

Meshlium Xtreme

Datasheet



Specifications



| | | |
|--|--|--------------|
| Processor | 500MHz (x86) | |
| RAM memory | 256MB (DDR) | |
| Disk memory | 8GB | |
| Power | 5W (18V) | |
| Power Source | POE (Power Over Ethernet) | |
| Normal Current Consumption | 270mA | |
| High Current Consumption | 450mA | |
| Max Supply Current | 1'5A | |
| Enclosure | Material | Aluminium |
| | Dimensions | 210x175x50mm |
| | Weight | 1,2Kg |
| | External protection | IP65 |
| Temperature Range | -20°C / 50°C | |
| Response Time to ethernet ping | 60s | |
| Time to have all the services running | 90s | |
| Types of power supply* for POE | AC-220V | |
| | Battery – solar panel (DC-12V) | |
| | Car lighter (DC-12V) | |
| System | Linux, Debian. OLSR Mesh communication protocol. MadWiFi Drivers. | |
| Management software | Meshlium Manager System (open source) | |
| Security | Authentication WEP, WPA-PSK, HTTPS and SSH access. | |

(*) Only with the accessories supplied by Libelium

WiFi AP - 2.4GHz Radio



| WiFi RADIO | |
|------------|----------------------------------|
| Chipset | Atheros AR5213A - IEEE 802.11b/g |
| Tx-Power | 100mW - 20 dBm |
| Distance | 500m * |

(*) Depending on antenna and line of sight

| ANTENNA | |
|------------|-----------------|
| Type | Omnidirectional |
| Gain | 5dBi |
| Dimensions | 224 x 22 mm |

WiFi Mesh Dual Band 2.4 GHz / 5GHz Radio



| WiFi RADIO | |
|------------|------------------------------------|
| Chipset | Atheros AR5213A - IEEE 802.11a/b/g |
| Tx-Power | 20dB - 802.11b/g / 18dB - 802.11a |
| Distance | 2-50km * |

(*) Depending on antenna and line of sight

| ANTENNA | |
|------------|-----------------------------|
| Type | Omnidirectional |
| Gain | 5dBi - 2.4GHz / 8dBi - 5GHz |
| Dimensions | 224 x 22 mm |

XBee Radio



| | |
|-----------------------|-----------------------|
| Model | XBee - PRO - 802.15.4 |
| Frequency | 2.4GHz |
| Tx-Power | 100mW |
| Rx Sensitivity | -100dBm |
| Antenna | 5dBi Dipole |
| Distance | 7km * |

| | |
|-----------------------|---------------------|
| Model | XBee - PRO - ZigBee |
| Frequency | 2,4GHz |
| Tx-Power | 50mW |
| Rx Sensitivity | -102dBm |
| Antenna | 5dBi Dipole |
| Distance | 7km * |

| | |
|-----------------------|------------------|
| Model | XBee - PRO - 868 |
| Frequency | 868MHz |
| Tx-Power | 315mW |
| Rx Sensitivity | -112dBm |
| Antenna | 5dBi Dipole |
| Distance | 12km * |

| | |
|-----------------------|------------------|
| Model | XBee - PRO - 900 |
| Frequency | 900MHz |
| Tx-Power | 50mW |
| Rx Sensitivity | -100dBm |
| Antenna | 5dBi Dipole |
| Distance | 10km * |

(*) Depending on antenna and line of sight

XBee Radio (continuation)



| | |
|-----------------------|-----------------------|
| Model | XBee - PRO - Digimesh |
| Frequency | 2.4GHz |
| Tx-Power | 100mW |
| Rx Sensitivity | -100dBm |
| Antenna | 5dBi Dipole |
| Distance | 7km * |

(*) Depending on antenna and line of sight

LoRa Radio



| | |
|-----------------------|-----------------|
| Model | Semtech SX1272 |
| Frequency | 868 and 915 MHz |
| Tx-Power | 14 dBm |
| Rx Sensitivity | -137 dBm |
| Antenna | 4.5dBi Dipole |
| Distance | 21+km * |

(*) Depending on antenna and line of sight

WiFi Scanner



| | |
|-----------------|----------------------------------|
| Chipset | Atheros AR5213A - IEEE 802.11b/g |
| Distance | 50-200m * |
| Antenna | 5dBi Dipole |

(*) Depending on antenna and line of sight

Bluetooth Scanner



| | |
|-----------------|------------------------------|
| Protocol | Bluetooth 2.1 + EDR. Class 2 |
| Tx-Power | 3dBm |
| Antenna | 5dBi |
| Power | 3dBm |
| Distance | 20-30m * |

(*) Depending on antenna and line of sight

3G/GPRS Module



| | |
|----------------------|---|
| Protocols | 3G *, WCDMA, HSPA, UMTS, GPRS, GSM |
| Tri Band | 900MHz/1900MHz/2100MHZ or 850MHz/1900MHz/2100MHZ |
| Output power: | UMTS 850/900/1900/2100: 0.25W GSM850/GSM900: 2W DCS1800/PCS1900: 1W |
| Rx Rate | 7.2Mb/s |
| Tx Rate | 5.5Mb/s |
| Antenna | 3dBi |
| SIM card | Access via the External SIM socket |

(*) Note for US users: We have tested the new 3G shield with the AT&T network which supports natively the GSM and 3G protocols. With other carriers may also work although we haven't tried and thus we can not ensure it. For this reason we recommend to use AT&T SIM cards.

GPS Module



| | |
|----------------|--|
| Modes | Assisted GPS (A-GPS), Standalone mode (NMEA frames) |
| Server | Server enabled to perform even indoor location ins A-GPS and S-GPS modes |
| Antenna | 26dBi (+/-4.5dBi) - 3m cable. Magnetic |

Understanding Meshlium

Concepts

Meshlium is a Linux router which works as the Gateway of the Waspote Sensor Networks. It can contain 6 different radio interfaces: WiFi 2.4GHz, WiFi 5GHz, 3G/GPRS, Bluetooth, XBee and LoRa. As well as this Meshlium can also integrate a GPS module for mobile and vehicular applications and be solar and battery powered. These features along with an aluminium IP65 enclosure allows Meshlium to be placed anywhere outdoor.

Meshlium can work as:

- an XBee / LoRa to Ethernet router for Waspote nodes *
- an XBee / LoRa to 3G/GPRS router for Waspote nodes *
- a WiFi Access Point
- a WiFi Mesh node (dual band 2.4GHz-5GHz)
- a WiFi to 3G/GPRS router
- a Bluetooth scanner and analyzer
- a GPS-3G/GPRS realtime tracker **
- a Smartphone scanner (detects iPhone and Android devices) **

(*) More info about Waspote at: <http://www.libelium.com/waspote>

(**) Antennas with longer range are available for WiFi and Bluetooth Scanner

All the networking options can be controlled from two different sources:

1. **Manager System:** a web interface which comes with Meshlium. It allows you to control all the interfaces and system options in a secure, easy and quick way.
2. **SSH console:** for expert users direct access to the shell console is enabled.

Meshlium is also a complete Linux station which offers different services, programming environments and storage systems:

Services activated:

- HTTP / HTTPS
- SSH

Examples of programming environments to be installed:

- C (by default)
- C++
- Java
- PHP (by default)
- Python
- Perl
- Ruby

Regarding the information storage Meshlium counts with two different data base systems.

- MySQL (by default)
- Postgre

All the information coming from all the interfaces (XBee, LoRa, Bluetooth, 3G/GPRS, WiFi and from the GPS module) can be stored in the Local Data Base as explained in the "Storage Options" section or even exported to an external Data Base connected to the internet.

Meshlium Models

There are different Meshlium models ("Presets") depending on the radios integrated and on the fact if they act as a Gateway (GW) node or not.

| Models | WiFi AP (2.4GHz) | WiFi Mesh (2.4GHz /5GHz) | 3G/GPRS | ZigBee | Ethernet | GW |
|------------------------------|------------------|--------------------------|---------|--------|----------|----|
| Meshlium AP | ✓ | | | | ✓ | ✓ |
| Meshlium 3G/GPRS-AP | ✓ | | ✓ | | ✓ | ✓ |
| Meshlium Mesh-AP | ✓ | ✓ | | | ✓ | |
| Meshlium Mesh-AP-GW | ✓ | ✓ | | | ✓ | ✓ |
| Meshlium Mesh-3G/GPRS-AP | ✓ | ✓ | ✓ | | ✓ | ✓ |
| Meshlium RF-AP | ✓ | | | ✓ | ✓ | ✓ |
| Meshlium RF-3G/GPRS-AP | ✓ | | ✓ | ✓ | ✓ | ✓ |
| Meshlium RF-Mesh-AP | ✓ | ✓ | | ✓ | ✓ | |
| Meshlium RF-Mesh-AP-GW | ✓ | ✓ | | ✓ | ✓ | ✓ |
| Meshlium RF-Mesh-3G/GPRS-AP | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Meshlium Scanner AP | ✓ | | | | ✓ | ✓ |
| Meshlium Scanner 3G-/GPRS-AP | ✓ | | ✓ | | ✓ | ✓ |
| Meshlium Scanner RF-AP | ✓ | | | ✓ | ✓ | ✓ |

All the configurations will act as GW nodes except the nodes configured to act as simple mesh nodes (Mesh-AP and XBee-Mesh-AP) which need one GW node in the mesh network which shares its Internet connection. **However, all the nodes can be changed to act as GW nodes with just one click through the Presets section.**

All the Meshlium models come with **Ethernet (IPv4 and IPv6)** interfaces.

On some of them two **extra modules** can be installed: **Bluetooth** and **GPS**.

| Models | WiFi Scans | Bluetooth Scans | GPS | 8GB / 16GB / 32 GB Storage options |
|-----------------------------|------------|-----------------|----------|------------------------------------|
| Meshlium AP | | | | ✓ |
| Meshlium 3G/GPRS-AP | | | Optional | ✓ |
| Meshlium Mesh-AP | | | | ✓ |
| Meshlium Mesh-AP-GW | | | | ✓ |
| Meshlium Mesh-3G/GPRS-AP | | | Optional | ✓ |
| Meshlium RF-AP | | | | ✓ |
| Meshlium RF-3G/GPRS-AP | | | Optional | ✓ |
| Meshlium RF-Mesh-AP | | | | ✓ |
| Meshlium RF-Mesh-AP-GW | | | | ✓ |
| Meshlium RF-Mesh-3G/GPRS-AP | | | | ✓ |
| Meshlium Scanner AP | ✓ | ✓ | | ✓ |
| Meshlium Scanner 3G/GPRS-AP | ✓ | ✓ | | ✓ |
| Meshlium Scanner RF-AP | ✓ | ✓ | | ✓ |

Note: For complete information go to the Meshlium Technical Guide at: <http://www.libelium.com/development/meshlium/>

Storage

The size of the Meshlium hard disk is 8 GB. The Operating System and the Manager System take ~2.5GB. This means the space which can be used to store the data captured and to be used by the applications loaded by the user is:

- $8\text{GB} - 2.5\text{GB} = 5.5\text{GB}$

This space is assigned to the user partition: `"/mnt/user"`

There are three folders where the captured data is stored when the "Store to a File or Data Base" option is activated:

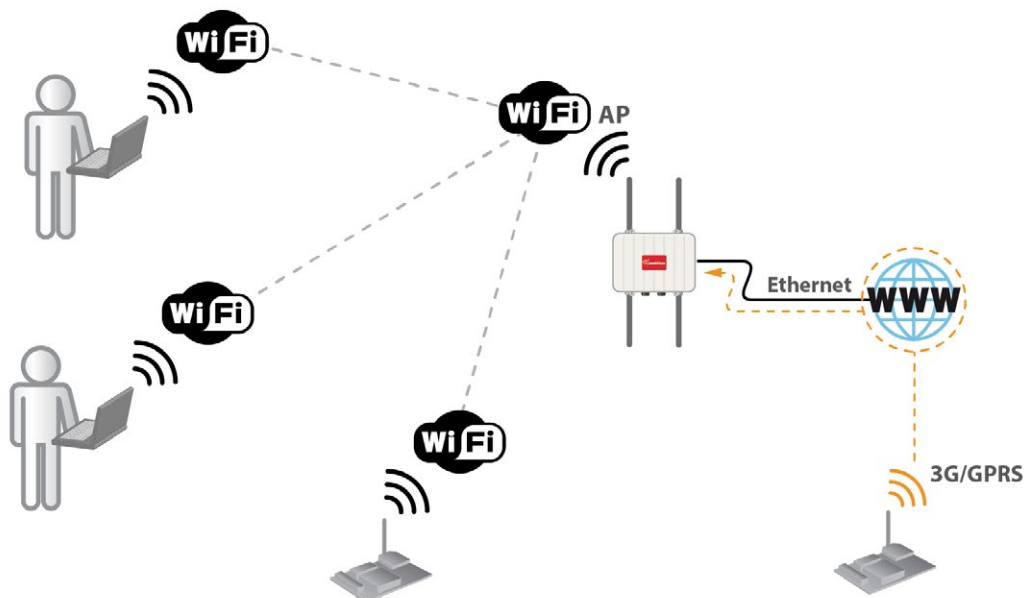
- `/mnt/user/zigbee_data`
- `/mnt/user/bluetooth_data`
- `/mnt/user/gps_data`

The Local Data Base files can be found in: `"/mnt/user/mysql/MeshliumDB"`

Applications model by model

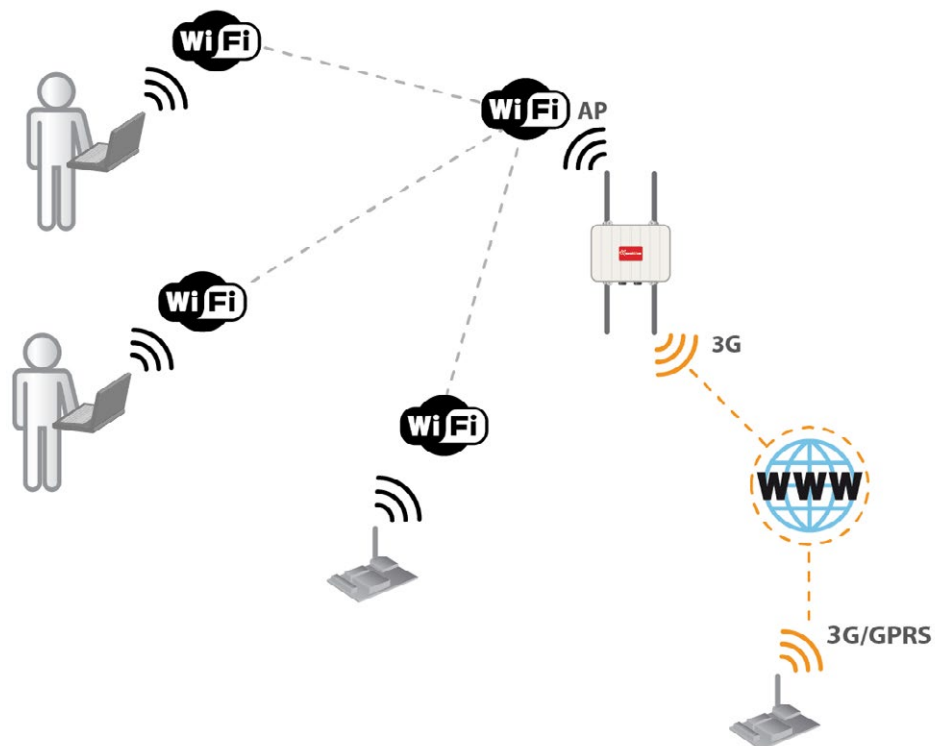
Meshlium AP

Clients can connect to Meshlium via WiFi with laptops and smart phones and get access to the Internet. In order to give Internet access Meshlium uses the Ethernet connection. Just connect it to your hub or switch and it will get automatically an IP from your network using DHCP. This model can receive and store data from Waspotes with GPRS, 3G or WiFi, sending via HTTP protocol.



Meshlium 3G/GPRS AP

Clients can connect to Meshlium via WiFi with laptops and smart phones and get access to the Internet. In order to give Internet access Meshlium uses the 3G/GPRS connection. This model can receive and store data from Waspmotes with GPRS, 3G or WiFi, sending via HTTP protocol.

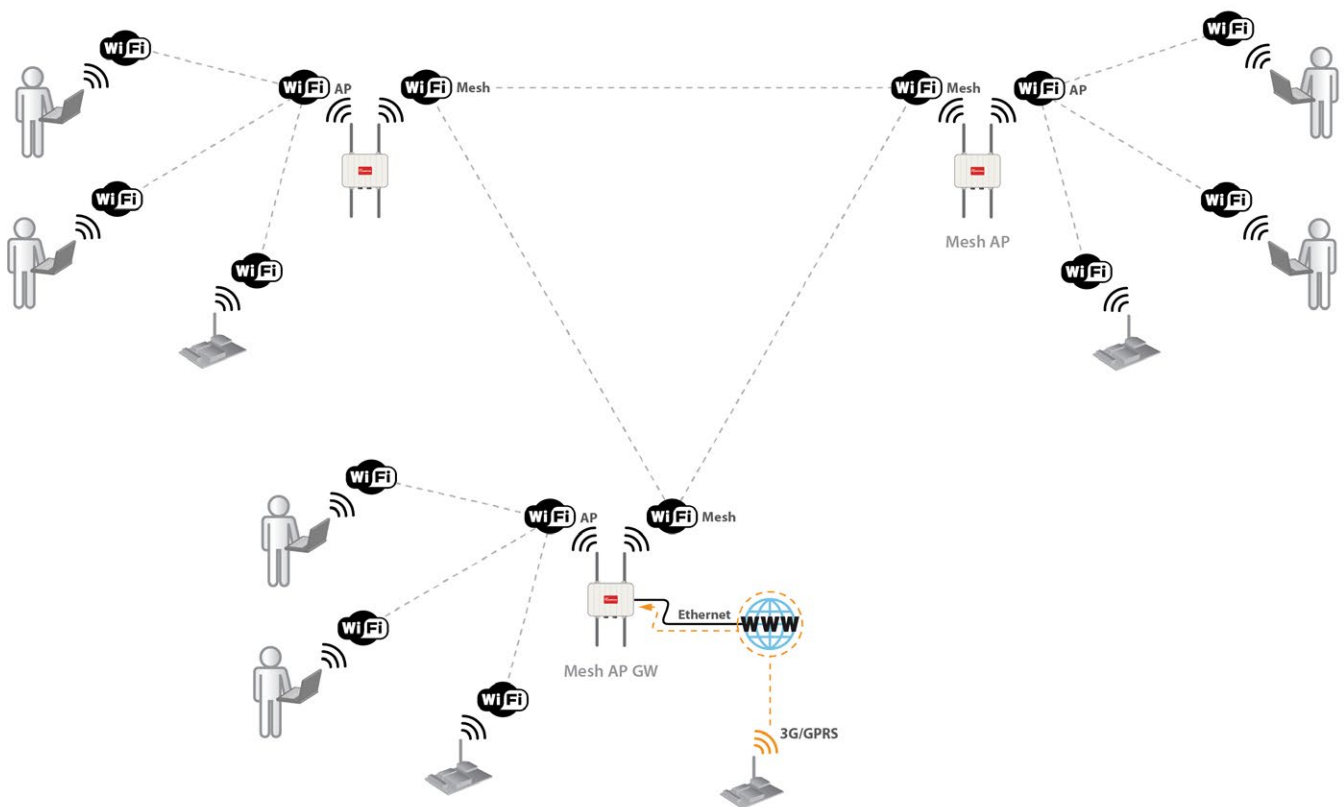


Meshlium Mesh AP - Meshlium Mesh AP GW

Meshlium can work as a Mesh node. This means we can interconnect several Meshliums in order to share a common resource as the Internet connection. This way, the clients connected to a certain node can access to the Internet connection of a third node which is some hops far away the actual connecting point. In a mesh network there are two kinds of nodes:

- **Meshlium Mesh AP** allows clients to connect via WiFi and creates links with other nodes using a second WiFi radio which operates in the 5GHz band.
- **Meshlium Mesh AP GW** (gateway) is the node which shares its Internet connection with the rest of the network. It takes the Internet connection from the Ethernet interface. There is only one GW in the mesh network.

This model can receive and store data from Waspnotes with GPRS, 3G or WiFi, sending via HTTP protocol.

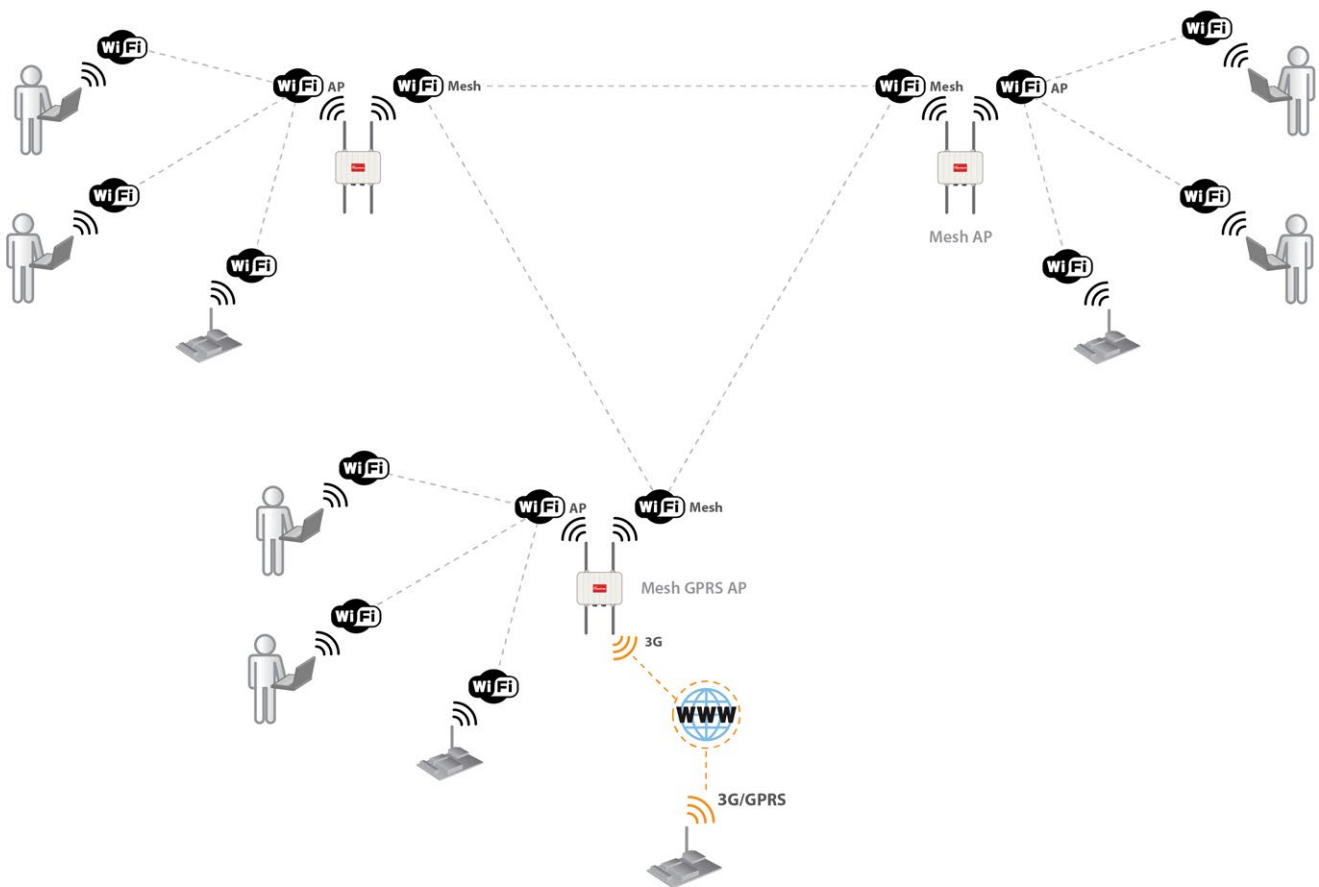


Meshlium Mesh AP - Meshlium Mesh 3G/GPRS AP:

Meshlium can work as a Mesh node. This means we can interconnect several Meshliums in order to share a common resource as an Internet connection. This way, the clients connected to a certain node can access to the Internet connection of a third node which is some hops far away the actual connecting point. In a mesh network there are two kinds of nodes:

- **Meshlium Mesh AP** allows clients to connect via WiFi and creates links with other nodes using a second WiFi radio which operates in the 5GHz band.
- **Meshlium Mesh 3G/GPRS AP** (3G/GPRS gateway) is the node which shares its Internet connection with the rest of the network. It takes the Internet connection from the 3G/GPRS interface. There is only one GW in the mesh network.

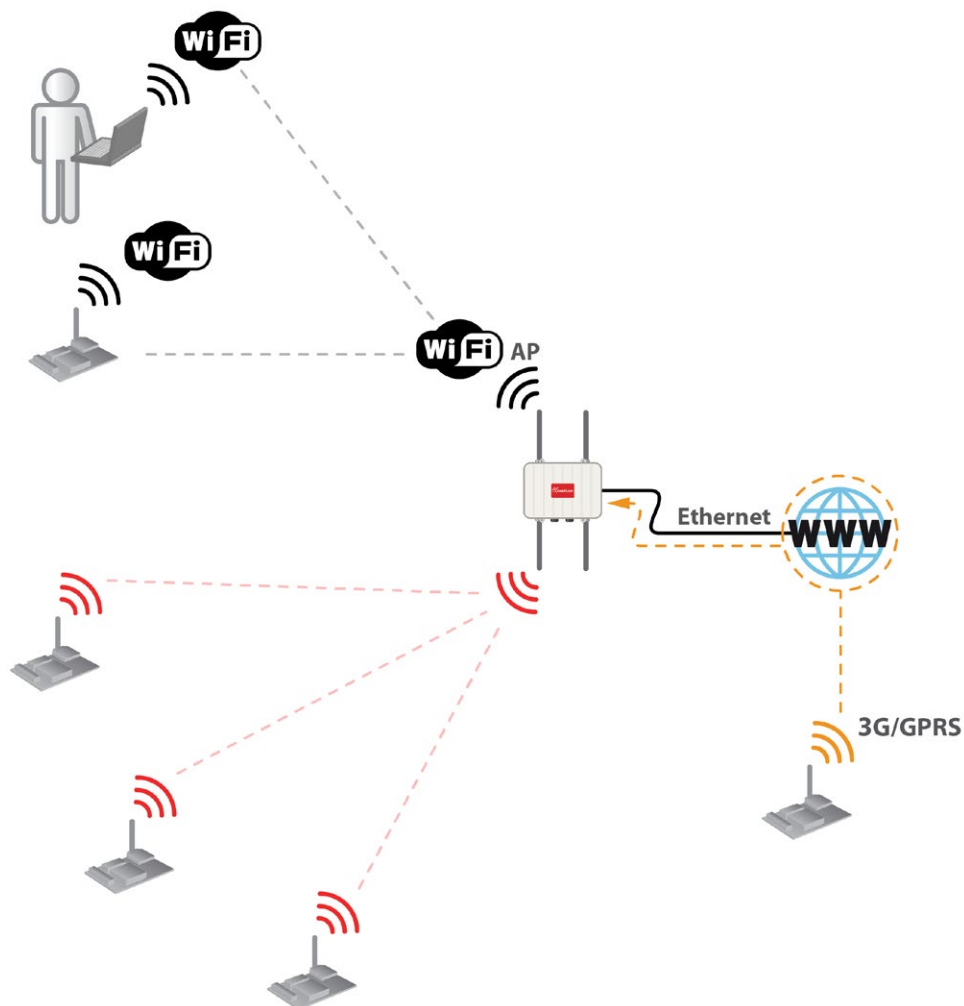
This model can receive and store data from Waspmites with GPRS, 3G or WiFi, sending via HTTP protocol.



Meshlium XBee/LoRa AP

Meshlium can take the sensor data which comes from an XBee / LoRa Wireless Sensor Network (WSN) made with Waspmote sensor devices* and send it to the Internet using the Ethernet interface. This model can receive and store data from Waspmotes with GPRS, 3G or WiFi, sending via HTTP protocol. Users can also connect directly to Meshlium using the WiFi interface to control it and access to the sensor data.

(*) <http://www.libelium.com/waspmote>

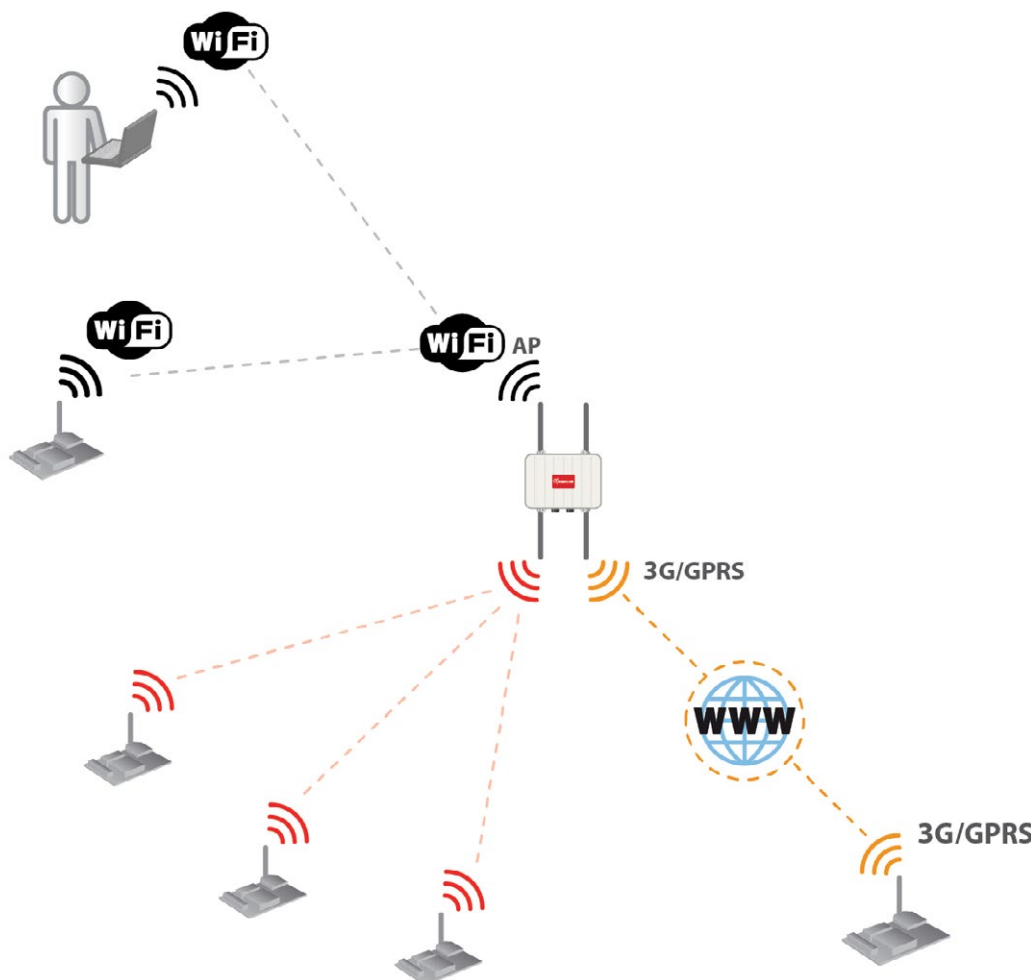


(*) For more information see section "Wireless Sensor Networks"

Meshlium XBee/LoRa 3G/GPRS AP

Meshlium can take the sensor data which comes from a Wireless Sensor Network (WSN) made with Waspote sensor devices *and send it to the Internet using the 3G/GPRS interface. This model can receive and store data from Waspotes with GPRS, 3G or WiFi, sending via HTTP protocol. Users can also connect directly to Meshlium using the WiFi interface to control it and access to the sensor data.

(*) <http://www.libelium.com/waspote>

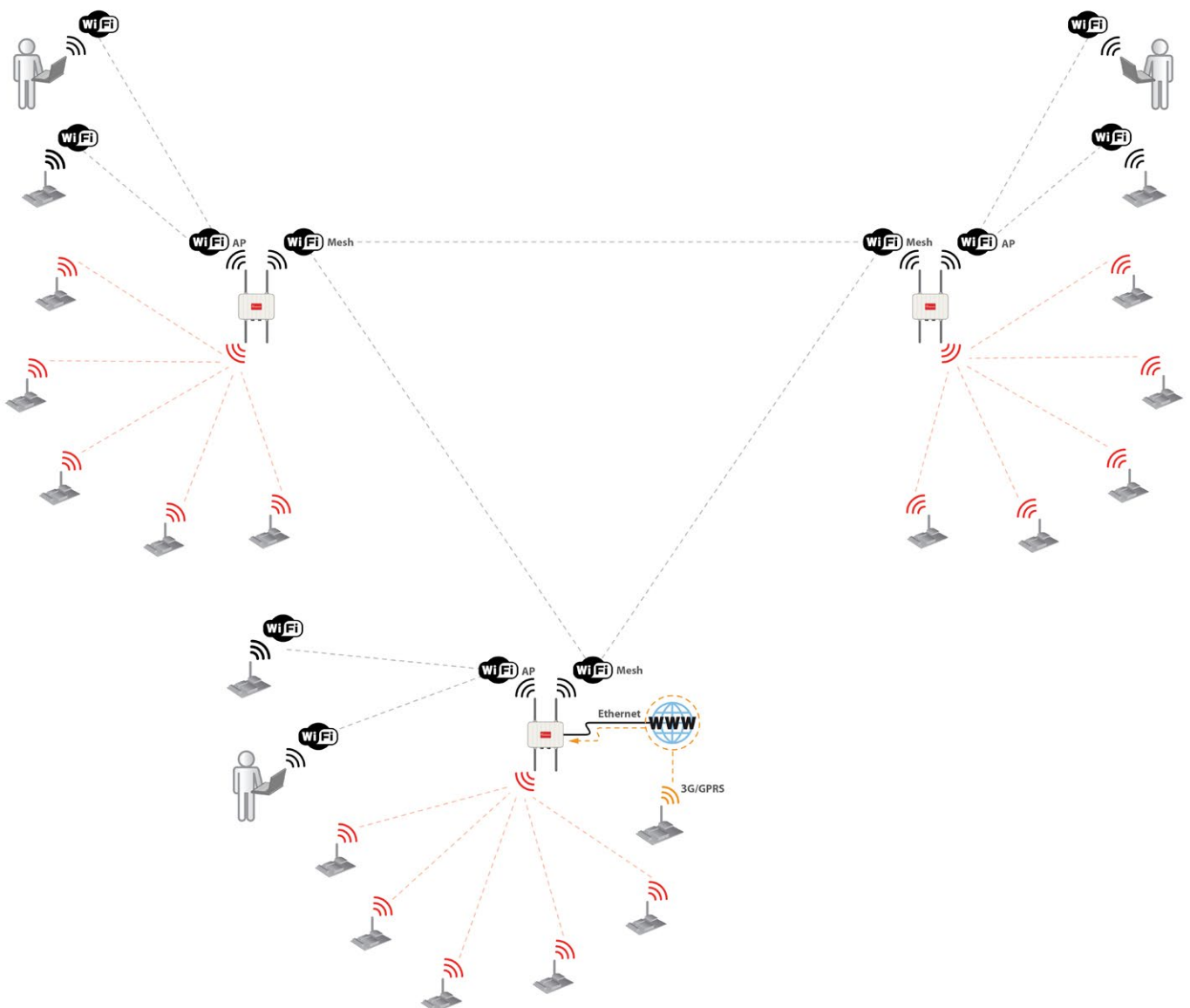


(*) For more information see section "Wireless Sensor Networks"

Meshlium XBee Mesh AP - Meshlium XBee Mesh AP GW:

Meshlium can work as an XBee Mesh node. This means we can interconnect several nodes in order to share a common resource as an Internet connection. This way, the sensor nodes connected to a node via XBee can send the information to the Internet link set on a third node which is some hops far away the actual point. In this hybrid XBee - WiFi mesh network there are two kinds of nodes:

- **Meshlium XBee Mesh AP** allows the sensor devices to connect via XBee, WiFi or Internet (Ethernet) and creates links with other nodes using a WiFi radio which operates in the 5GHz band. Users can also connect directly to Meshlium using the 2.4GHz WiFi interface to control it and access to the sensor data.
- **Meshlium XBee Mesh AP GW** (gateway) is the node which shares its Internet connection with the rest of the network. It takes the Internet connection from the Ethernet interface. There is only one GW in the mesh network.

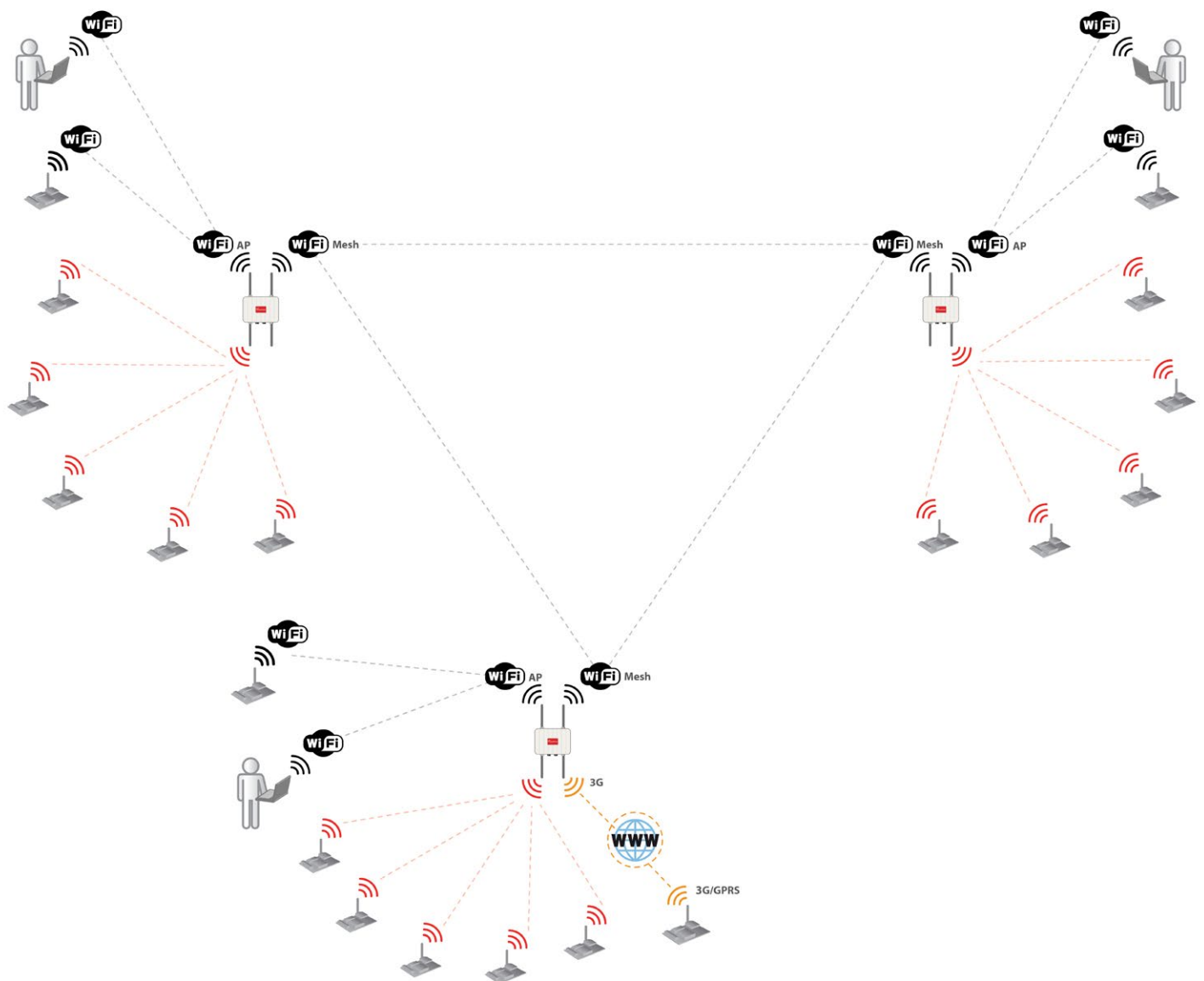


(*) For more information see section ["Wireless Sensor Networks"](#)

Meshlium XBee Mesh AP - Meshlium XBee Mesh 3G/GPRS AP

Meshlium can work as an XBee Mesh node. This means we can interconnect several nodes in order to share a common resource as an Internet connection. This way, the sensor nodes connected to a node via ZigBee can send the information to the Internet link set on a third node which is some hops far away the actual point. In this hybrid ZigBee - WiFi mesh network there are two kinds of nodes:

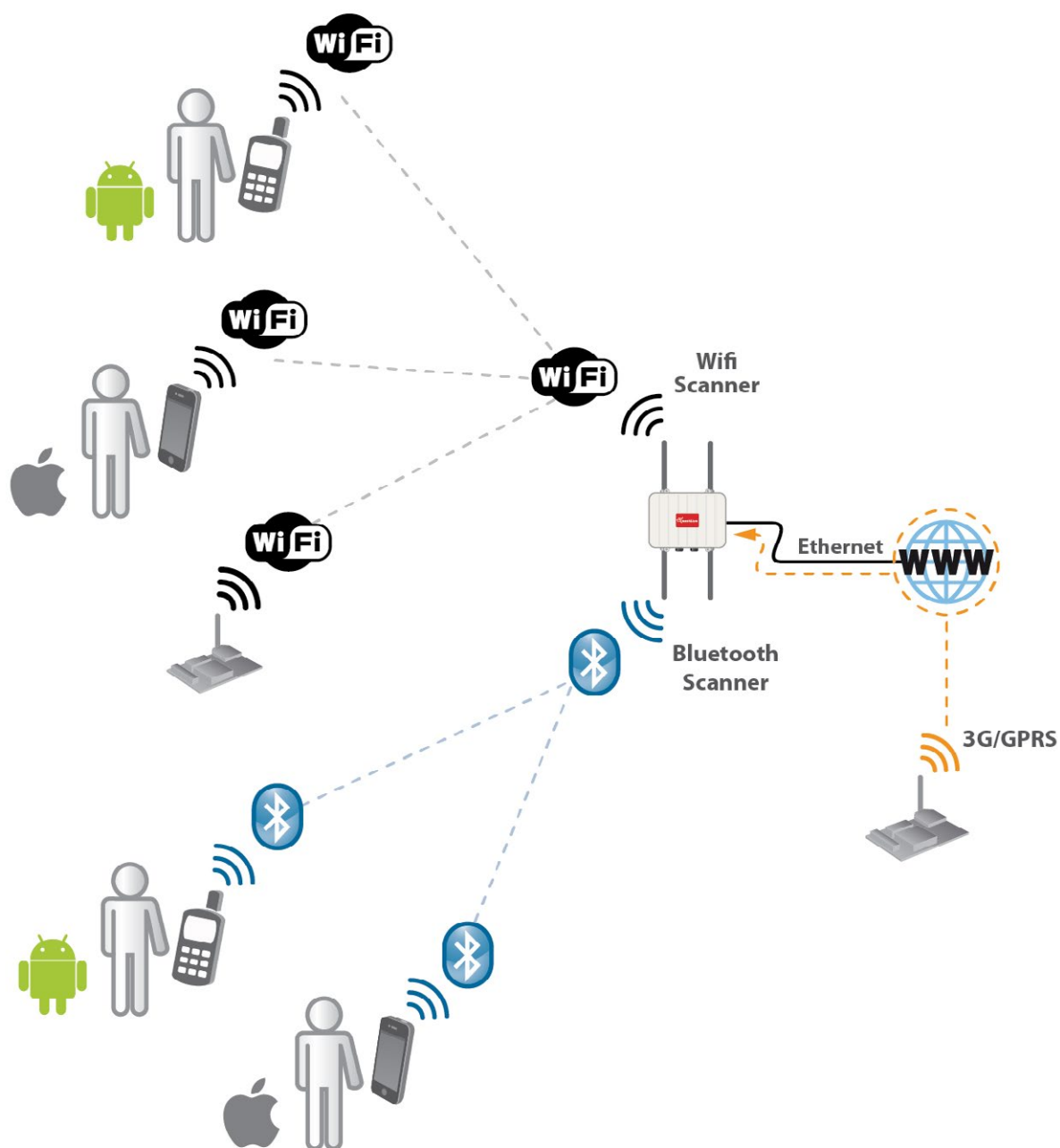
- **Meshlium XBee Mesh AP** allows the sensor devices to connect via XBee, WiFi or Internet (Ethernet) and creates links with other nodes using a WiFi radio which operates in the 5GHz band. Users can also connect directly to Meshlium using the 2.4GHz WiFi interface to control it and access to the sensor data.
- **Meshlium XBee Mesh 3G/GPRS AP** (3G/GPRS gateway) is the node which shares its Internet connection with the rest of the network. It takes the Internet connection from the 3G/GPRS interface. There is only one GW in the mesh network.



(*) For more information see section ["Wireless Sensor Networks"](#)

Meshlium Scanner AP

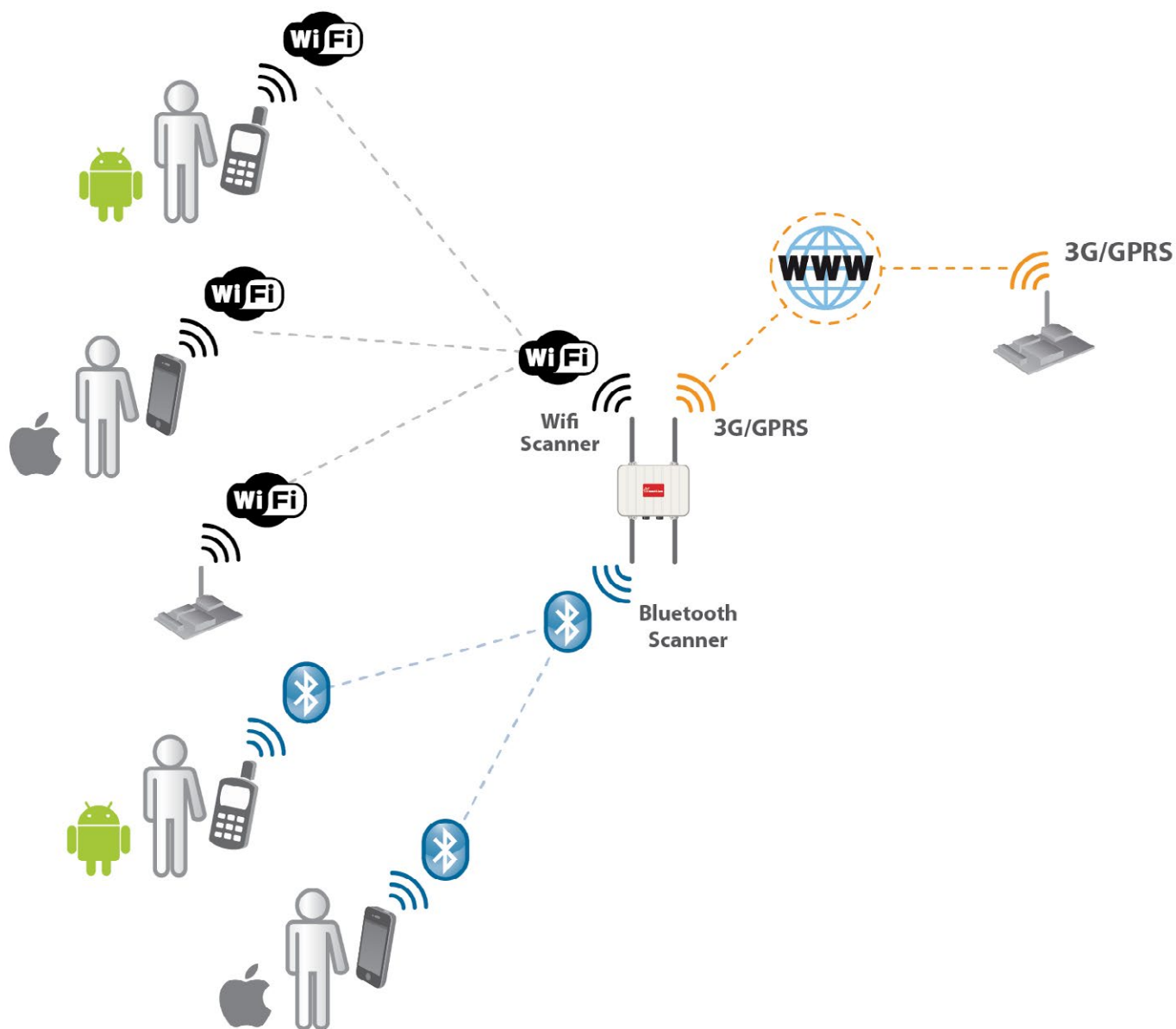
It allows to detect Smartphones (iPhone, Android) and in general any device which works with **WiFi** or **Bluetooth** interfaces. This model can receive and store data from Waspnotes with GPRS, 3G or WiFi, sending via HTTP protocol. The collected data can be send to the Internet by using the Ethernet. Clients can also connect to Meshlium via WiFi with laptops and smart phones and get access to the Internet (as a common Access Point).



(*) For more information see section "Smartphone Detection"

Meshlium Scanner 3G/GPRS-AP

It allows to detect Smartphones (iPhone, Android) and in general any device which works with **WiFi** or **Bluetooth** interfaces. This model can receive and store data from Waspnotes with GPRS, 3G or WiFi, sending via HTTP protocol. The collected data can be send to the Internet by using the Ethernet, and 3G/GPRS connectivity. Clients can also connect to Meshlium via WiFi with laptops and smart phones and get access to the Internet (as a common Access Point).

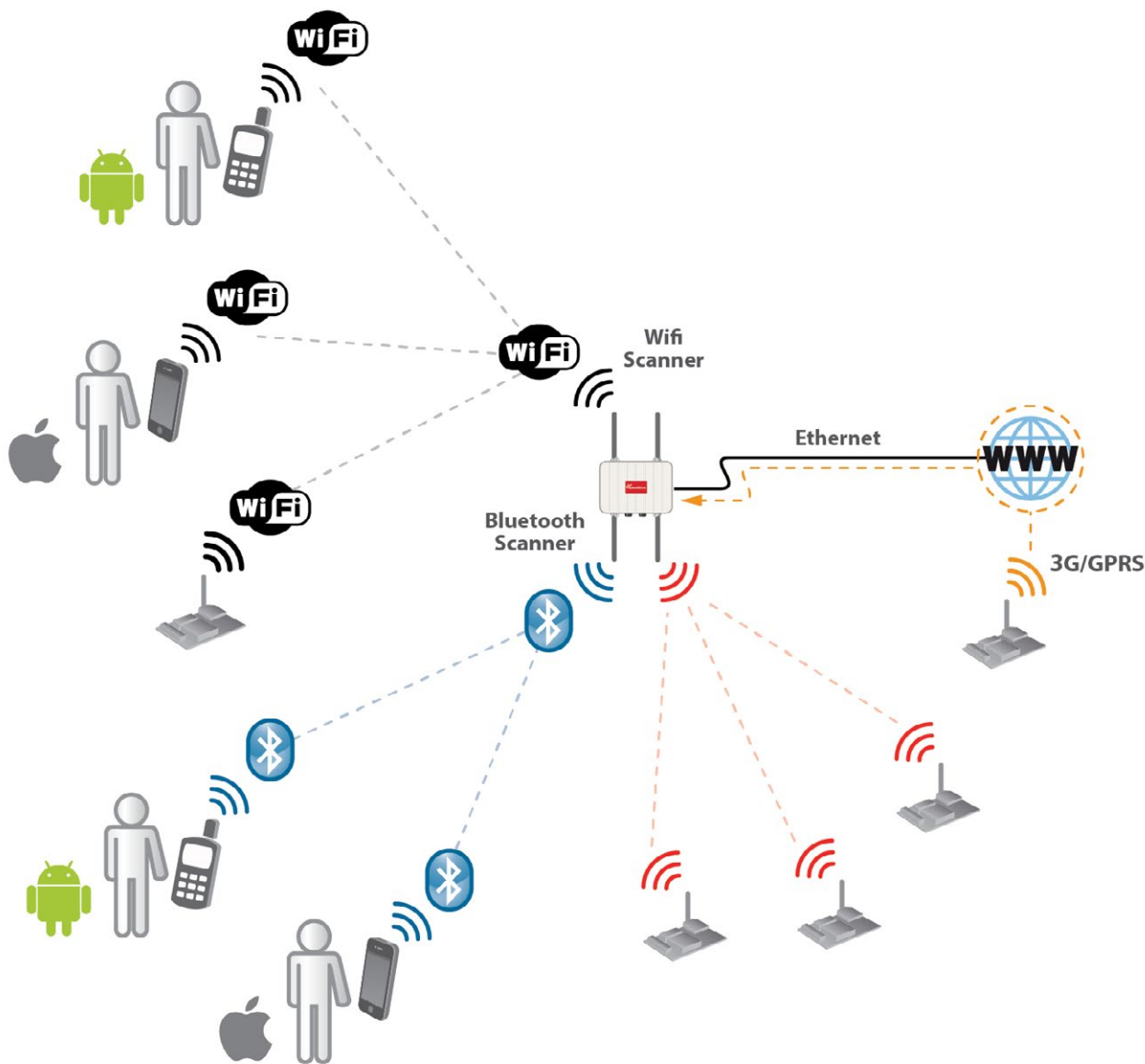


(*) For more information see section "Smartphone Detection"

Meshlium Scanner XBee/LoRa -AP

It allows to detect Smartphones (iPhone, Android) and in general any device which works with **WiFi** or **Bluetooth** interfaces. It can also capture the sensor data which comes from the Wireless Sensor Network (WSN) made with Wasp mote sensor devices.

The collected data can be send to the Internet by using the Ethernet and WiFi connectivity. Clients can also connect to Meshlium via WiFi with laptops and smart phones and get access to the Internet (as a common Access Point).



Note: For complete information go to the Meshlium Technical Guide at: <http://www.libelium.com/development/meshlium/>

<http://www.libelium.com/development/meshlium/documentation>

(*) For more information see section "Wireless Sensor Networks"

(*) For more information see section "Smartphone Detection"

Software

Meshlium comes with the **Manager System**, an open source web application which allows to control quickly and easily the WiFi, XBee, LoRa, Bluetooth and 3G/GPRS configurations along with the data base storage options of the sensor data received.

Interfaces

Configuration of WiFi, XBee, LoRa, Bluetooth, GPRS and Ethernet radios in a **intuitive and easy way**. Configure all the connection preferences in minutes.

