lleshietics

Easy Wireless for Things

User App Deshletics ZigBeeNet ZigBit OEM Device Network Router **End Device** Coordinator Star Tree Mesh Home Automation

ZigBeeNet ZigBee Stack and Software Development Kit

Introducing ZigBeeNet

ZigBeeNet is a full-featured, next generation embedded software stack from MeshNetics. The stack provides a software development platform for reliable, scalable, and secure wireless applications running on MeshNetics ZigBit modules. ZigBeeNet is designed with an explicit goal of supporting a broad ecosystem of user-designed applications addressing diverse requirements and enabling a full spectrum of software customization. Primary application domains include home automation, commercial building automation, automated meter reading, asset tracking, and industrial automation.

ZigBeeNet is fully compliant with ZigBee PRO and ZigBee standards for wireless sensing and control. It provides an augmented set of APIs which, while maintaining 100% compliance with the standard, offer extended functionality designed with developer's convenience and ease-of-use in mind. As seasoned ZigBee technology experts, we at MeshNetics created ZigBeeNet to dramatically lower the developer learning curve, factor out the unnecessary complexity and expose as much power of the underlying ZigBit hardware platform as possible. The stack incorporates three years worth of wireless system design experience, field work, and actual user feedback.

ZigBeeNet's target audience is system designers, embedded programmers and hardware engineers evaluating, prototyping, and deploying wireless solutions and products built around the ZigBit hardware platform. ZigBeeNet is delivered as a software development kit, which includes (1) extensive documentation, (2) standard set of libraries comprising multiple components complete set of peripheral drivers (also in source code) for the supported platforms.



MeshNetics

Easy Wireless for Things

APL APS APS NWK BSP HAL HWD MAC PHY HWD HWD User application

Core stack

Software Architecture

Shared, low-level services

API Overview

ZDO & APS

Provides a set of fully compliant ZigBee Device Object APIs to enable network management (start, reset, formation, join), and power management (sleep, wakeup). Defines ZigBee Device Profile types, device and service discovery commands. Provides APIs for unicast, multicast, and broadcast data transmission and acknowledgment.

BSP & HAL

Hardware Abstraction Layer (HAL) includes a complete set of APIs for using on-module hardware resources (EEPROM, app, sleep, and watchdog timers) as well as the reference drivers for rapid design-in and smooth integration with a range of external peripherals (IRQ, I2C, SPI, UART, 1-wire). Board Support Package (BSP) includes a complete set of drivers for managing standard peripherals (sensors, UID chip, placed on a MeshBean development board.

Task manager

Provides API for scheduling tasks in a priority queue optimized for ZigBee multi-layer stack environment and time-critical protocol demands.

Advanced Features

Power management is essential to low power applications with sleeping devices. To ensure maximum battery life, the stack must minimize wake up time and fall asleep time, thus decreasing active period and overall power consumed by the module. Power management APIs include those that let user application inform the stack of its readiness to sleep, and callbacks that inform the user application of a wakeup.

If there are no outstanding user timers, power down mode is selected automatically at run time, yielding more than 60% energy savings over standard power save mode ($2.5 \ \mu$ A vs. 6 μ A). When user timers are present, power save mode is chosen, allowing users to wake up on a timer, and to keep track of time through the sleep periods.

Mesh routing ensures maximum network utilization, while minimizing the number of hops that each packet has to traverse to its destination. Because mesh routing tables create additional RAM pressure, extreme care must be taken to optimize RAM consumption in order to maximize the number of concurrent routes going through a single node. Route discovery algorithm employed by ZigBee is yet another challenge. ZigBeeNet addresses these network traffic management challenges with innovative optimizations and algorithms that deliver ultimate robustness while remaining fully compliant with ZigBee specification.

Multiple addressing modes provide additional flexibility in the way users can refer to their nodes. In tree routing (alternative to mesh routing), nodes are given addresses which are fully determined by their position in the tree. If a node's position changes, so does its address, making it an inconvenient identifier for a persistent reference. Likewise, in mesh routing, stochastic addresses are chosen randomly for every node. These addresses can also change many time in a network's lifetime. ZigBeeNet employs a novel approach that addresses both of these limitations with a static addressing scheme (addresses, once given, are kept for the entire lifetime of the network), making it easy to refer to devices no matter which type of routing or addressing scheme is used.

Over-the-air upgrade is supported over a multi-hop network without interrupting network operation or significantly affecting network performance. Downloaded images are stored off-module, checksummed, and flashed into the module ensuring failure-free operation throughout the upgrade process and beyond. Moreover, the default factory image can be restored at any point during the device's lifetime effectively unrolling the upgrade.

Configuration server is a component of the stack that stores key stack configuration parameters and allows users to change them without recompiling the core stack layers. Users can configure the stack and specify key parameters (e.g. select tree vs. mesh routing, network fan-in, and depth, PAN ID, channel mask, etc.) all without managing multiple versions of the stack libraries.

* Exclusive ZigBeeNet feature and/or enhancement

Sample User Applications

- ZigBeeNet demo
- Throughput measurement app
- Latency measurement app
- Mesh routing demo
- