# Talaria TWO - Exceptionally Low Power IoT Wi-Fi

# A Game Changer for IoT 2023

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InnoPhase IoT

# InnoPhase IoT Company Overview

- Innovative RF Architectures, Software Programmable Radios and Solutions
- System on Chip (SoC) and Certified System on Modules
- Exceptionally Low Power IoT Wi-Fi and BLE5
- Complete Solution – Application Kits, Networking Stack and SDK
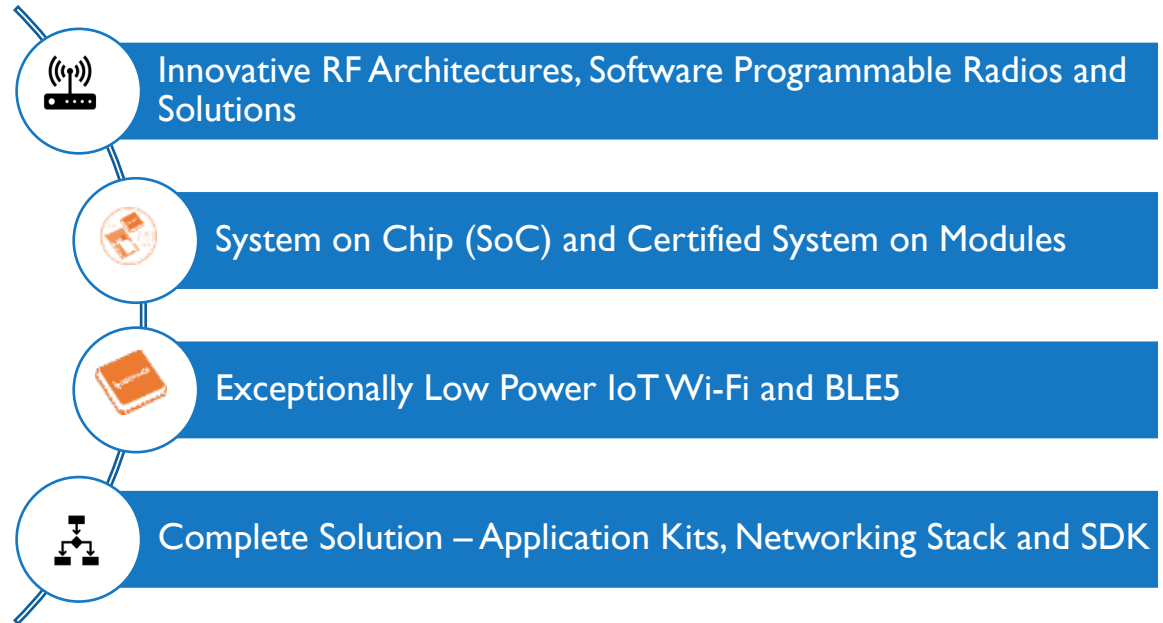
## Company at-a-Glance

- Privately held, Venture-backed
- Incorporated in 2022
- Established as an Extreme Low Power Smart Wireless Platform Company
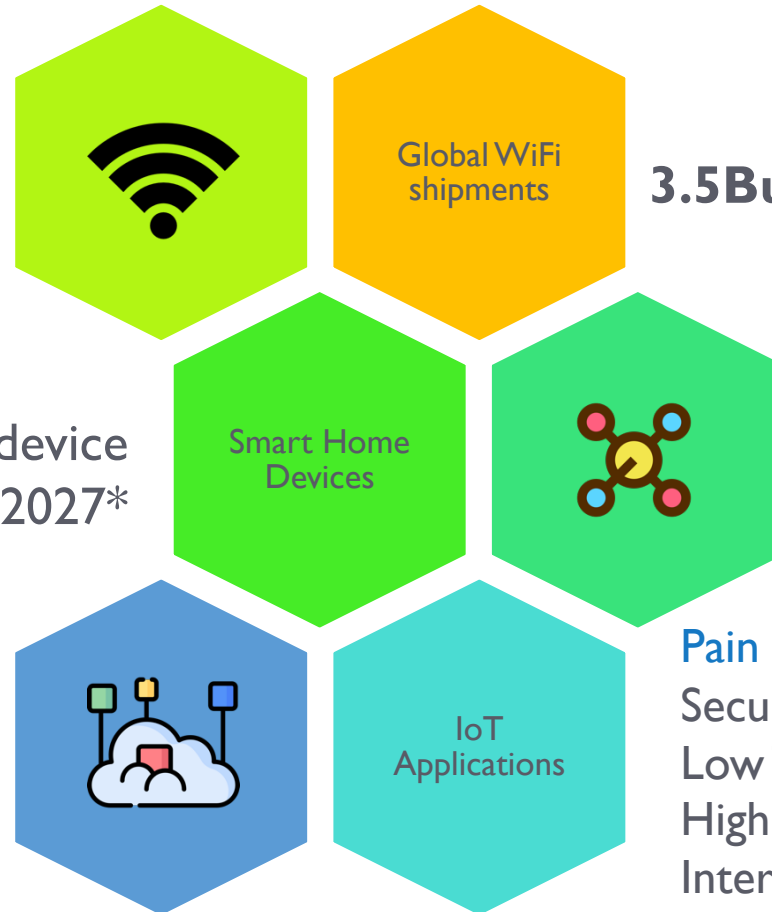- ~ 100 Employees

## R&D Offices

- **San Jose, California (HQ)**
- San Diego, California
- Kista, Sweden
- Bangalore, India

# Ubiquitous WiFi for IoT connectivity

**Global WiFi shipments**

**3.5Bu** (2021) to **5.2Bu** (2026)*

**50%** of connected Smart Home device shipments to be IP-based by 2027*

**Smart Home Devices**

**IoT Applications**

Pain Points:
Secure & Low-Power Solution
Low Throughput for Everyday Operations &
High Throughput for FOTA
Intermediate Gateway Cost

