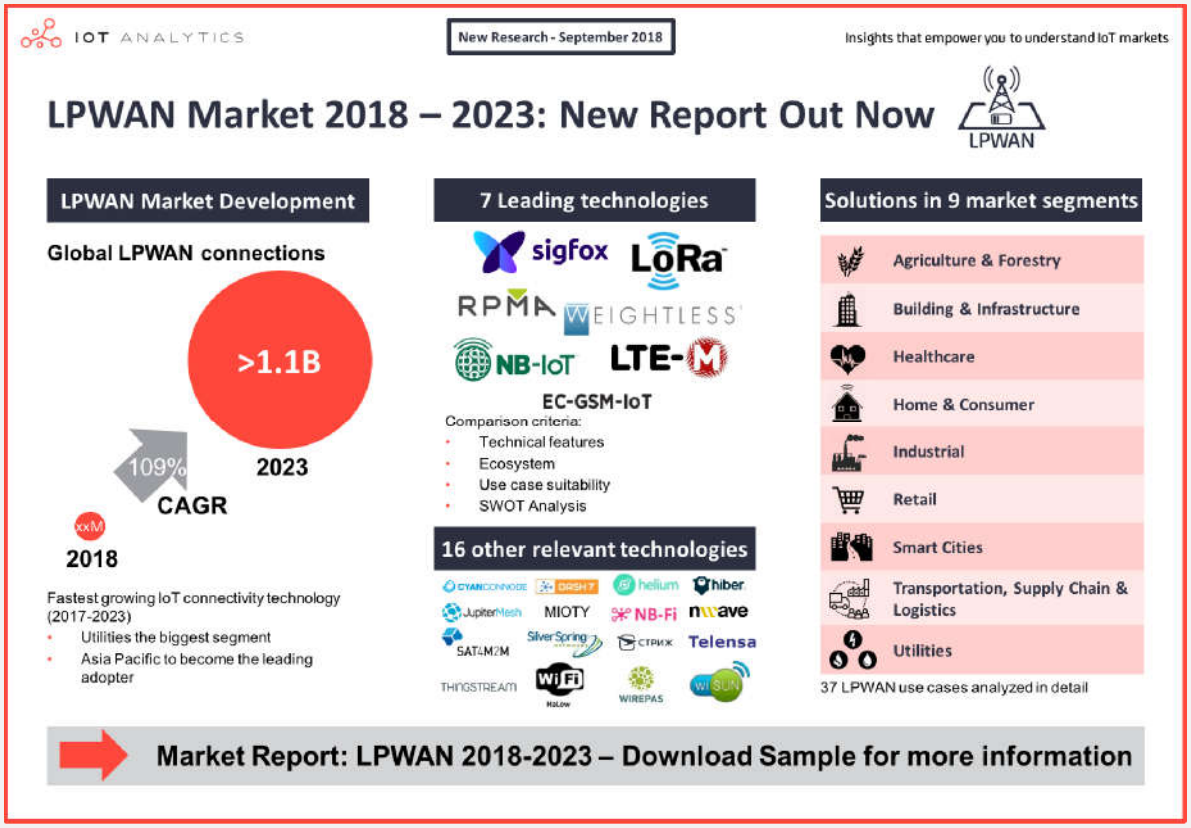
Design driven innovation

Design Considerations for LPWAN based Smart Devices

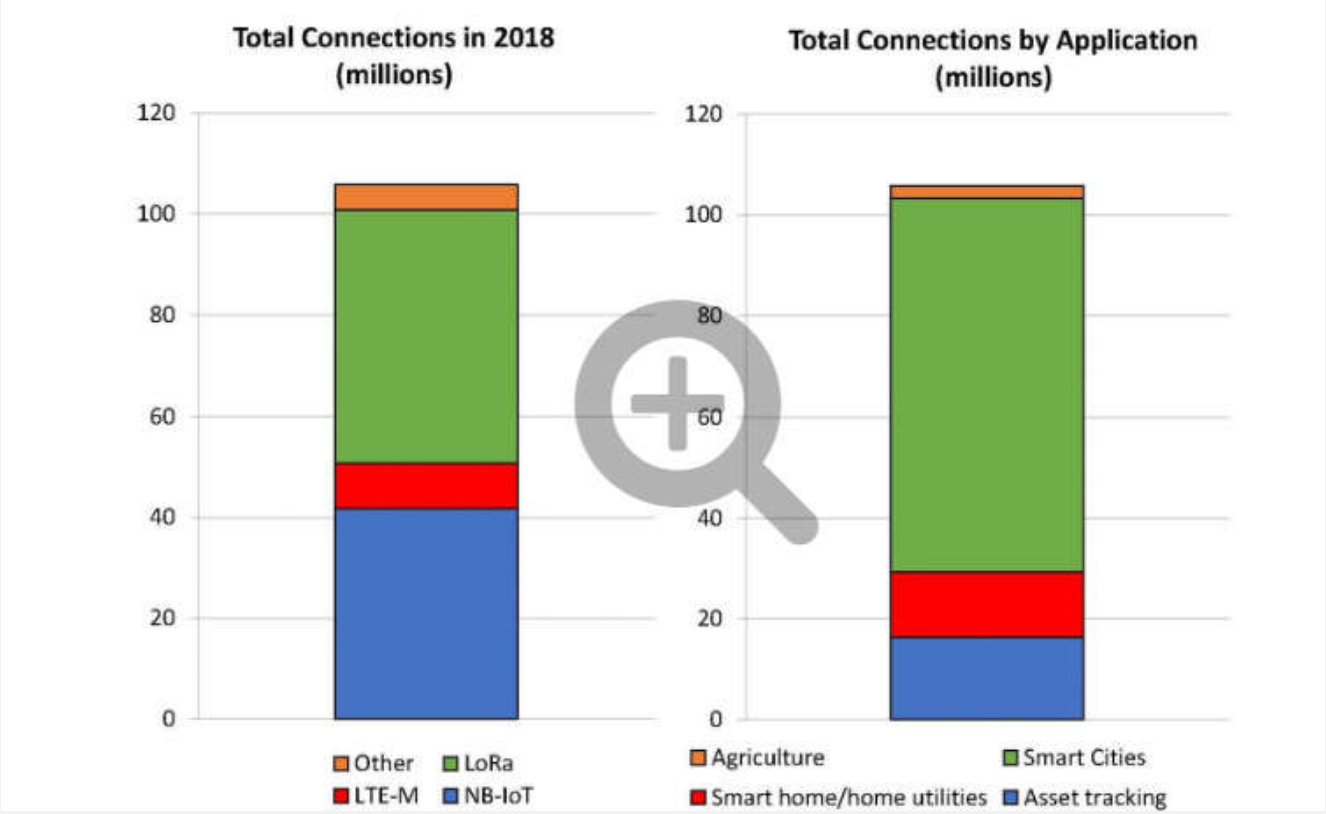
LPWAN SYSTEM : GLOBAL MARKET OVERVIEW

Market Overview:

- LPWAN) Market to Hit 1.1 bn connections by 2023
- North American is expected to account for over 40% industry share
- Increasing invest in NB-IoT and LTE-M, growing demand for low-cost, long-range M2M communications are main growth drivers