Ethernet Network

| | |
|------------------|---|
| Choose IP method | Static ▼ |
| IP address | 192.168.1.210 |
| Netmask address | 255.255.255.0 |
| Gateway | 192.168.1.1 |
| Broadcast | 192.168.1.255 |
| Primary DNS | 8.8.8.8 |
| Secondary DNS | 8.8.4.4 |
| Use IPv6 | <input checked="" type="checkbox"/> Generate IPv6 Address |
| IPv6 address | 2001::20d:b9ff:fe26:b620 |
| Netmask number | 64 |
| Gateway | 2001::1 |

[Save](#)

Configure where you want to **store the sensor data captured**. Now it is possible to do it in an automatic way with any type of frame thanks to the new **Sensor Parser**. In just one minute you can get an external data base being updated with the data coming from the Waspote network. Sensor Parser can receive data from all these interfaces:

- XBee
- LoRa
- 3G/GPRS
- WiFi
- Ethernet

Captured Data

Local DataBase External Database Show me NOW Advanced

Connection data

Database: MeshliumDB
 Table: sensorParser
 IP: localhost
 Port: 3306
 User: root
 Password: libellum2007

☒ Store frames in the local data base

Last 100 insertions.

| ID | Date | Sync | ID Wasp | ID Secret | Frame Type | Frame Number | Se |
|-------|---------------------|------|---------|-----------|------------|--------------|----|
| 73650 | 2013-01-30 18:57:18 | 0 | N1 | 35690399 | 253 | 29 | IN |
| 73649 | 2013-01-30 18:57:18 | 0 | N1 | 35690399 | 253 | 29 | BA |
| 73648 | 2013-01-30 18:57:18 | 0 | N1 | 35690399 | 253 | 29 | ST |
| 73647 | 2013-01-30 18:57:07 | 0 | N1 | 35690399 | 253 | 28 | IN |
| 73646 | 2013-01-30 18:57:07 | 0 | N1 | 35690399 | 253 | 28 | BA |
| 73645 | 2013-01-30 18:57:07 | 0 | N1 | 35690399 | 253 | 28 | ST |
| 73644 | 2013-01-30 18:56:57 | 0 | N1 | 35690399 | 253 | 27 | IN |
| 73643 | 2013-01-30 18:56:57 | 0 | N1 | 35690399 | 253 | 27 | BA |
| 73642 | 2013-01-30 18:56:57 | 0 | N1 | 35690399 | 253 | 27 | ST |
| 73641 | 2013-01-30 18:56:46 | 0 | N1 | 35690399 | 253 | 26 | IN |
| 73640 | 2013-01-30 18:56:46 | 0 | N1 | 35690399 | 253 | 26 | BA |
| 73639 | 2013-01-30 18:56:46 | 0 | N1 | 35690399 | 253 | 26 | ST |
| 73638 | 2013-01-30 18:56:36 | 0 | N1 | 35690399 | 253 | 25 | IN |



Create a mesh network with **fixed and mobile nodes** in just one click with the predefined presets or specify your own mesh node preferences. Set the Gateway of the mesh network pressing one button.

Meshlium Manager System
The open source router web manager

Meshlium Zigbee Mesh 3G AP

meshlium Home | Logout Restart Shutdown Presets

Interfaces Sensor Networks Tools System Update Manager Help

Ethernet WiFi AP Clients connected WiFi Mesh OLSR conf. 3G / GPRS Joined networks

Wifi Mesh Network

Address: 10.1.20.1
 Netmask: 255.255.255.0
 Broadcast: 10.10.11.255
 Primary DNS: 8.8.8.8
 Secondary DNS: 8.8.8.4

Radio

ESSID: meshlium-X
 CELL ID: AAAAAAAAAA
 Frequency: 5GHz
 Channel: 64
 Tx power: auto
 Rate: auto

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Set an Access Point with **WPA** security in just 1 minute and control the users connected.



Set Meshlium as a **3G/GPRS Gateway** in order to send the sensor data captured from the XBee/LoRa radio to the Internet and to provide connectivity to the users connected through the WiFi AP and WiFi Mesh interfaces.



It allows to detect **iPhone** and **Android** Smartphones and in general any device which works with WiFi interfaces. The data captured (**MAC, RSSI, AP, Vendor**) may be easily stored in the internal Meshlium data base or in any external one located in the Cloud.

Captured Data

Local file | Local DataBase | External Database | Show me NOW

Connection data

Database: MeshliumDB
 Table: wifiScan
 IP: localhost
 Port: 3306
 User: root
 Password: libelium2007

☒ Store frames in the local data base

Last 100 insertions.

| DB ID | TimeStamp | MAC | AP | RSSI | Vendor |
|-------|---------------------|-------------------|---------------|------|-----------------------|
| 65265 | 2012-05-03 13:05:40 | 90:A4:DE:BC:CA:41 | | 0 | Wistron Neweb Corp |
| 65264 | 2012-05-03 13:06:05 | 18:F4:6A:29:7D:CC | | 2 | Hon Hai Precision In |
| 65263 | 2012-05-03 13:05:23 | 90:C1:15:C5:00:19 | | 11 | Sony Ericsson Mobile |
| 65262 | 2012-05-03 13:05:26 | F8:DB:7F:50:5E:F3 | | 6 | HTC Corporation 14: |
| 65261 | 2012-05-03 13:05:56 | D4:20:6D:B8:37:76 | libelium_wsn1 | 21 | HTC Corporation 13: |
| 65260 | 2012-05-03 13:06:20 | 00:19:D2:BB:11:6F | | 13 | Intel Corporation 12: |
| 65259 | 2012-05-03 13:06:18 | 74:DE:2B:AE:A7:CF | BBT_wifi | 18 | Liteon Technology C |



It allows to detect **iPhone**, **Android**, **handsfree's** and in general any device which works with Bluetooth interfaces. The data captured (**MAC, RSSI, CoD, Vendor**) may be easily stored in the internal Meshlium data base or in any external one located in the Cloud.

Captured Data

Local file | Local DataBase | External Database | Show me NOW

Connection data

Database: capturedData
 Table: bluetoothData
 IP: 192.168.1.150
 Port: 3306
 User: root
 Password: root

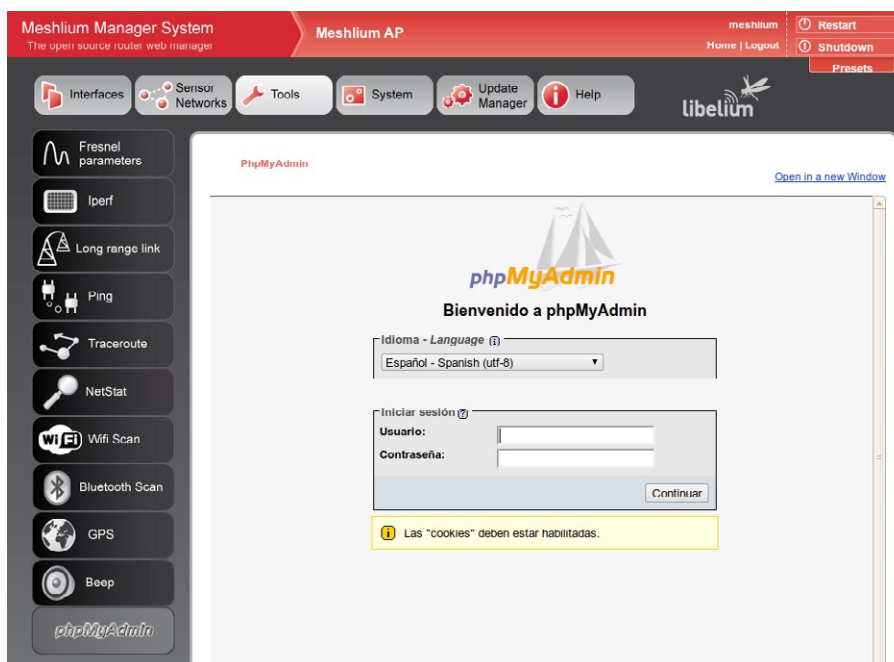
☒ Store frames in the external data base

Last 100 insertions. (to create database and table)

| DB ID | TimeStamp | MAC | ID | RSSI | CoD | Vendor |
|-------|---------------------|-------------------|------------------------|------|------------|-------------|
| 343 | 2012-05-16 17:55:02 | 74:DE:2B:AF:17:5F | EXPERIMENTOS | -79 | Computer | Liteon Tech |
| 342 | 2012-05-16 17:54:52 | 00:22:A9:3C:09:92 | Teo | -85 | Smartphone | LG Electron |
| 341 | 2012-05-16 17:54:41 | 00:1E:3D:A6:64:12 | NACHO1 | -90 | Computer | Alps Electr |
| 340 | 2012-05-16 17:54:30 | 00:A0:96:34:EA:43 | Porti7-16el 0207120001 | -86 | Computer | MITSUMI EL |
| 339 | 2012-05-16 17:54:20 | 00:07:80:4B:2B:C4 | UNO | -68 | Computer | Bluegiga Te |
| 338 | 2012-05-16 17:53:47 | 74:DE:2B:AF:17:5F | EXPERIMENTOS | -79 | Computer | Liteon Tech |
| 337 | 2012-05-16 17:53:36 | 00:07:80:4B:2B:C4 | UNO | -68 | Computer | Bluegiga Te |
| 336 | 2012-05-16 17:53:26 | 00:25:D3:B0:5F:2E | matrix-0 | -67 | Computer | AzureWave |

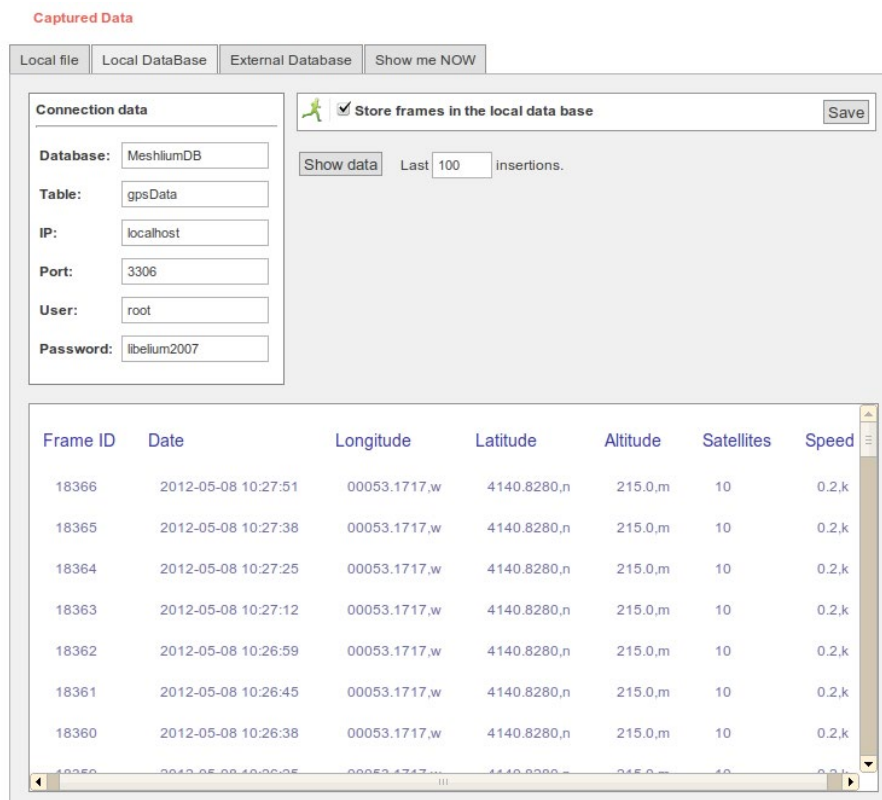
Linux

Meshlium runs a Linux system based on Debian with the package system available. This means you can install **any application** or service you need.



GPS

The GPS module allows to trace real time the Meshlium **location**, **speed** and **altitude**. All this information can be stored in a internal or external data base pressing just one button.



Special WiFi Tools

Configure Meshlium to support **long range WiFi radio links** (km) and calculate the Fresnel zone easily.