Talaria TWO Ultra Low Power (ULP) WiFi

Battery Life: 10 years    Low-to-High Throughput: 30 Mbps Peak Tput    Gateway: Zero cost

*ABI Research, Q1 2022

# Target IoT Applications

### Smart Home

Video Camera/doorbell, Door Lock, Garage door opener, Glass break sensor, Human audio sensors
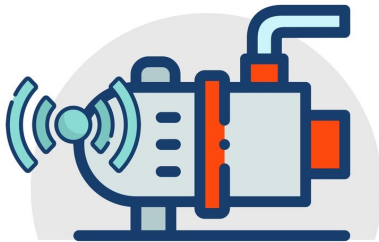
### Commercial Building

Door locks/access control, Building management and sensors, Air quality monitoring

### Smart Retail

POS terminals, Shelf monitoring, Customer traffic monitoring, Commercial refrigeration

### Industrial IoT

Machine monitoring – vibration & audio sensors, Predictive Maintenance, Asset Tracking

### Smart Healthcare

Patient tracking & monitoring, Asset tracking, Secure & connected equipment

### Pet & People Tracking

Geo-fencing

# Battery Operated IoT Market Needs

### ULP Wi-Fi at BLE power levels

- Always ON, always connected, higher bandwidth video & audio use cases
- Year long battery operated IoT solutions & smaller battery size

### Direct-to-cloud connectivity

- Ubiquitous Wi-Fi connectivity at home, commercial building & industrial markets
- No intermediate gateway required for IoT applications
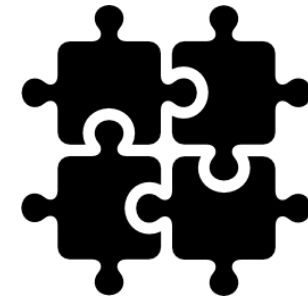
### Multi-protocol wireless solutions

- Integrated Wi-Fi, BLE & Thread for new applications

Based on PolaRFusion™ Digital radio architecture, Talaria platform brings an integrated, ultra-low-power wireless solution that enables battery operated, high-bandwidth solutions
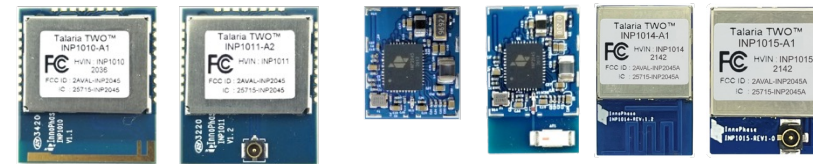
## INP2045 SoC

- 802.11b/g/n and BLE5LR
- Exceptional low power Wi-Fi
- Advanced security
- Full networking software stack
- Cloud ready
- GCC/Eclipse based SDK

## System on Modules

- Fully certified modules for rapid product development
- Castellated and LGA Mini-Modules with different antenna configurations
- Self-hosted and hosted configurations

# Talaria TWO™ Wi-Fi & BLE Module: Benefits

## Ultra Low Power Wi-Fi

- **10+ years** battery life for sensors, 1+ year for video camera
- Industry's lowest Wi-Fi Transmit current ([81mA@12.5dBm](#)), 50% reduction to Tx & Polling Current
- System Level Low Power Optimizations: RF technology, Silicon, platform SW, programmable API and Smart Wi-Fi scanner

## Lower Systems TCO

- Direct-to-cloud connectivity. **No intermediate gateway** required
- Self-Hosted (no MPU required)
- Integrated Wi-Fi/BLE for easy device provisioning
- Secure connection to cloud, Secure Boot & FOTA
- Ubiquitous and Interoperable Wi-Fi eco-system

## Reduce Time-To-Market

- **WW Regulatory Certified Wi-Fi & BLE SoC and Modules in Production**
- Integrated software and Market Ready Solution with ISPs (Ambarella, Ingenic), MCUs (STM, Nuvoton) and Cloud support (Azure, AWS certified)
- Global Sales support: FAEs, Distributors, ODMs, Design houses

## Scalable Performance & Features

- Low power enables intelligence on device without sacrificing battery life
- Robust Network Throughput under noisy environments, Up to **2K** camera resolution capable
- High performance lossless audio use-case
- High throughput FOTA update
- Matter * protocol support for Smart Home eco-system

## Untethered IoT Devices with Battery Life that Extends to Device Life

**Leverage strategic partnerships to expand markets**

- Companion ICs
  - MCUs
  - ISPs
  - ULP Sensors
- Cloud Platforms

**Reference solution kits for rapid prototyping**

- Battery-Powered Camera
- Low-Power IoT Sensors

**Certified IoT products**

- Wi-Fi & BLE Compliance
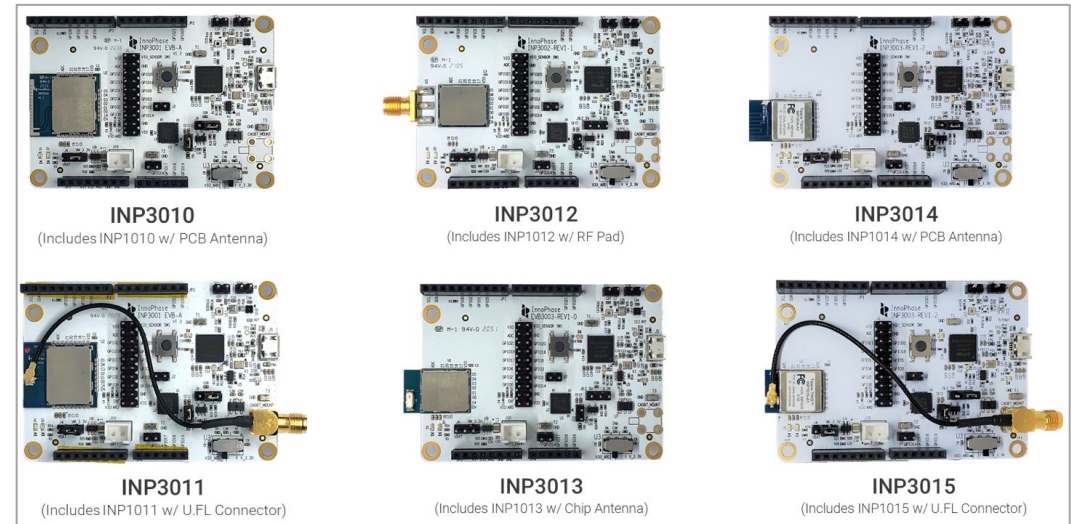- Global Regulatory
- Cloud Connectivity
- Matter for Smart Home

