacement Transmitter
  - Flow Transmitter
  - Level Transmitter
  - Pressure Transmitter
  - Process Analytics
  - Temperature Transmitter
- Automated Machinery
  - Robotics Control
- Machine Vision
  - Camera
  - Code Readers
- Field Actuators
  - Hydraulic Valves
  - Pneumatic Valves
  - Signage

- Wireless technologies are relevant for non time-critical applications such HMI panel interface, parameters monitoring, predictive maintenance, gateways, wireless sensor network.

http://www.ti.com/lsds/ti/processors/applications/industrial/overview.page
Factory Automation/ industry 4.0 and wireless

Sensor Network Monitoring for maintenance
HMI Wireless Interface
Parameters Monitoring
Cables to wireless bridges Data-logging

NFC / RFID
Bluetooth
WiFi CERTIFIED
Sub-1GHz

Bluvision Beacons and IoT: https://www.youtube.com/watch?v=TFL4i6lKuZI
TI Wireless Connectivity Portfolio

Largest wireless selection
Support for all key technologies and standards for industrial, automotive and consumer
A solution for any application. Future proof. Leverage your investment

Lowest power consumption
Use a coin cell or for multi-year, always-on operation or go battery-less with energy harvesting
Ultra-low power by design

Easiest to design with
Quickest learning-curve and development time with full broad market ecosystem
Software, tools, E2E, certified TI modules, TI Designs, SensorTag, online trainings, Cloud

Connect More with TI
# TI wireless portfolio:
A solution for each industry/applications challenge

<table>
<thead>
<tr>
<th>Network type</th>
<th>NFC RFID</th>
<th>Bluetooth®</th>
<th>Proprietary 2.4 GHz</th>
<th>ZigBee®</th>
<th>Wi-Fi®</th>
<th>6LowPAN</th>
<th>Proprietary Sub-1 GHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identification</td>
<td>Personal connection</td>
<td>Customizable</td>
<td></td>
<td>Mesh</td>
<td>Existing infrastructure</td>
<td>IP Mesh</td>
<td>Customizable</td>
</tr>
<tr>
<td>Range</td>
<td>Proximity</td>
<td>Personal area networks</td>
<td>Local area networks</td>
<td>Neighborhood area networks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Key differences</td>
<td>Data • Up to 848 Kbps • No battery to coin cell</td>
<td>Data or voice • Up to 3 Mbps • Coin cell to AAA</td>
<td>Data • Up to 1 Mbps • Coin cell</td>
<td>Data • Up to 256 Kbps • Energy harvesting to AAA</td>
<td>Voice or video • Up to 100 Mbps • AA battery</td>
<td>Data • Up to 256 Kbps • Energy harvesting to AAA</td>
<td>Data • Up to 1 Mbps • Coin cell</td>
</tr>
<tr>
<td>Industrial applications</td>
<td>• Device configuration / Firmware upgrade</td>
<td>• Lighting • Wire replacement • Beaconing • Asset tracking • Factory automation</td>
<td>• Building and factory automation • Beaconing</td>
<td>• Smart energy • Building automation • Lighting networks • Industrial Internet</td>
<td>• Assets tracking • Remote control of machinery • Sensors • Building automation</td>
<td>• Smart energy • Building automation • Lighting networks • Low-power Industrial Internet-gateways</td>
<td>• Metering • Smart grid • Alarm and security • Environmental monitoring</td>
</tr>
</tbody>
</table>
TI SimpleLink Connectivity portfolio

<table>
<thead>
<tr>
<th>MSP432</th>
<th>CC3220</th>
<th>CC2640R2F</th>
<th>CC1350</th>
<th>CC1310</th>
<th>CC3120</th>
</tr>
</thead>
<tbody>
<tr>
<td>Host MCUs</td>
<td>Standalone Wireless MCUs or Network Processors</td>
<td>Wireless Network Processor</td>
<td>Wireless Network Processor</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The SimpleLink SDKs run on TI's scalable, highly-integrated, low-power, ARM® Cortex®-M based microcontrollers spanning more than 100 different configuration options in a single development environment. The family of SimpleLink devices offers:

- Lowest power, advanced security and best-in-class analog integration
- Easy integration into your system enabling faster time to market
- Wireless MCUs to support many applications without requiring a separate host MCU
- Host MCU can add advanced analog capabilities, more memory or processing power with common SDK elements