Fresnel parameters

Distance (km)

| 2.4 Ghz | 5 Ghz |
|----------|---------|
| 24.999 m | 17.32 m |

$$b = 17.32 \sqrt{\frac{D}{4f}}$$

Networking Tools

Test the link quality and the **bandwidth** of the radio links using **diagnosis tools** such as iperf, ping and traceroute. All from the browser.

Iperf test

Select interface

Destination Host

```

Launching: iperf -c '192.168.1.131' -r
-----
Server listening on TCP port 5001
TCP window size: 85.3 KByte (default)
-----
Client connecting to 192.168.1.131, TCP port 5001
TCP window size: 26.9 KByte (default)
-----
[ 17] local 192.168.1.7 port 55189 connected with 192.168.1.131 port 5001
[ ID] Interval      Transfer    Bandwidth
[ 17] 0.0-10.0 sec   112 MBytes  94.1 Mbits/sec

iperf finished.
    
```

Note: For complete information go to the Meshlium Technical Guide at: <http://www.libelium.com/development/meshlium/>

Wireless Sensor Networks with Waspote and Meshlium

Two Libelium technologies:

Waspote is a sensor device specially oriented to developers. It works with different protocols (ZigBee, Bluetooth, GPRS) and frequencies (2.4GHz, 868MHz, 900MHz) being capable of getting links up to 22km. It counts with an hibernate mode of 0.7uA which allows to save battery when it is not transmitting. More than 50 sensors already available and a complete open source IDE (API libraries + compiler) made really easy to start working with the platform.

More info: <http://www.libelium.com/waspote>



Meshlium is a Linux router which works as the Gateway of the Waspote Sensor Networks. It can contain 5 different radio interfaces: WiFi 2.4GHz, WiFi 5GHz, **3G/GPRS**, Bluetooth and **XBee/LoRa**. As well as this, Meshlium can also integrate a GPS module for mobile and vehicular applications and be solar and battery powered. These features a long with an **aluminium IP-65 enclosure** allows Meshlium to be placed anywhere outdoor. Meshlium comes with the Manager System, a web application which allows to control quickly and easily the WiFi, XBee, LoRa, Bluetooth and 3G/GPRS configurations a long with the storage options of the sensor data received.

The new Meshlium Xtreme allows to detect iPhone and Android devices and in general any device which works with WiFi or Bluetooth interfaces. The idea is to be able to measure the amount of people and cars which are present in a certain point at a specific time, allowing the study of the evolution of the traffic congestion of pedestrians and vehicles.

More info: <http://www.libelium.com/meshlium>



How do they work together?

Meshlium receives the sensor data sent by Waspote using the one wireless radio. The **Sensor Parser** is a software system which is able to do the following tasks in an easy and transparent way:

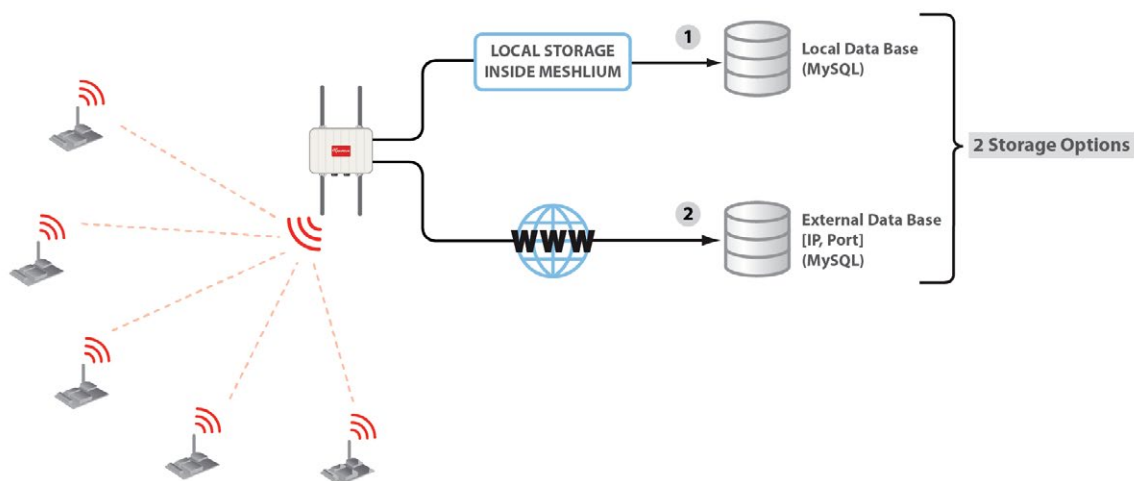
- receive frames from XBee and LoRa (with the Data Frame format)
- receive frames from 3G/GPRS, WiFi and Ethernet via HTTP protocol (Manager System version 3.1.4 and above)
- parse these frames
- store the data in local Database
- synchronize the local Database with an external Database

Besides, the user can add his own sensors.

Then 4 possible actions can be performed:

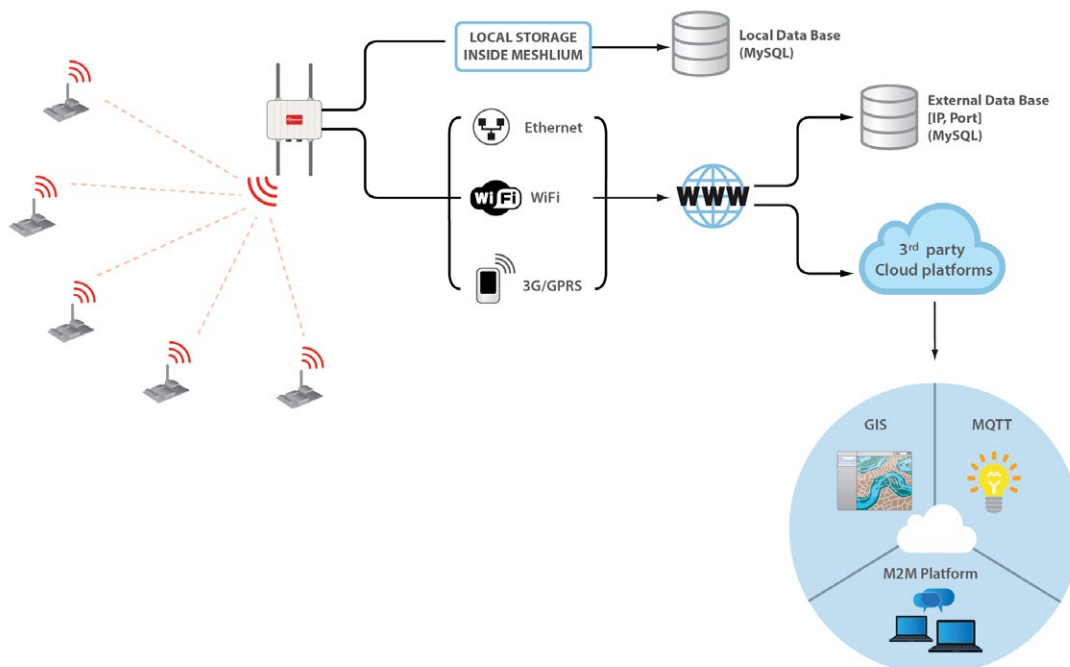
1. Store the sensor data in the Meshlium Local Data Base (MySQL)
2. Store the sensor data in an External Data Base (MySQL)
3. Send the information to the Internet using the Ethernet or WiFi connection
4. Send the information to the Internet using the 3G/GPRS connection

Meshlium Storage Options



- Local Data Base
- External Data Base

Meshlium Connection Options



- XBee / LoRa / GPRS / 3G / WiFi → Ethernet
- XBee / LoRa / GPRS / 3G / WiFi → WiFi
- XBee / LoRa / GPRS / 3G / WiFi → 3G/GPRS

Note: For complete information go to the Meshlium Technical Guide at: <http://www.libelium.com/development/meshlium/>

Smartphone Detection

The new **Meshlium Xtreme** allows to detect **iPhone** and **Android** devices and in general any device which works with **WiFi** or **Bluetooth** interfaces.

These devices can be detected without the need of being connected to an specific Access Point, enabling the detection of any Smartphone, laptop or handsfree device which comes into the coverage area of **Meshlium**.

The idea is to be able to measure the amount of people and cars which are present in a certain point at a specific time, allowing the study of the evolution of the traffic congestion of pedestrians and vehicles.



Users have to do nothing to be detected as the WiFi and Bluetooth radios integrated in their Smartphones periodically send a "hello!" message telling about their presence.

The information read from each user contains:

- The MAC address of the wireless interface, which allows to identify it uniquely.
- The strength of the signal (RSSI), which gives us the average distance of the device from the scanning point.
- The vendor of the Smartphone (Apple, Nokia, etc)
- The Class of Device (CoD) in case of Bluetooth which allows us to differentiate the type of device (Smartphone, Handsfree, Computer, LAN/Network AP). With this parameter we can differentiate among pedestrians and vehicles.

The coverage areas may be modified by changing the power transmission of the radio interfaces allowing the creation of different scanning zones from a few meters (in order to study an specific point) to dozens of meters (to study the whole street or even the entire floor of a shopping mall).

Example of information monitored by the **WiFi Scanner**:

| DB ID | Timestamp | MAC | AP | RSSI | Vendor |
|-------|---------------------|-------------------|---------------|------|-------------------|
| 53483 | 2012-04-24 07:56:25 | C4:2C:03:96:0E:4A | | 69 | Apple |
| 53482 | 2012-04-24 09:11:26 | D8:2A:7E:10:1E:63 | libelium_wsn1 | 60 | Nokia Corporation |

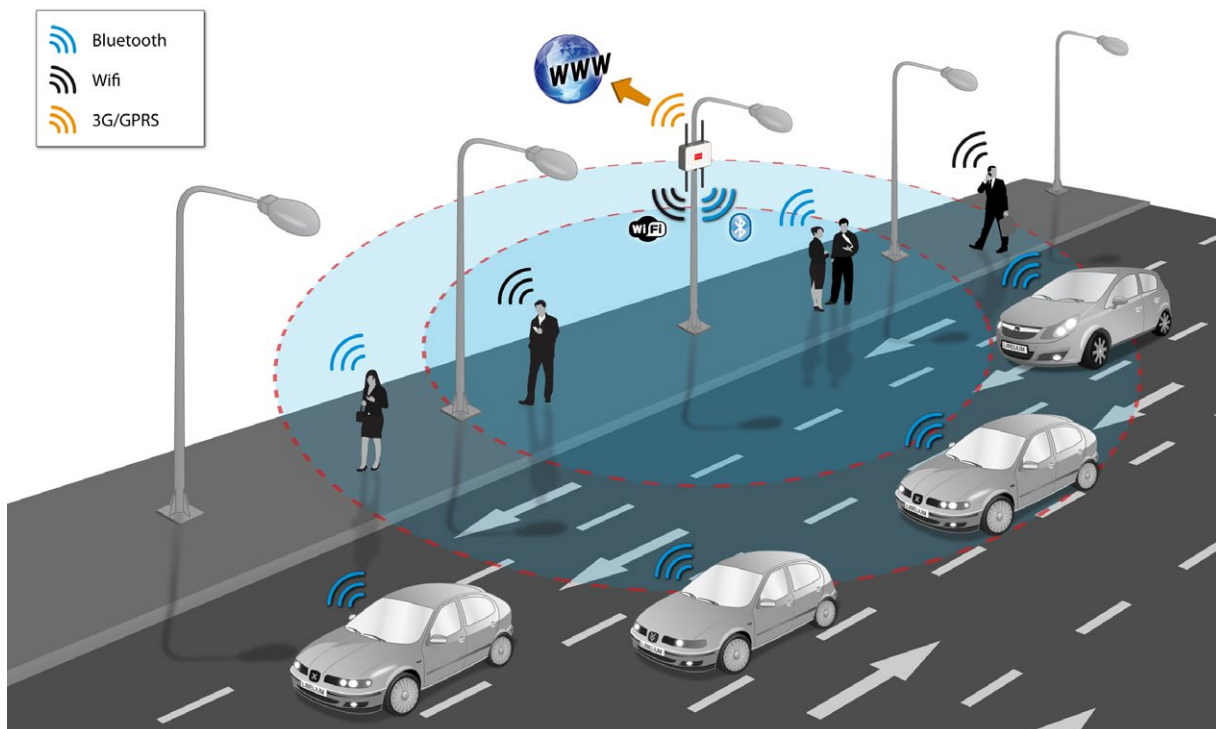
Example of information monitored by the **Bluetooth Scanner**:

| DB ID | Timestamp | MAC | ID | RSSI | CoD | Vendor |
|-------|---------------------|-------------------|--------|------|------------|-------------------|
| 45400 | 2012-05-16 16:18:12 | 00:26:7E:5F:3C:18 | myCar | -72 | Handsfree | PARROT SA |
| 78005 | 2012-04-20 12:59:27 | D8:2A:7E:0E:C3:10 | Tropic | -85 | Smartphone | Nokia Corporation |