**Reduce TTM with production ready solutions**

- ODMs / OEMs
- IDHs

# Talaria TWO Evaluation Kits

- EVB-A Part #s: INP3010 to INP3015
  - Standalone and 3.3V Arduino Shield compatible
  - PCB, ceramic and u.fl external antenna versions
  - Integrated low power sensors **including Bosch Pressure Sensor**

- Evaluation support/binaries
  - Multi-purpose demoes for quick use-case evaluation
  - Scan, Throughput and latency testing

- Development support
  - Plenty of example applications with full source code FOTA, Provisioning, peripherals, AWS/Azure cloud etc.
  - Comprehensive AT commands support
  - GCC based development environment with comprehensive documentation

- Download demo & example applications from InnoPhase IoT website for free



INP3010 (Includes INP1010 w/ PCB Antenna)
INP3012 (Includes INP1012 w/ RF Pad)
INP3014 (Includes INP1014 w/ PCB Antenna)
INP3011 (Includes INP1011 w/ U.FL Connector)
INP3013 (Includes INP1013 w/ Chip Antenna)
INP3015 (Includes INP1015 w/ U.FL Connector)

**Distributed by Mouser and Richardson-RFPD**

# InnoPhase Low Power Sensor ADK

## Nuvoton M252 + Talaria 2



Labels: Grove I2C, VOC / Temp Sensor, INP1014, USB-C, PIR Sensor, OLED Display 128x32
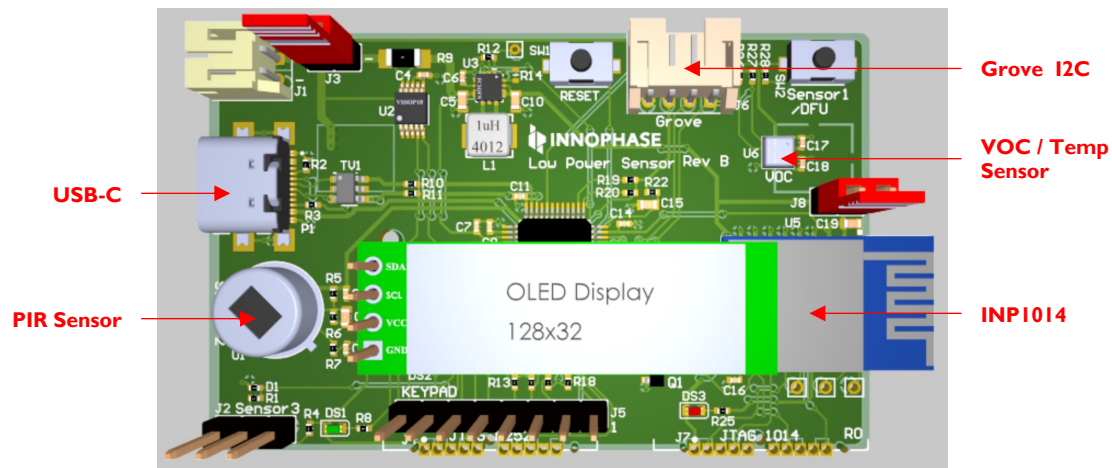
- Small form factor
- Supports constant monitoring of sensors
- Short Interval Sensors – always connected
  - Maintains AP connection through use of Keep Alives
  - Constant Cloud Connection
- Supports long interval monitoring of "sleeping sensors"
  - System awaken by clock, keypad, sensor inputs
  - MCU sleeps between postings for additional power savings
- Rapid integration of new customer sensors (Grove I2C Connection)
- Integrated PIR Motion Sensor, VOC gas sensor
- HTTP/s Post/Get, MQTT Publisher/Subscriber
- WPA2, WPA3 Wi-Fi and TLS 1.2 application security
- Directly connected to internet via existing home or enterprise router, unlike BLE or Sub-GHz technologies
- Wi-Fi provisioning through BLE, Android app supplied
- FOTA and factory loader capabilities
- AWS and Azure certified

