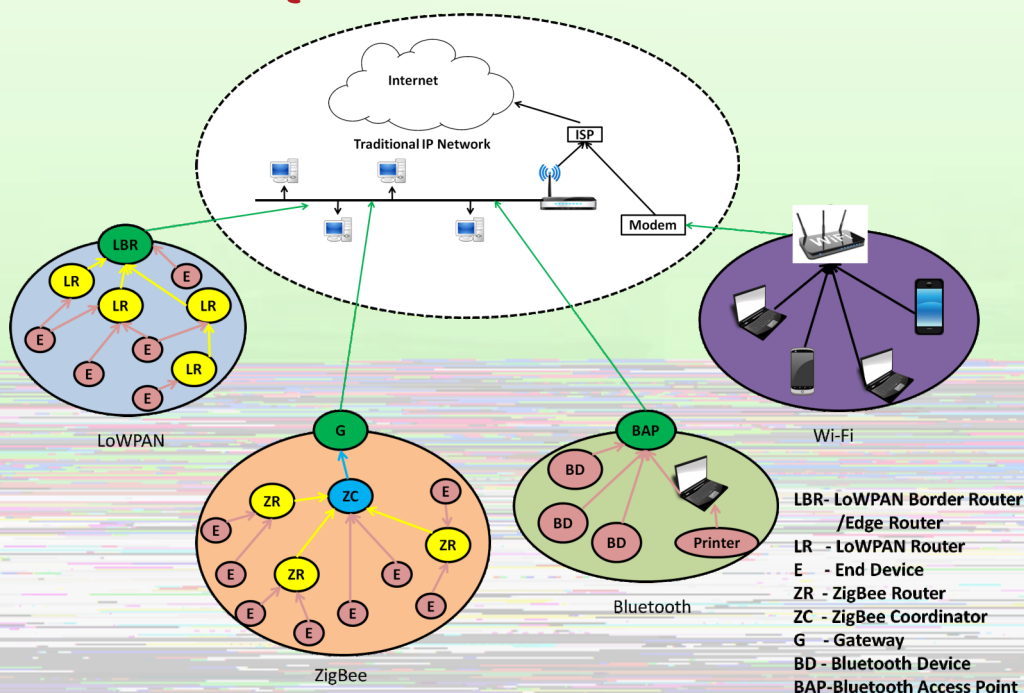


Internet of Things (IoT) provides IP connectivity to various Things apart from Desktops, Laptops and Mobile Devices. The term "THINGS" means any physical parameter that could be sensed and connected to Internet. For example a device monitoring temperature and humidity at certain location and relaying the data will become a "THING" in IoT domain.

IoT is a bridge between physical world and cyber world and Machine to Machine communication with automation as one subset. IoT Refers to uniquely identifiable objects and their virtual representations in an Internet like structure. IoT all together a new environment in which current Internet will be smartly utilized by all new range of embedded connected things.

Sensors are the building blocks of IoT which can collect parameters and low power wireless embedded systems transmit information to gateway devices. Gateway device will make the parameters available over internet so that parameters are globally accessible. Till now there is no dedicated network stack defined for IoT, as it is a heterogeneous network of networks. The most popular protocols used for realization of IoT are ZigBee and 6LoWPAN (IEEE 802.15.4), Bluetooth and Wi-Fi.

Sample Network Architecture of IoT



Systems

WINGZ™

(Wireless Multiprotocol Gateway)

- ARM Cortex-A9 application, up to 1GHz
- 1 GB/2 GB DDR3 SDRAM, 4GB/8GB onboard eMMC flash memory
- External Micro-SD card support (up to 32GB)
- Onboard Gigabit Ethernet, USB 2.0 with OTG Support
- Supports various Serial Communication protocols like SPI, I2C, UART, CAN
- High Definition Video Output through HDMI Port and 7" LCD with capacitive touch panel
- High quality Stereo audio codec with 3.5mm audio port for Audio In/Out
- High Range IEEE802.15.4 (ZigBee/6LoWPAN) Transceiver (upto 22dBm Tx power)
- WLAN (IEEE802.11b/g/n), Dual mode Bluetooth (BLE), 3G, GPS
- Temperature & Relative Humidity Sensor, Digital Ambient Light Sensor and 3-Axis Digital Accelerometer
- Linux, Android



Ubi mote™

- ▲ Highly integrated IEEE 802.15.4 System on Chip with ARM Cortex M3 microcontroller with 32kB RAM, 512kB Flash
- ▲ Modes of operation as Coordinator, Router and End device
- ▲ Intelligent power system with rechargeable lithium polymer battery and solar energy harvesting
- ▲ State of the Art Security Engines for RSA, SHA2, AES and Random number generator.
- ▲ Expansion headers for connecting Ubi-Sense, Ubi-DAQ and External Sensors
- ▲ High range variant for Longer coverage area

Wi-Fi mote

- ▲ High-performance ARM Cortex-M4 MCU with (IEEE802.11 b/g/n) with 256KB RAM.
- ▲ External Serial Flash Boot loader
- ▲ Supports Station, Access Point, and Wi-Fi Direct modes.
- ▲ 8Mb Serial Flash memory
- ▲ Hardware Crypto Engine for Advanced Fast Security including AES, DES, and 3DES, SHA2 and MD5, CRC and Checksum
- ▲ Expansion headers for connecting Ubi-Sense, Ubi-DAQ and External Sensors

BLE mote

- ▲ Integrated System on Chip with ARM Cortex M0 with 32kB RAM, 256kB flash, 8Mb serial Flash memory
- ▲ AES Hardware Encryption Engine , Accelerated Address Resolver and Random Number Generator.
- ▲ Expansion headers for connecting Ubi-Sense, Ubi-DAQ and External Sensors

UbiSense

- ▲ Digital data of physical parameters:
 - Temperature and Relative Humidity
 - Light Intensity
 - Barometric Pressure
 - Proximity sensing

Ubi-DAQ

- ▲ Single Ended and Differential Analog channels
- ▲ Digital channels for I/O expansion
- ▲ RTC support
- ▲ High drive capability Relays

C-mote™

- ▲ MSP430 based WSN platform
- ▲ High range with +5dBm output power
- ▲ Over The Air Programming
- ▲ Dynamic Voltage and Frequency Scaling for effective power management
- ▲ Application development using TinyOS, Contiki-OS and Custom stacks
- ▲ IP65 certified enclosure
- ▲ Smart Power Management with Solar Energy Harvesting

Solutions

Data Centre Monitoring and Alerting System

- ▲ Collects data from various wireless sensor nodes from different places
- ▲ Real time data through Gateway
- ▲ Comprehensive GUI for Network and field parameters
- ▲ Administrative controls for Monitoring and control
- ▲ Creates log files for each of the nodes and parameter
- ▲ Critical and warning threshold for every node
- ▲ SMS alerts with location and parameter when warning and critical threshold is exceeded

Solutions developed by other C-DAC centres using IoT Systems

Ubiquitous Agriculture (U-Agri)

U-Agri is a solution developed using WSN for pest and disease forewarning in groundnut field

- ▲ Various kinds of sensors for monitoring micro-climate
- ▲ Soil Moisture, Soil Temperature, Leaf Wetness, Atmospheric Temperature And Relative Humidity in the agriculture field.
- ▲ C-Motes and WINGZ.
- ▲ Energy Harvesting from renewable sources like solar for longer sustainability

Smart Lighting System

Smart buildings equipped with networked devices:

- ▲ Sense and Actuate the appliances.
- ▲ Home or office environments.
- ▲ Self Learning algorithms for maximum energy efficiency