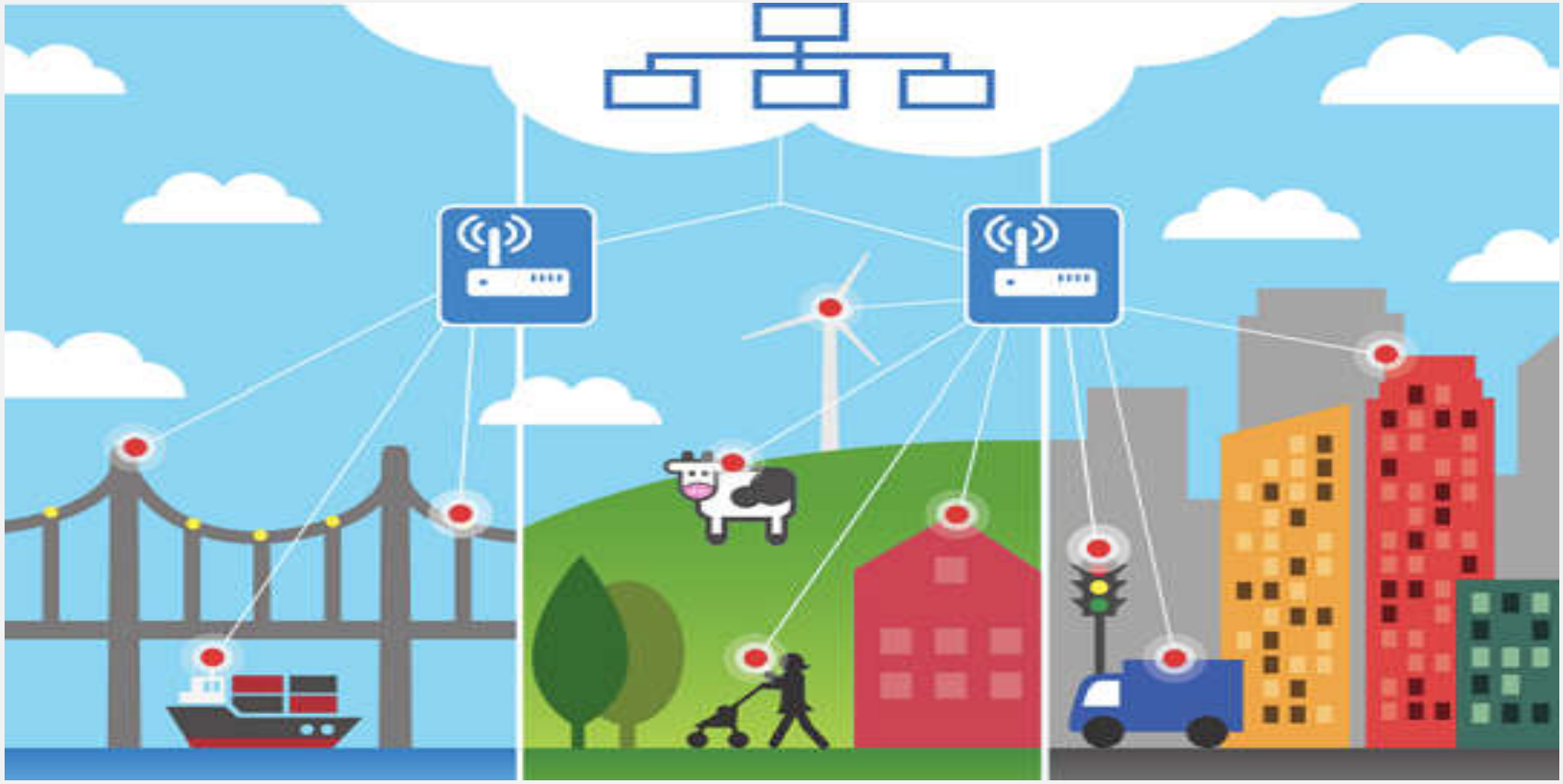
LPWAN CONNECTIONS



Source: IDTechEx

The LPWAN System

- Devices
- Gateways
- Network server



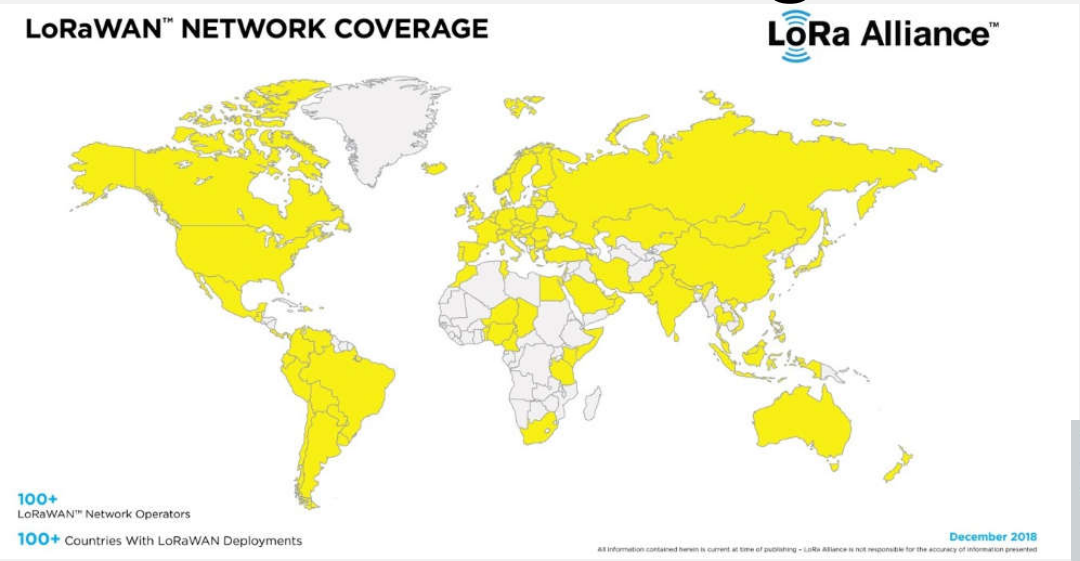
The LPWAN System

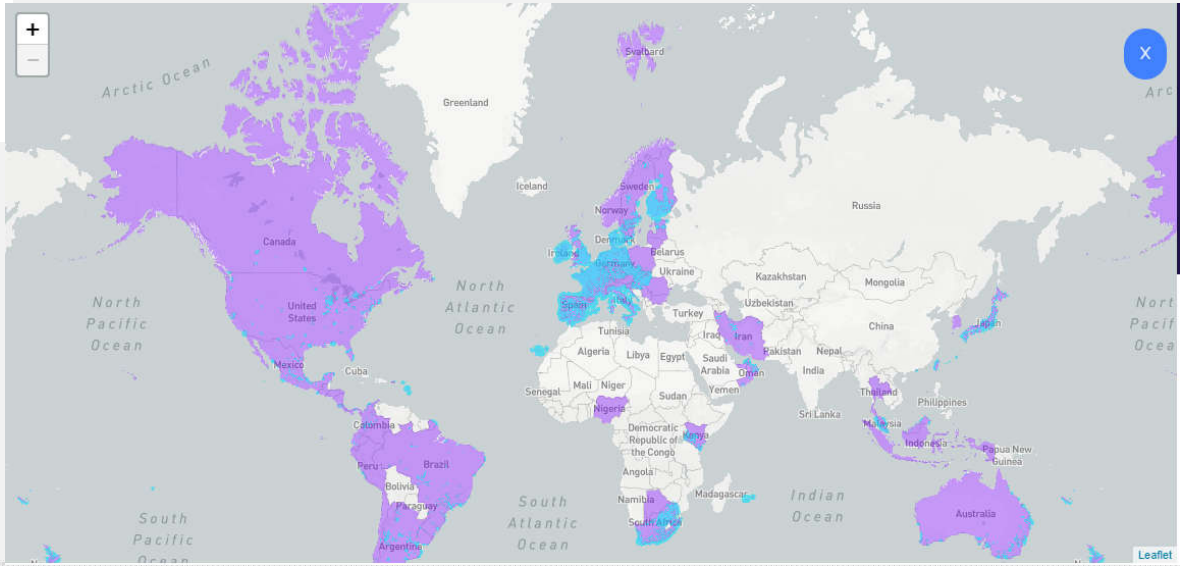
LPWAN

Low-power WAN (LPWAN) is a wireless wide area network technology that interconnects low-bandwidth, battery-powered devices with low bit rates over long ranges. Bitrates upto 200Kbps

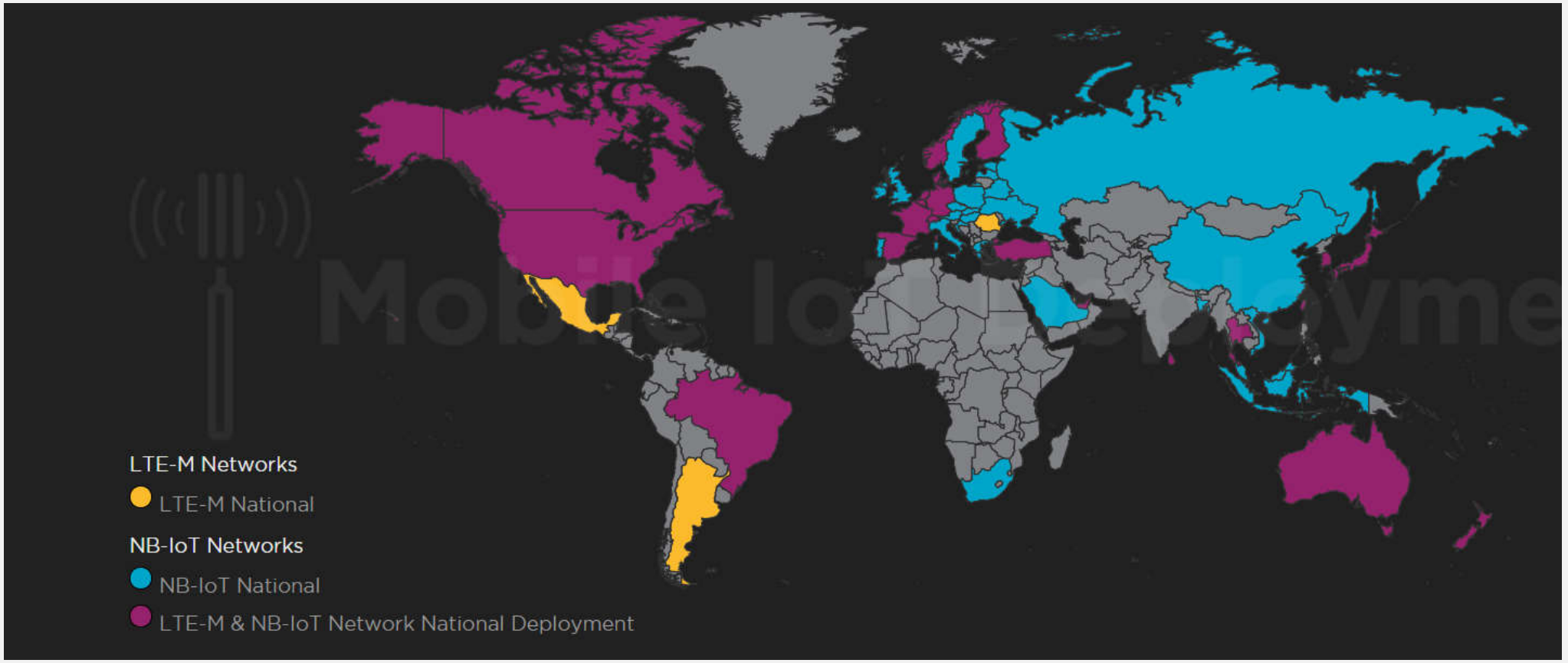
Type	Licensed band	Public / Private	Data Rate
LoRa	No	Both	Low
Sigfox	No	Public	Low
Weightless	Licensed & Non-Licensed	Private	Low
NBIOT	Licensed	Public	Low
CAT-M1 (LTE-M)	Licensed	Public	Medium

Coverage – LoRaWAN / SigFox





Coverage


LTE-M Networks
LTE-M National
NB-IoT Networks
NB-IoT National
LTE-M & NB-IoT Network National Deployment

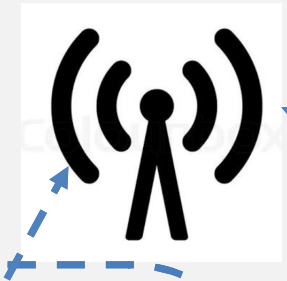
LPWAN – Key Considerations

- Capacity
  - Number of devices, Data Rate
- Cost
  - Gateways. Devices
  - Operational Costs
- Energy Consumption
  - Battery Life
  - Energy Source – Solar ??
- Range
  - Distance between Devices to Gateway
  - ADR
- Reliability
  - Confirmed / Unconfirmed
- Security

LPWAN – Security

- Device /Subscriber authentication
- Network Authentication
- Identity protection
- advanced standard encryption (AES)
- message confidentiality
- key provisioning

IoT Value Chain



Network Server

SENSE → PROCESS → CONNECT

Temperature
Humidity
Motion
Pressure
Proximity
Energy
Flow

Multiple I/O Interfaces like analog, digital and more.
Multi-Protocol like Modbus, TCP/IP, MQTT, Lonworks and more.

Sigfox
LoRaWAN
LTE-M
NBIOT

AWS
Azure
IBM Blue Mix
3rd Party Cloud

Online / Mobile Users Real Time Data Analytics

Device Design

- Hardware
  - Device Selection – Size/Power
  - Battery life
  - 24x7 operation
  - Environmental
  - RF Tuning & Antenna Design
    - EIRP – Effective Isotropic Radiated Power, TRP : Total Radiated Power

- Device Firmware
  - Network Stack
  - Firmware loop / Scheduler
  - Power Management
  - Watchdog
  - OTA

Case Studies

- Industrial
  - Safety Wearable devices
- Smart Cities
  - Pest Management
- Agriculture
  - Smart Irrigation

Industrial Safety Wearable

Business Challenge: **Need of a workplace safety wearable which can keep track of workers health key vitals, provide real time critical health data and reduce workplace accidents.**

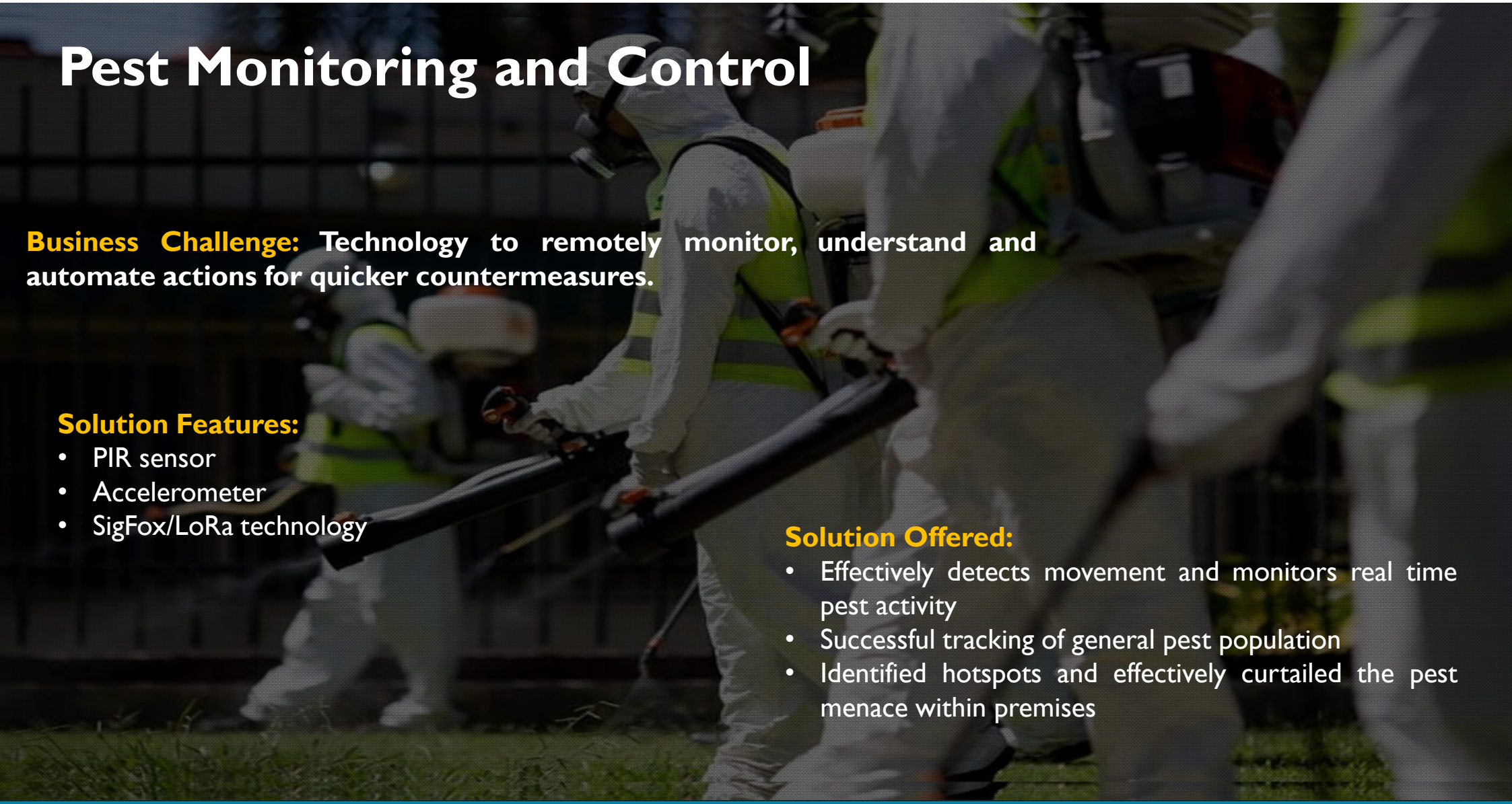
Solution Features:

- BLE
- LoRa

Solution Offered:

- Monitors critical health vitals as body temperature, heart rate etc
- Real time critical health data
- Enhances worker safety
- Provides real time alerts
- Prevents workplace accidents

Pest Monitoring and Control



Business Challenge: **Technology to remotely monitor, understand and automate actions for quicker countermeasures.**

Solution Features:

- PIR sensor
- Accelerometer
- SigFox/LoRa technology

Solution Offered:

- Effectively detects movement and monitors real time pest activity
- Successful tracking of general pest population
- Identified hotspots and effectively curtailed the pest menace within premises

Smart Irrigation

Business Challenge: **Optimize water delivery based on soil & weather conditions.**

Solution Features:

- Soil Moisture & water flow monitoring
- LoRa Private Network
- Solar powered Node
- Power Optimization
- Water flow programmed by AI based Cloud application, consdering weather and Crop information

Solution Offered:

- Remote monitoring and utilization of real time data
- Enhanced farm produce
- Water conservation
- Soil Protection

About Technosphere

Hardware Design

- Complex Multi-layer PCBs
- Miniature components – BGA, Flip Chip, 0201 discrete
- High Speed Design
- Flex and Flex Rigid PCBs
- Analog – Audio, ADC, DAC
- RF : Chip level , PCB antenna
- 8/16/32 bit µControllers and Processors
  - Microchip (PIC) / 8051 / Atmel (AVR), TI (MSP430)
  - ARM uC: TI (CC2538, Tiva)
  - ARM uP : TI (AM335x), Freescale : Kinetis
  - MIPS uP