# Eoxys Xeno+ Wi-Fi & BLE Nano ML Module

- Battery-powered Wi-Fi + BLE5.0 IoT devices

- Talaria TWO INP1014 module w/ PCB antenna

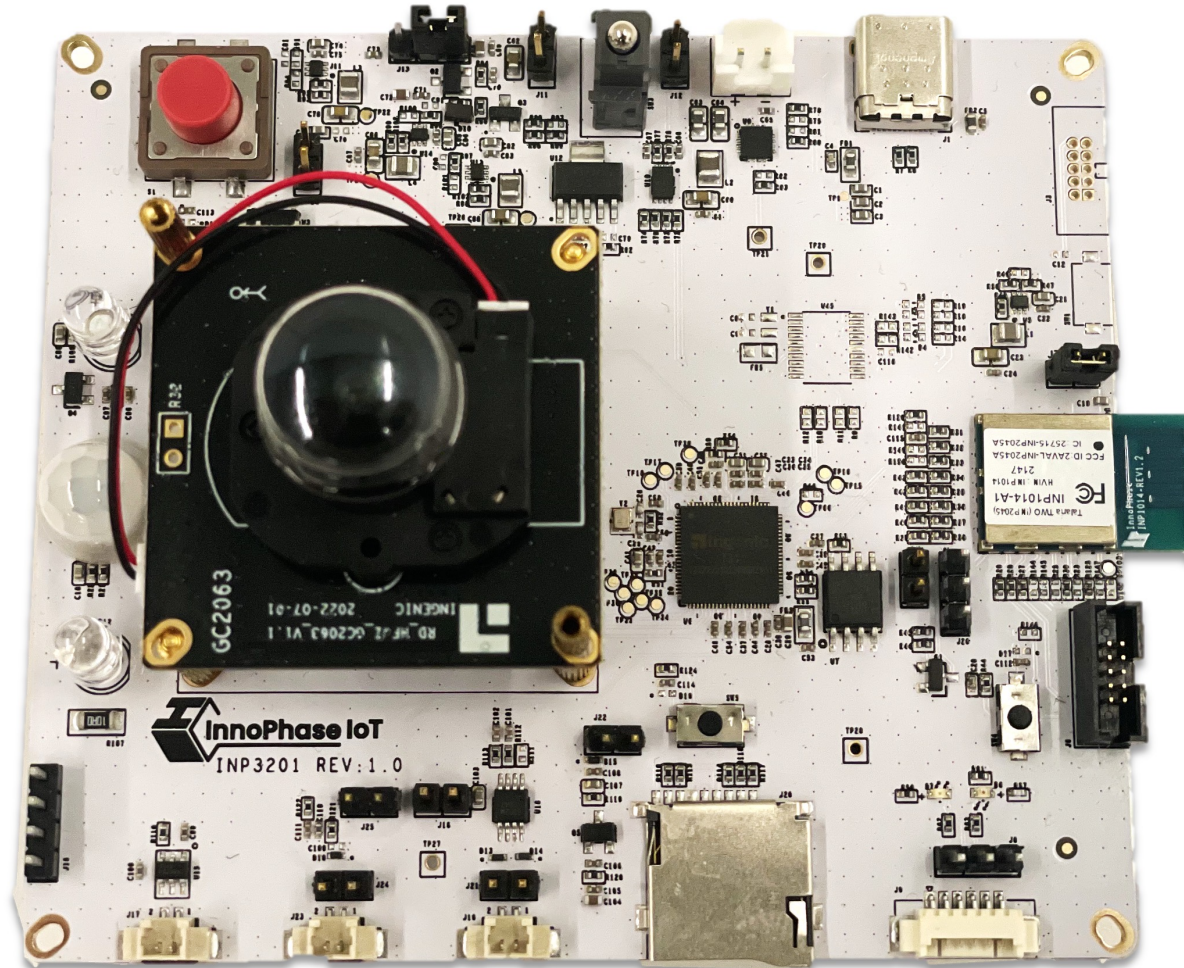- Nuvoton M2354 & Keil IDE Software SDK

Eoxys' Xeno +™ Nano ML Module Includes
InnoPhase IoT's Talaria TWO™ Low Power
WiFi plus BLE5.0 Module and Nuvoton's
NuMicro® M2354 MCU

InnoPhase IoT Low-Power Wi-Fi Video Camera
Reference Kit w/ Talaria TWO™ INP1014 Module

# Throughput Optimized for Video Streaming

- Up to 2K resolution camera applications
- Consistent performance in noisy environments
- Linux host interface via SDIO & SPI