TI Wireless Modules benefits

Industry-leading Performance

- Lowest Power
- Longest Range
- Extensive qual and reliability test
- Proven interoperability

High-quality module choice for many wireless technologies

Faster Development Time

- Certified Modules
- Antenna integrated
- Free certified Software Stack
- Easy access development tools

Get to market faster with TI’s worldwide ecosystem

Connect More with TI

Proven and Dependable Supplier

- Millions of modules shipped worldwide
- World class on-time delivery performance
- Continuity of supply
- Easy migration to chip level design
- Distributed Worldwide

Protect your production and your investment

TI store WW Distribution
# TI Bluetooth® Low Energy (BLE)
Low Power, Low Latency, Low Throughput

## Value Propositions

<table>
<thead>
<tr>
<th>Large Tools and ref designs Ecosystem</th>
<th>Easiest to design with: Complete SW stack, wiki guides, dynamic design kits, low-cost tools, &amp; software starting points</th>
</tr>
</thead>
<tbody>
<tr>
<td>SensorTag</td>
<td>Lowest Power: Multi-year operation on smaller coin-cell</td>
</tr>
<tr>
<td></td>
<td>The most Integrated: single chip wireless MCU, integrated flash, small package</td>
</tr>
</tbody>
</table>

## Products

<table>
<thead>
<tr>
<th>SimpleLinkTM Wireless MCU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flash based wireless MCU</td>
</tr>
<tr>
<td>CC2640R2F (Ultra Low Power)</td>
</tr>
<tr>
<td>CC2540 (USB interface)</td>
</tr>
<tr>
<td>CC2541 (I2C interface)</td>
</tr>
<tr>
<td>CC2540T (125°C)</td>
</tr>
<tr>
<td>Apps developer tools</td>
</tr>
<tr>
<td>Many TI Designs</td>
</tr>
</tbody>
</table>

## Features

| Lowest Power down to 1/10th of BT Classic |
| Run BT stack and application on one single chip down to 4x4mm QFN package |
| Fully Featured BT5.0 LE Stack |
| Industrial and extended temp range: -40 to 85 C and 125 C |
| Automotive qualification option |

## Applications

| UART to BLE |
| Sensors Monitoring |
| Cable replacement |
| Remote display |

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*Easiest to design with: Complete SW stack, wiki guides, dynamic design kits, low-cost tools, & software starting points*
## Dual-mode Bluetooth (Classic + BLE)

Bluetooth connection across any end point (BLE or classic); enables bridge between BLE and classic

### Value Propositions

<table>
<thead>
<tr>
<th>Tools/Modules/TI Designs</th>
<th>Features</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Smart RF transceivers</td>
<td>• Best Performance: reliable connection over a long range (100m) with optimized power consumption</td>
<td>• Embedded audio</td>
</tr>
<tr>
<td>• CC2560 (Classic only)</td>
<td>• Flexible: connect to any host (MCU or processor)</td>
<td>• Heath and medical care</td>
</tr>
<tr>
<td>• CC2564 (Classic + BLE)</td>
<td>• Most proven solution: 300 millions devices shipped, robust royalty free SW, solution available for broad market</td>
<td>• Mobile device accessories</td>
</tr>
<tr>
<td>• Pin-to-pin compatible</td>
<td>• FCC, IC, CE &amp; Bluetooth SIG Fully <strong>Certified module</strong></td>
<td>• Toys</td>
</tr>
<tr>
<td>• TI modules</td>
<td>• Performance over long range (100m) with throughput up to 3Mbps</td>
<td></td>
</tr>
<tr>
<td>• CC2564MODN</td>
<td>• Connect to any MCU or processor</td>
<td></td>
</tr>
<tr>
<td>• CC2564MODA</td>
<td>• BT stack runs on external host</td>
<td></td>
</tr>
<tr>
<td>• 3 Parties Modules</td>
<td>• Bluetooth 2.1 +EDR/ BT 4.2</td>
<td></td>
</tr>
<tr>
<td>• Audio TI Designs (sink and source)</td>
<td>• Fully certified module (FCC, IC, CE, Bluetooth SIG)</td>
<td></td>
</tr>
</tbody>
</table>
# Wilink™ Combo solutions

**high-performance WiFi + Bluetooth/Bluetooth Low Energy**

## Value Propositions

<table>
<thead>
<tr>
<th>Tools/modules for easy development</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image" /></td>
</tr>
</tbody>
</table>