Firmware Design

- **Bare metal Coding**
  - Super-loop based
  - Resource and power efficient
  - Time critical response
- **RTOS (Real Time Operating Systems)**
  - More complex but real time designs
  - Multiple processes and threads
  - Inter process communication
  - FreeRTOS, MQX, ThreadX
- **Embedded Linux**
  - High End OS based systems
  - Rich graphics
  - Concurrent Applications
- **Device Drivers**
- **Board Support Packages**
- **Diagnostics Tools**

Interface Design

Variety of Sensors
- Temperature/Humidity
- Impedance measurements
- Infrared / UV
- Contact Image Sensors

Peripherals
- Display
  - LCD – Color Graphics
  - OLED
- Input Devices
  - Touchscreen
  - Capsense
  - Keypad

Thermal Printers

Motor Control
- **Stepper**
- **PMDC**
- **BLDC**

Communication Protocols & Stacks

Expertise in various wired and wireless communication technologies

- Ethernet, RS-485, RS-232, CANBUS, USB
- Zigbee, BT, BTLE, 6LOWPAN, GSM/GPRS

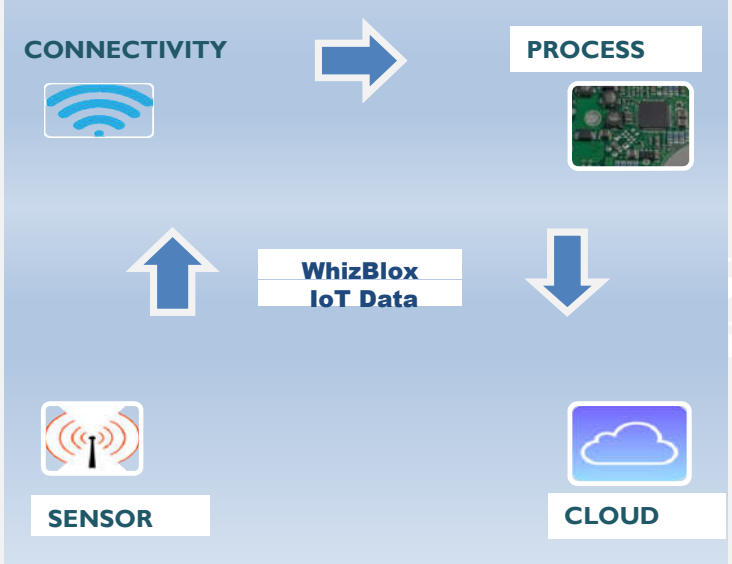
Worked with key protocol stacks

- Lonworks, Modbus, TCPIP, CoAP, HTTP

Technosphere team has extensive experience in developing connected devices.

WhizBlox :An IoT Enabler

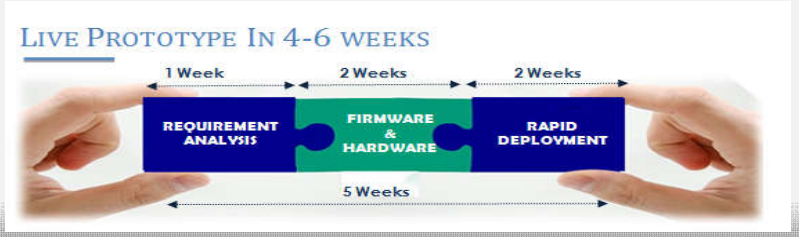
WhizBlox, a smart, multi-sensor, multi-protocol IoT enabler which seamlessly integrates with more than 100 types of sensors, for quick deployment of vertical IOT solutions.



WhizBlox IOT Hub, helps to deploy end to end IOT Pilots in just 4-6 weeks!

- **Benefits**
- Rapid Prototyping, quick proof of concept (POC)
- Operations Optimization
- Quick and easy deployment through plug and play techniques
- Intelligent cloud data analytics

WhizBlox Datasheet



Thank You !!