Talaria TWO (T2) Peak Tput for Video Streaming



Ingenic T31ZX + Talaria TWO Tput under noisy conditions
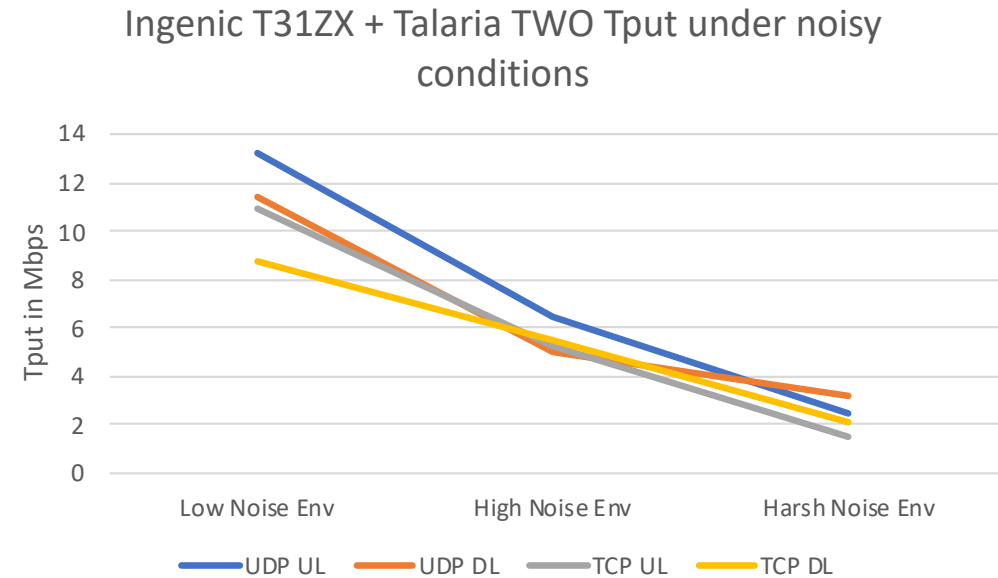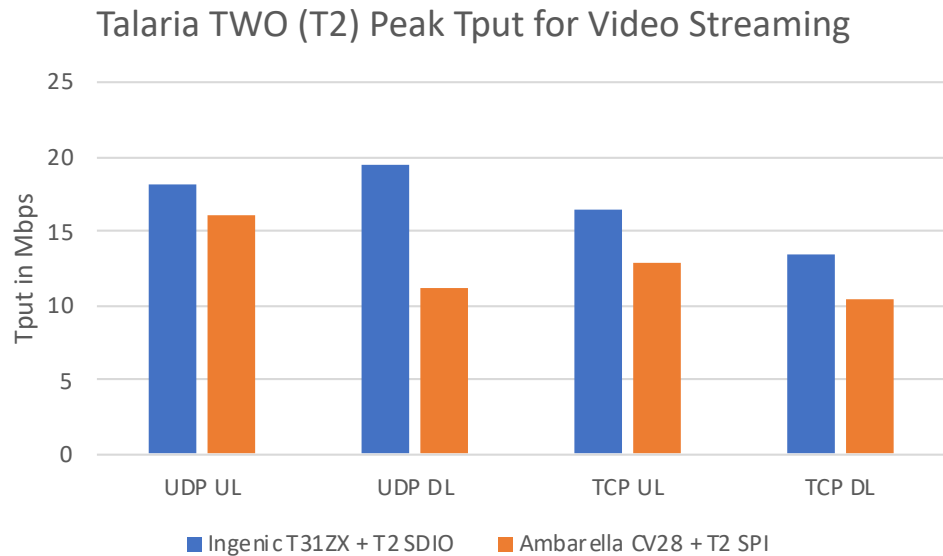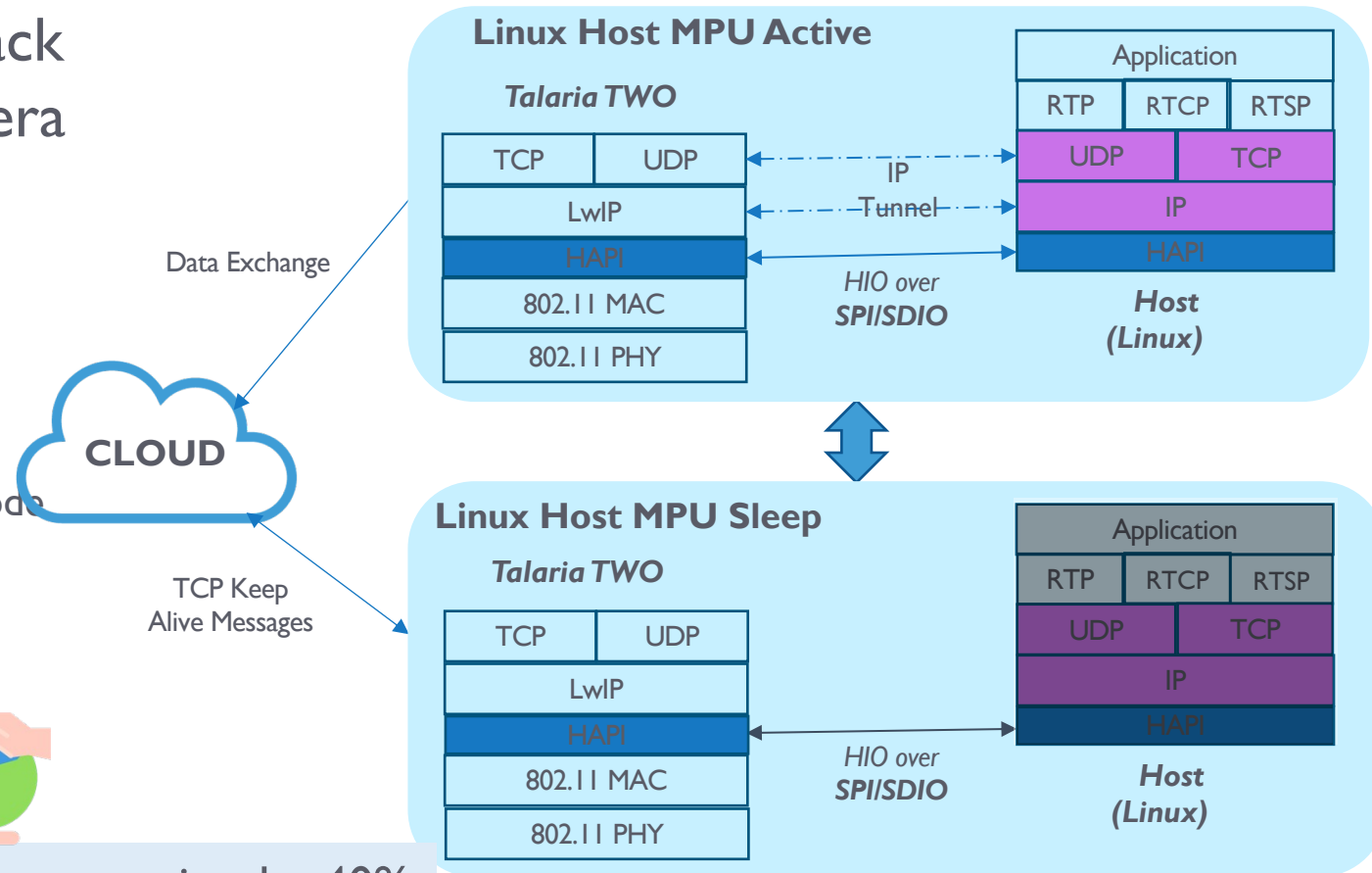
# Maximize Battery Life Performance

## Build Video Solutions with 1+ year* Battery Life

Custom Designed and Patented Dual-Stack Implementation for Wireless Video Camera

- Talaria TWO takes over the battery-consuming task:
  - maintaining real-time connectivity with Cloud and App
  - monitoring event trigger sensors

- Allows power hungry Linux Host MPU to enter sleep mode and greatly improves battery life performance

- Wireless video integration for the following MPUs:
  - Ambarella CV28
  - Ingenic T31X/ZX
  - Omnivision 8000