Applications related to **Shopping and Street activities**:

- Number of people passing daily in a street
- Average time of the stance of the people in a street
- Differentiate between residents (daily matches) and visitants (sporadic matches)
- Walking routes of people in shopping malls and average time in each area

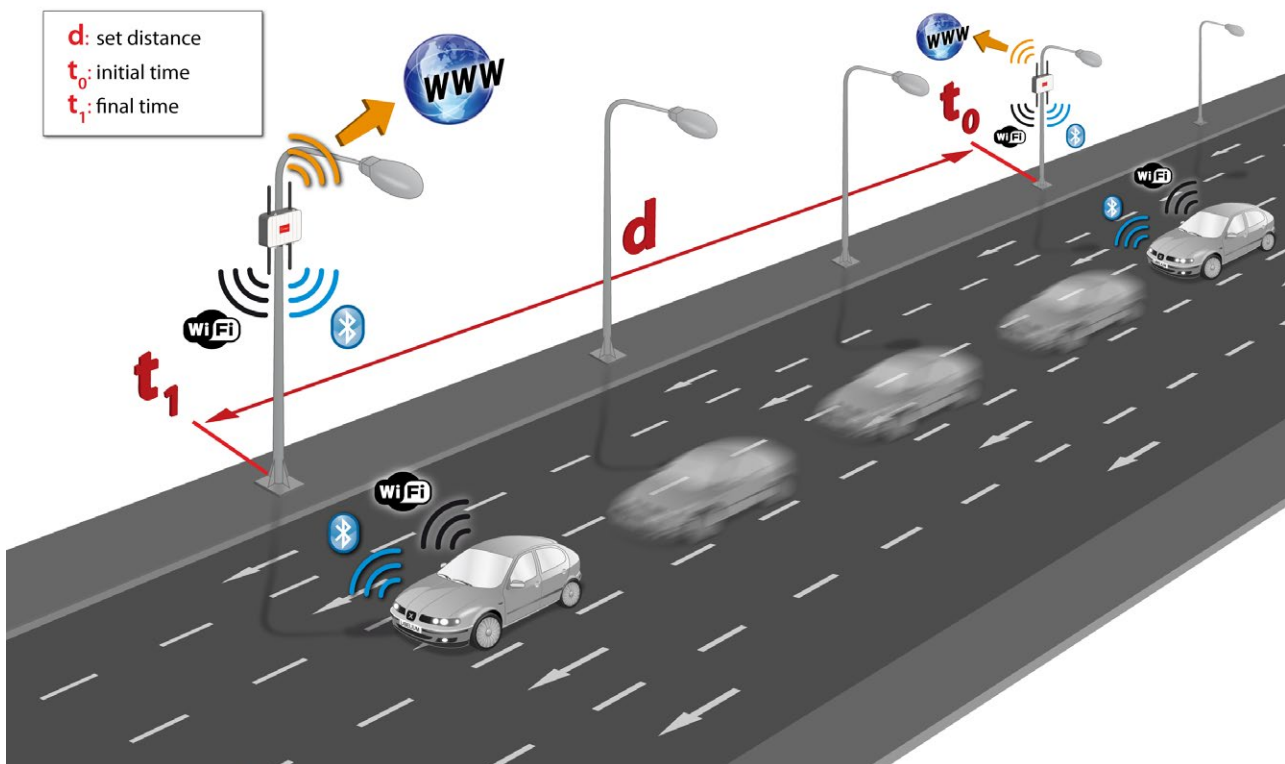
The Vehicle Traffic Monitoring is also another important application as understanding the flow and congestion of vehicular traffic is essential for efficient road systems in cities. Smooth vehicle flows reduce journey times, reduce emissions and save energy. Similarly the efficient flow of pedestrians in an airport, stadium or shopping centre saves time and can make the difference between a good and a bad visit. Monitoring traffic - whether road vehicles or people - is useful for operators of roads, attractions and transport hubs.



Applications for **Vehicle Traffic Detection**:

- Monitor in real time the number of vehicles passing for a certain point in highways and roads
- Detect average time of vehicle stance for traffic congestion prevention
- Monitor average speed of vehicles in highways and roads
- Provide travel times on alternate routes when congestion is detected

The monitoring system can also be used to calculate the average speed of the vehicles which transit over a roadway by taking the time mark at two different points.



For Vehicle Traffic Detection it is advised to purchase the special pack of 2 directional antennas which enlarges the detection area.

Do the users need to have an specific app installed or interact somehow to be detected?

No, the scan is performed silently, **Meshlium** just detects the “beacon frames” originated by the WiFi and Bluetooth radios integrated in the Smartphones. Users just need to have at least one of the two wireless interfaces turned on.

How do we differentiate if the Bluetooth device detected is a car’s hands-free or an Smartphone?

In the scanning process each Bluetooth device gives its “Class of Device” (CoD) attribute which allows to identify the type of service it gives. We can differentiate easily the CoD’s generated by the car’s handsfree from the people’s phone ones.

How do I control the inquiry area?

In the Bluetooth inquiry there are seven different power levels which go from -27dBm to +3dBm in order to set different coverage zones from 10 to 50m. In both WiFi and Bluetooth radios these zones can also be increased or decreased by using a different antenna for the module as it counts with an standard N-Male connector. The default antenna which comes with the scanning modules is an omnidirectional antenna with a gain of 5dBi.

How do I calculate the distance of any of the devices detected?

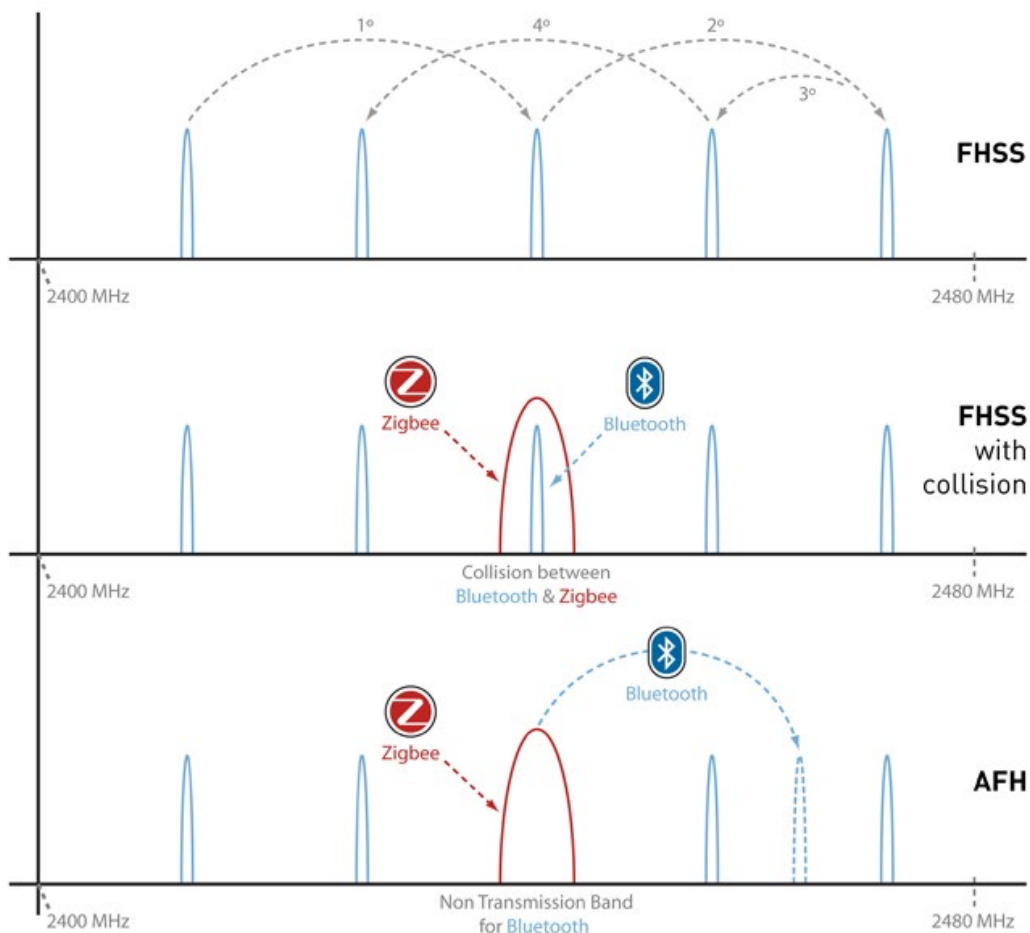
In the inquiry process we receive the MAC address of the Bluetooth device along with the Received Signal Strength Indicator (RSSI) which gives us the quality of the transmission with each device. RSSI values usually go from -40dBm (nearest nodes) to -90dBm (farthest ones). In the tests performed devices at a distance of 10m reported -50dBm as average, while the ones situated at 50m gave us an average of -75dBm.

What about privacy?

The anonymous nature of this technique is due to the use of MAC addresses as identifiers. MAC addresses are not associated with any specific user account or mobile phone number not even to any specific vehicle. Additionally, the "inquiry mode" (visibility) can be turned off so people have always chosen if their device will or won't be detectable.

How do the Bluetooth, WiFi and XBee radios coexist without causing interferences with each other?

WiFi, XBee and Bluetooth work in the 2.4GHz frequency band (2.400 - 2.480MHz), however, the Bluetooth radio integrated in **Meshlium** uses an algorithm called Adaptive Frequency Hopping (AFH) which improves the common algorithm used by Bluetooth (FHSS) and enables the Bluetooth radio to dynamically identify channels already in use by XBee and WiFi devices and to avoid them.



Note: For complete information go to the Meshlium Technical Guide at: <http://www.libelium.com/development/meshlium/documentation>

Certifications:

- CE (Europe)
- FCC (USA)