- **Performance and low power:** 100Mbps with the lowest power (800uA IDLE)
- **Certified and easy to use:** Pre-integrated, certified, production ready solutions, software downloadable. Open documentation (Wiki), Forums (E2E), TI and 3rd party network
- **Integrated and scalable:** single chip multi-combo with pin to pin compatible variants, consumer, industrial (85 degree C) and automotive grade (Q100)

## Products

<table>
<thead>
<tr>
<th>• WL18xx Combo</th>
</tr>
</thead>
<tbody>
<tr>
<td>• WiFi Only</td>
</tr>
<tr>
<td>• WiFi + BT/ BLE</td>
</tr>
<tr>
<td>• WiFi + BT/ BLE + GNSS</td>
</tr>
<tr>
<td>• TI Modules</td>
</tr>
<tr>
<td>• WL1831MOD</td>
</tr>
<tr>
<td>• WL1835MOD</td>
</tr>
<tr>
<td>• WL1807MOD</td>
</tr>
<tr>
<td>• WL1837MOD</td>
</tr>
<tr>
<td>• 3rd Parties modules</td>
</tr>
</tbody>
</table>

## Features

<table>
<thead>
<tr>
<th>Combo BT Dual Mode + WiFi on one single-chip</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Rock solid performance: long distance, stability, robustness, throughput and co-existence with BT 4.1</td>
</tr>
<tr>
<td>• Connect to processors(high level OS)</td>
</tr>
<tr>
<td>• Industrial temp -40 to 85 C</td>
</tr>
<tr>
<td>• 2.4GHz and 5GHz support</td>
</tr>
<tr>
<td>• Fully certified module (FCC, IC, CE, Telec)</td>
</tr>
</tbody>
</table>

## Applications

<table>
<thead>
<tr>
<th>• Security Camera</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Gateways</td>
</tr>
<tr>
<td>• Industrial Panel/ HMI</td>
</tr>
<tr>
<td>• Control Panel</td>
</tr>
<tr>
<td>• Professional Camera</td>
</tr>
<tr>
<td>• Test and measurement</td>
</tr>
</tbody>
</table>

[Texas Instruments Logo]
# SimpleLink™ Wi-Fi® platform

**Lowest power, programmable wireless MCU, easiest to use**

## Value Propositions

- **The lowest power**: Run for over a year on two AA batteries
- **First single chip programmable Wi-Fi solution**: Add Wi-Fi to any system
- **Easiest to design with**: No Wi-Fi experience needed; HW designs, 50+ software examples, extensive documentation and TI E2E support forum all readily available

## Products

<table>
<thead>
<tr>
<th>CC3220 (Wireless MCU)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrated ARM Cortex-M4 MCU + Wi-Fi network processor</td>
</tr>
<tr>
<td>First programmable single chip Wi-Fi solution</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CC3120 (Wi-Fi network processor)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Embedded TCIP/IP stack</td>
</tr>
<tr>
<td>Connect any MCU to the Internet of Things</td>
</tr>
</tbody>
</table>

| CC3220MODA/CC3220MOD and CC3120MOD TI Certified modules |

## Features

- On-chip Internet & Wi-Fi security
- Wireless MCU separate from TCP/IP Stack, free for customer applications
- Flexible provisioning such as SmartConfig, WAC, & AP Mode
- Cloud supported
- FCC/CE/ETSI certified modules
- SDK for development with Code Composer Studio and IAR support

## Applications

- Internet of Things (IoT)
- Home automation & appliance
- Thermostat, fire alarm
- Smart energy, home monitoring
- Lighting control
- Access Control
- Irrigation automation
Sub-1 GHz
Industrial 169/315/433/470/868/915/920 MHz solutions

### Value Propositions

- **Robust RF range** in buildings: Longer range than 2.4 GHz. Stable wireless links that go through walls
- **Most complete design support**: 15 years of accumulated knowledge documented on the web: 100+ app notes, dedicated E2E forum, SmartRF tools
- **Most optimized** Sub-1 GHz solutions: Tx, Rx, Trx, wireless MCU + small SW stack

### Products

- Smart RF transceiver
  - CC110L, CC1120, CC1200, CC1125
- Wireless MCU
  - CC1310
  - CC1350
  - CC1110
  - CC430
- Wireless MCU with USB
  - CC1111
- Free software examples
  - SimpliciTI software stack

### Features

- Complete solutions for 169, 315, 433, 470, 868, 915 and 920 MHz
- Flexible RF packet sniffer helps debug RF solutions quicker
- High sensitivity & narrowband support, the de facto standard for long range communication
- Lowest power Wireless MCU with CC1310 SimpleLink
- Launchpad ecosystem