**Further reduces current consumption by 40% & extends battery life**

### Linux Host MPU Active

**Talaria TWO**

| TCP | UDP |
|-----|-----|
| LwIP ||
| HAPI ||
| 802.11 MAC ||
| 802.11 PHY ||

| Application | | |
|-----|-----|-----|
| RTP | RTCP | RTSP |
| UDP | | TCP |
| IP | | |
| HAPI | | |

*Host (Linux)*

IP Tunnel

HIO over **SPI/SDIO**

Data Exchange

**CLOUD**

TCP Keep Alive Messages

### Linux Host MPU Sleep

**Talaria TWO**

| TCP | UDP |
|-----|-----|
| LwIP ||
| HAPI ||
| 802.11 MAC ||
| 802.11 PHY ||

| Application | | |
|-----|-----|-----|
| RTP | RTCP | RTSP |
| UDP | | TCP |
| IP | | |
| HAPI | | |

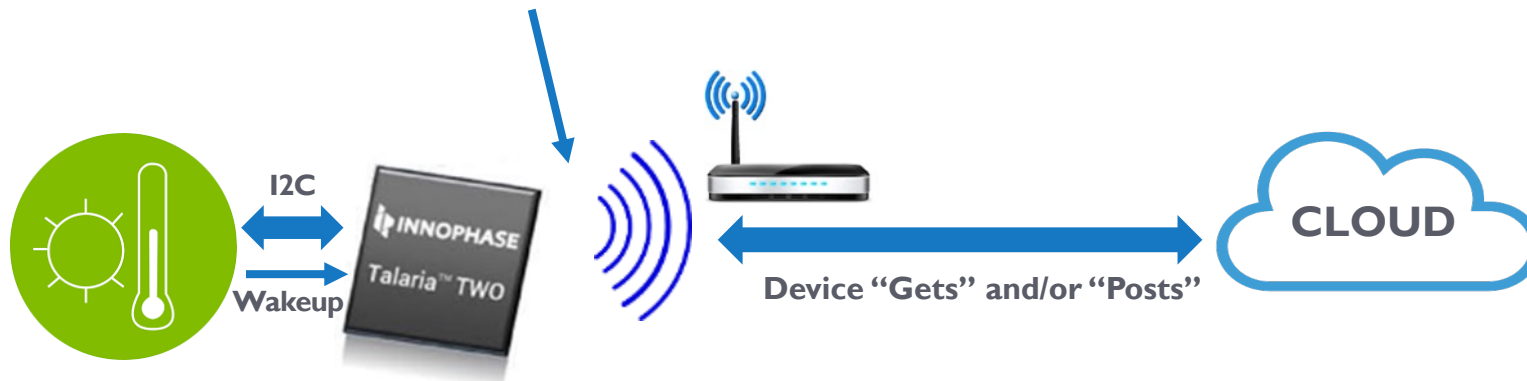*Host (Linux)*
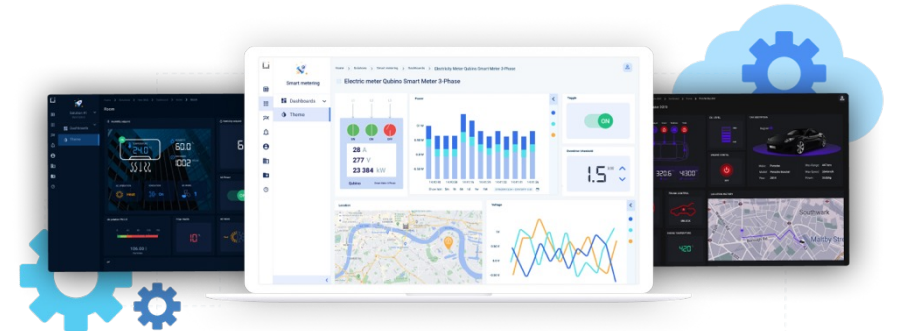
HIO over **SPI/SDIO**

*\* 3000mAh battery capacity*

# Talaria TWO enabled E2E Multi-year Battery Operated Sensor solution

Device also sends out router association keep-alive, typically every 1-5min



**I2C**

INNOPHASE
Talaria™ TWO

**Wakeup**

**Device "Gets" and/or "Posts"**

**CLOUD**

**Analytics, Alerts & Device Management**

amazon alexa

AWS IoT

Azure

## Battery Powered Sensor

- Direct connectivity to cloud via router, no gateway with BLE/subGHz required
- Periodic sampling polling and/or posting of sensor data - Low duty cycle, time and/or event-based posting
- Smart sensor event wakeup
- Always connected – Talaria TWO optimizes power consumption and maintains both router and cloud connection
- Battery powered Web Client (HTTP/s) or MQTT Publisher
- WPA2, WPA3 Wi-Fi and TLS 1.2 application security
- Bandwidth to handle video, audio and FOTA updates
- Device maintains router association/connection (keep alive)

## Remote Device Management & Service

- Command and control
- Device status/health
- Location management
- Over the air firmware update management
- Home or building automation

# Talaria TWO: Software Support
## Self-Hosted and Hosted Configurations

**SENSOR APPLICATION**

**VIDEO CAMERA APPLICATION**

### T2 SDK

### MCU Host Package

### Embedded Linux Host Package



### Self-Hosted

- Application, networking and wireless (BLE/Wi-Fi) functionality on Talaria TWO
- Reference applications and services minimizes development effort
- 11 GPIO and 10bit A/D available for peripheral interface

### Hosted-MCU

- Talaria TWO offers Wi-Fi, BLE networking, cloud connectivity, MCU runs application and extends peripheral connectivity
- Talaria TWO wakes up host MCU on Rx (cloud, remote device mgmt., Alexa Ready)
- UART (2W/4W), SDIO and SPI interface
- Wi-Fi/BLE C library (HAPI) host package or AT Commands (native on Talaria TWO)
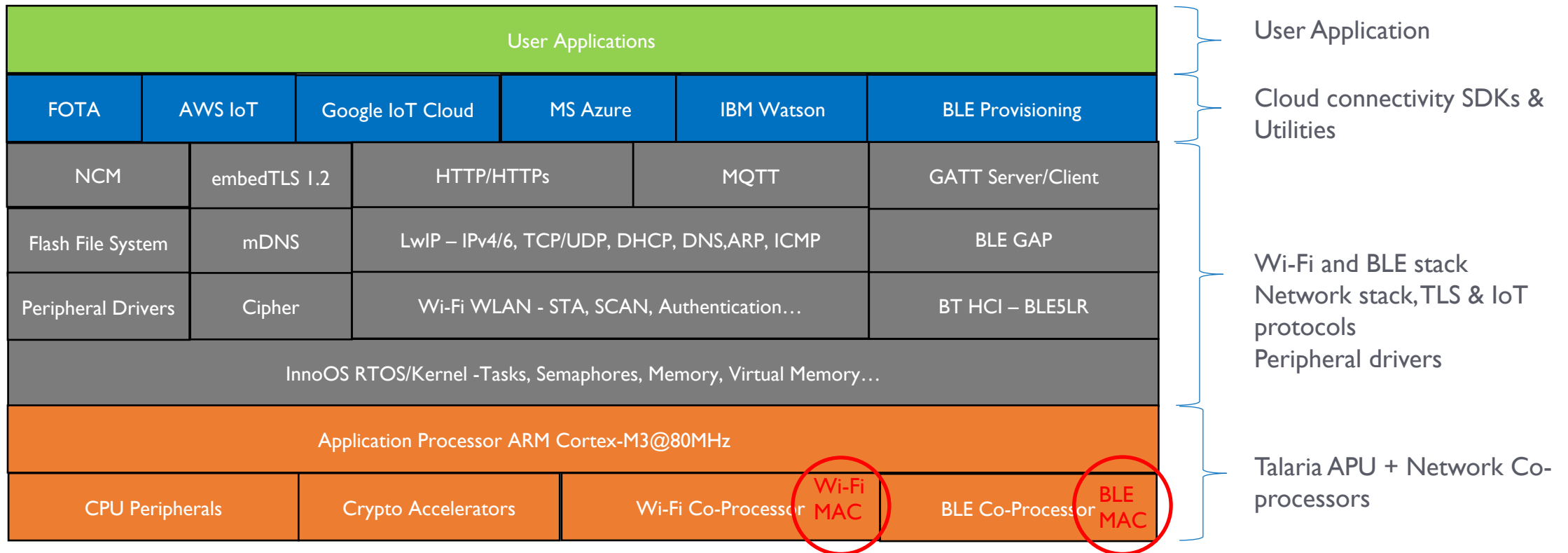- Easy to port to different MCU's, host RTOS independent

### Hosted-MPU

- Unique Low Power, dual stack architecture
- Linux host for data application, and T2 for networking stack and low power/sleep application
- UART (2W/4W), SDIO and SPI interface
- Wi-Fi/BLE User Space C library (HAPI) host package
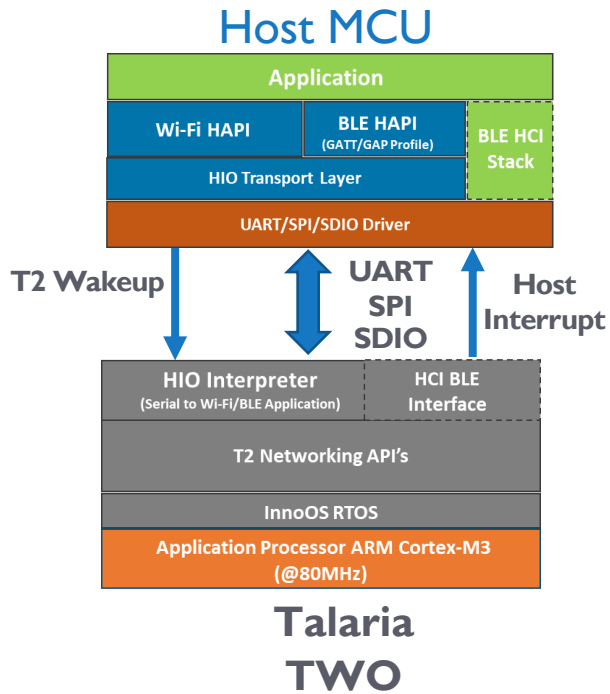- Easy to port to different CPU's and Linux Kernel versions

# Talaria TWO SDK

- Complete software solution with certified Wi-Fi and BLE stack, networking stack, and integrated cloud connectivity SDK
- GCC toolchain and eclipse-based IDE for software development
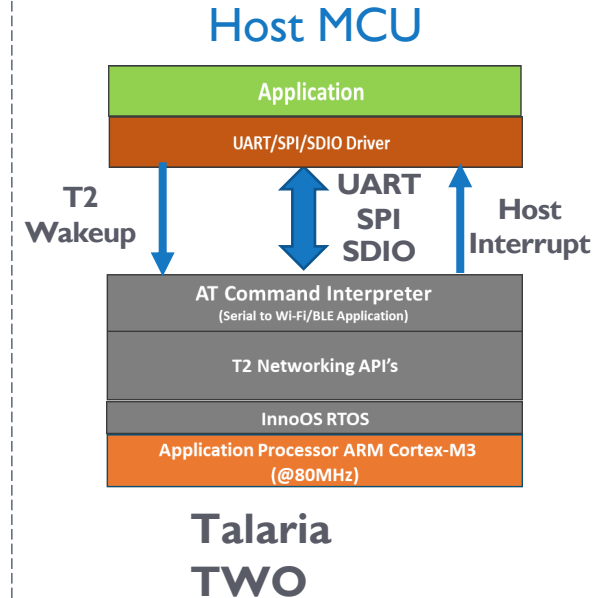- Reference applications for rapid prototyping and development

| | | | | | |
|---|---|---|---|---|---|
| User Applications | | | | | |
| FOTA | AWS IoT | Google IoT Cloud | MS Azure | IBM Watson | BLE Provisioning |
| NCM | embedTLS 1.2 | HTTP/HTTPs | | MQTT | GATT Server/Client |
| Flash File System | mDNS | LwIP – IPv4/6, TCP/UDP, DHCP, DNS, ARP, ICMP | | | BLE GAP |
| Peripheral Drivers | Cipher | Wi-Fi WLAN - STA, SCAN, Authentication… | | | BT HCI – BLE5LR |
| InnoOS RTOS/Kernel -Tasks, Semaphores, Memory, Virtual Memory… | | | | | |
| Application Processor ARM Cortex-M3@80MHz | | | | | |
| CPU Peripherals | Crypto Accelerators | Wi-Fi Co-Processor | Wi-Fi MAC | BLE Co-Processor | BLE MAC |