### Applications

- Safety and security
- Home, building and industrial automation
- Sensor Network
SimpleLink™ 6LoWPAN
IP cloud connection, lowest power, largest network

Value Propositions

- **Complete solution from silicon to Cloud:** Best-in-class performance, comprehensive and intuitive software with sample code and examples, large cloud partners to support both industrial and consumer markets
- **Lowest power:** Use a coin cell for multi-year, always-on operation or go battery-less with energy harvesting
- **Large and secure mesh network:** Connect up to 1000s of nodes

<table>
<thead>
<tr>
<th>Products</th>
<th>Features</th>
<th>Applications</th>
</tr>
</thead>
</table>
| SimpleLink 6LoWPAN/ZigBee | - An edge router connects the 6LoWPAN network to IP Applications. No gateway needed  
- Mesh routing that is robust and self-healing  
- Can achieve multi-year operation on a coin-cell battery | - Home and building automation  
- Low-power sensor networks  
- Internet of Things (IoT)  
- Safety and security |
| o CC2630 (Ultra low-power 2.4GHz) |                                                                           |                                   |
| o CC2538 (High performance 2.4GHz) |                                                                           |                                   |
| SimpleLink Range Extender |                                                                           |                                   |
| o CC2592 (2.4GHz extend up to 4x range) |                                                                           |                                   |
| **Contiki Software:** Open source solution |                                                                           |                                   |

Contiki Software: Open source solution
# ZigBee®

Lowest power, large secure mesh network, easiest to use

## Value Propositions

- **The lowest power**: Multi-year operation on small coin-cell
- **Robust and standardized mesh network**: Connect up to 100s of nodes in industrial settings
- **Easiest to design with**: Proven and robust ‘copy-paste’ kits, reference designs together with Golden Unit software stack

## Products

<table>
<thead>
<tr>
<th>Wireless MCUs</th>
<th>Features</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>- <strong>CC2630</strong> (Ultra low-power Wireless MCU)</td>
<td>- Run Z-Stack and application on one single chip</td>
<td>- Home automation</td>
</tr>
<tr>
<td>- <strong>CC2530/1</strong> (Wireless MCU)</td>
<td>- Secure Over-the-air software update capability</td>
<td></td>
</tr>
<tr>
<td>- <strong>CC2538</strong> (High performance, large memory)</td>
<td>- Industrial temp range: -40 to 125°C</td>
<td></td>
</tr>
<tr>
<td>- <strong>Z-Stack</strong>: Robust and Proven TI ZigBee stack</td>
<td>- Certified ZigBee Golden Unit</td>
<td></td>
</tr>
<tr>
<td>- <strong>Range extender</strong></td>
<td>- USB support</td>
<td></td>
</tr>
<tr>
<td>- <strong>CC2592</strong> (Extends up to 7x range)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Features

- Run Z-Stack and application on one single chip
- Secure Over-the-air software update capability
- Industrial temp range: -40 to 125°C
- Certified ZigBee Golden Unit
- USB support

## Applications

- Home automation  
  - Comfort  
  - Security  
  - Energy efficiency
- Lighting networks  
  - Lights  
  - Switch/sensor
- Generic mesh
- IP-to-ZigBee gateways

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### Texas Instruments

[Visit Texas Instruments website](https://www.ti.com)
SimpleLink ULP CC1310/50 Platform

Full Production today

CC1310: Sub-1 GHz only
- Pin-to-pin compatible with SimpleLink ULP Platform
- Various flash sizes: 32KB, 64KB, 128KB
- Ultra-low power, long range networks up to 15 km
- Operation in 315 MHz, 433 MHz, 470 MHz, 500 MHz, 868 MHz, 915 MHz and 920 MHz ISM bands
- Software: 6LoWPAN, wM-Bus, GFSK, TI-15.4MAC

CC1350: Dual-band
- Most versatile & integrated radio for 2.4 GHz and Sub-1 GHz operation on the same chip
- Enables ultra-low power long range Sub-1 GHz networks utilize Bluetooth Smart for easy cloud connectivity
- Supports: Sub-1 GHz, Bluetooth Smart, 6LoWPAN, & GFSK modes up to 4Mbps
Top 3 Wireless Connectivity Technologies

- **Easiest to use, Low power, Integration**
  - Control applications through smartphone/tablet
  - Moving to industrial, automotive markets, extended temp