Right-side bracket labels:
- User Application
- Cloud connectivity SDKs & Utilities
- Wi-Fi and BLE stack Network stack, TLS & IoT protocols Peripheral drivers
- Talaria APU + Network Co-processors

# Hosted MCU SDK

**Host MCU**

| Application |
|---|
| Wi-Fi HAPI | BLE HAPI (GATT/GAP Profile) | BLE HCI Stack |
| HIO Transport Layer | |
| UART/SPI/SDIO Driver | |

**T2 Wakeup** ↕ **UART SPI SDIO** ↑ **Host Interrupt**

| HIO Interpreter (Serial to Wi-Fi/BLE Application) | HCI BLE Interface |
|---|---|
| T2 Networking API's | |
| InnoOS RTOS | |
| Application Processor ARM Cortex-M3 (@80MHz) | |

**Talaria TWO**

## Host 'c' Library (HAPI)

- Wi-Fi and BLE supported
- Remote procedure call library
- Host/Talaria TWO communication is via binary messaging (HIO)
- BLE HCI interface also supported
- Optional scrambled host communications
- UART supports wakeup on Rx
- Talaria TWO secure boot and secure vault options

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**Host MCU**

| Application |
|---|
| UART/SPI/SDIO Driver |

**T2 Wakeup** ↓ **UART SPI SDIO** ↕ **Host Interrupt** ↑

| AT Command Interpreter (Serial to Wi-Fi/BLE Application) |
|---|
| T2 Networking API's |
| InnoOS RTOS |
| Application Processor ARM Cortex-M3 (@80MHz) |

**Talaria TWO**

## Native AT Commands

- Wi-Fi and BLE supported
- Host Talaria TWO communication via ASCII messaging
- Simple host "driver"
- AT Commands are native on Talaria TWO
- UART supports wakeup on Rx
- Talaria TWO secure boot and secure vault options

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- Talaria TWO provides Wi-Fi & BLE connectivity and manages cloud connectivity
- Talaria TWO wakes up the Host MCU on Rx (cloud, remote device management, Alexa Ready…)
- Small, low power MCU can be used to extend peripheral connectivity to Talaria TWO

# Anchor Customers

## Battery-Powered Camera

Video Doorbell

Home Security

Home Security

Building Surveillance

Retail Monitoring

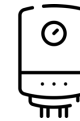## Smart Home

Blind Controller

Smart Button

Garage Door Opener

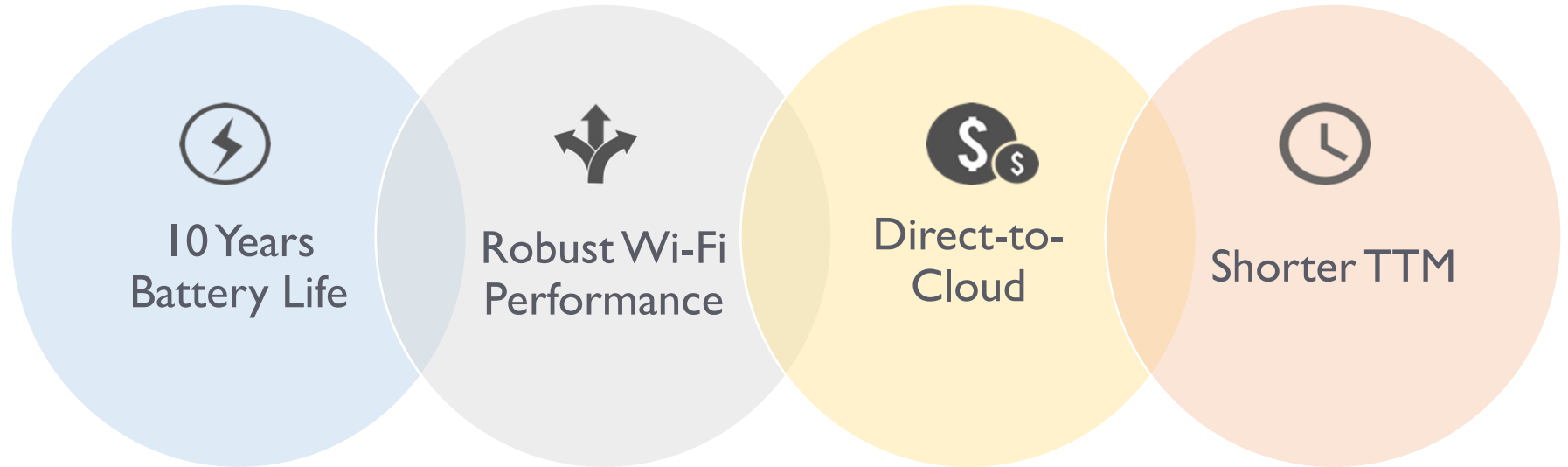## Industrial IoT

Machine Monitoring

Industrial Sensor

Boiler Controller

Asset Tag

Adoption in battery-powered IoT applications
Recognized by customers as industry's lowest power Wi-Fi solution with uncompromised performance