- **Integrated ARM® Cortex®-M MCU, Easiest to use, Low Power**
  - Home and enterprise, audio, wearable, Internet of Things (IoT), home automation, security

- **Longest Range, Robust, Low Power**
  - Proprietary and open protocols (e.g. 6LoWPAN)
  - Metering, security systems, home automation

---

**BLE**
- CC2540/41
- CC2540T
- CC2640REF
- CC2650
- CC2560/4C
- CC2564MDN
- CC2564MDA

**WiFi Certified**
- CC3120
- CC3220
- WL180x/3x
- WL1807/37

**Sub-1GHz**
- CC1200
- CC1120
- CC1310
- CC1350
# Easy-to-use: Software, support and more

## Software

<table>
<thead>
<tr>
<th>Common software</th>
<th>Royalty-free network stacks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Across all SimpleLink™ ULP products:</td>
<td>Robust, certified and proven stacks:</td>
</tr>
<tr>
<td>- TI-RTOS operating system</td>
<td>- BLE-Stack with OTA support</td>
</tr>
<tr>
<td>- Code Composer Studio™ integrated development environment</td>
<td>- Z-Stack supporting various ZigBee applications</td>
</tr>
<tr>
<td>- IAR Embedded Workbench for ARM®</td>
<td></td>
</tr>
</tbody>
</table>

## Support

<table>
<thead>
<tr>
<th>Comprehensive</th>
<th>Design support</th>
<th>Training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development documentation, guides and wikis available online</td>
<td>Online community – answers at your fingertips from engineers</td>
<td>Online videos and other resources to learn more about the parts and tools</td>
</tr>
</tbody>
</table>

## And more...

- TI reference designs online
- TI IoT cloud ecosystem
- Silicon & kit sales & samples on TI Store

**TI CCS Cloud Tool:** [https://dev.ti.com/](https://dev.ti.com/)
Get started fast: Development kits

**SensorTag**
- Sensor to the cloud evaluation tool
- 10 sensors to the cloud in 3 min

$29 on TI Store

**LaunchPad™**
- Low-cost MCU development kit
- Leverages existing TI tool ecosystem
- [www.ti.com/launchpad](http://www.ti.com/launchpad)
- Add-on features with many booster-packs

$29 on TI Store

**CC antenna development kit**
- PCB and chip antenna design
- Coin cell design for CC1310
- Antennas for following frequencies:
  - 2.4 GHz
  - 169 MHz
  - 315 MHz
  - 433 MHz
  - 868 MHz
  - 915 MHz

$29 on TI Store
TI SensorTag – IoT Made Easy

• Access Sensor data in the cloud in 3 minutes

• Connected thanks to TI SimpleLink™ Ultra Low Power Wireless MCU

• 10 low-power sensors

• Complete designs at www.ti.com/tidesign
  – Including 3D files
  – Print your own SensorTag

• $29 Complete IoT development kit
Multi Standard TI SensorTag

- IR Thermopile Temperature Sensor
  - TMP007
  - Texas Instruments
- 9-axis Motion Sensor
  - MPU-9250
  - Invensense
- Multi-Standard Wireless MCU
  - CC2650
  - Texas Instruments
- Digital Humidity Sensor
  - HDC1000
  - Texas Instruments

- PCB antenna
  - High-performance Inverted-F PCB Antenna
- uSMA RF connector
- Altimeter/Pressure Sensor
  - BMP280
  - Bosch Sensortec
- Ambient Light Sensor
  - OPT3001
  - Texas Instruments
TI Overall IoT ecosystem

- Wi-Fi®
- Bluetooth® Smart
- 6LoWPAN ZigBee®

Gateway

Phone

Low Cost BeagleBone Gateway

6LoWPAN ZigBee

Wi-Fi

Ethernet
Where to go next: www.ti.com/launchpad
TI’s official LaunchPad portal

TI LaunchPad
Develop. Make. Innovate.
Get started with MCU LaunchPad Evaluation Kits from Texas Instruments.
Choose from a variety of low-cost kits & BoosterPack plug-in modules.
Scalable software tools provide multiple points of entry for programming your LaunchPad.

Get specs, order hardware, find software tools, and download datasheets and design files

Sign up for a myTI account!
Launch Pad / Booster Pack Eco System

Isolated Thermocouple with HMI, IO-Link & BLE Wireless Interface

- Sharp® Memory LCD Booster Pack
- EM Adapter Booster Pack
- IO-Link Device with SPI Sensor IF, TIDA-00339
- CC2650 Evaluation Module
- Isolated Power & Data Transmission Booster Pack, TIDA-00459
- Thermocouple AFE with RTD CJC, TIDA-00168
- Data Isolation for loop powered applications, TIDA-00245
- Ultra Low Power Isolated DCDC with Schottky Diodes, TIDA-00349

http://www.ti.com/launchpad
Getting started with a cloud solution

1. Purchase a TI EVM and follow its getting started guide
2. Download and install a cloud SDK for the TI device from the cloud service provider
3. Sign up for free evaluation account in the cloud provider web site
4. Register your EVM on-line in the cloud provider web site
5. Connect your EVM to the cloud and explore the new world of IoT
## Wireless Connectivity TI Designs per Technology

### Bluetooth® Low Energy / Bluetooth® Dual Mode

- **RS-485**
- **Light Harvesting**
- **Mini Broadcaster**
- **Heart Monitor**
- **Optical Heart Rate**
- **Pulse Oximeter**
- **Haptic Feedback**
- **BLE Light**
- **BLE to Wi-Fi gateway**
- **Body Composition**
- **Weight Scale**
- **Gas Sensor**
- **Postage Stamp**
- **USB Dongle**
- **Audio Sink**
- **Audio Source**
- **Audio Streaming**
- **SensorTag**
- **Display**
- **Led Audio**
- **CC256x EM**
- **UART to BLE**

### WiFi®

- **CC3200MOD**
- **LaunchPad**
- **CC3100MOD**
- **BoosterPack**
- **Smart Electric Meter**
- **Smart Plug**
- **Wi-Fi Camera**
- **CC3200 Battery Power**
- **Smart Plug**

### Sub-1 GHz

- **ETSI Cat. 1 Receiver**
- **RF Layout Reference Design for 420-470 MHz**
- **RF Layout Reference Design for 868-930 MHz**
- **Home network**
- **CC2538 EM**

### ZigBee®

- **Network Range Extender**
- **Home Automation Gateway**
- **Light Link Development Kit**
- **Low End In-Home Display**

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http://www.ti.com/general/docs/refdesignsearchresults.tsp
New SimpleLink™ MCU platform
One environment, unlimited potential

100% code reuse
Common software
SimpleLink™ SDK code portability
100% code reuse
End-to-end development resources
Start your design today

- Wired & wireless ARM®-based MCUs
- Common software
- Development Kits
- TI Resource Explorer
- Code Composer Studio™ IDE
- SimpleLink Academy
TI Cloud Tools

https://dev.ti.com/
SimpleLink MSP432P4 SDK

The SimpleLink™ MSP432 SDK delivers components that enable engineers to develop applications on Texas Instruments MSP432 microcontroller devices. The product is comprised of multiple software components and examples of how to use these components together. In addition, examples are provided to demonstrate the use of each functional area and each supported device and as a starting point for your own projects.

The SimpleLink™ MCU portfolio offers a single development environment that delivers flexible hardware, software and tool options for customers developing wired and wireless applications. With 100 percent code reuse across host MCUs, Wi-Fi™, Bluetooth® low energy, Sub-1GHz devices and more, choose the MCU or connectivity standard that fits your design. A one-time investment with the SimpleLink software development kit (SDK) allows you to reuse often, opening the door to create unlimited applications. For more information, visit http://www.ti.com/simplink.
SimpleLink Academy

• Available at: SimpleLink Academy link
• Gets «anybody» up to speed on SW development for CC2640
• Integrated with CCS Desktop via separate installer
• Continuous roll-out of new labs and features.
• Richly formatted lab instructions
• Theory of operation
• Interactive quiz
• Learning by doing
• Quick links to further documentation
Summary

• TI has all the ingredients for the industry 4.0

• Wireless Connectivity has a role to play and TI has the largest portfolio supporting more than 15 standards and technologies

• BLE, Wi-Fi and Sub 1-GHz are gaining traction today

• Many tools and TIDesigns available to start from today

• Large solution ecosystem including cloud solution
Resources – get more information

www.ti.com/iot
www.ti.com/wireless

SLYY050B
www.ti.com/automation

SZZY004
<table>
<thead>
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<th>Recommended links for more information</th>
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<td>TI SimpleLink Wireless connectivity portfolio</td>
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<td>TI's official LaunchPad portal</td>
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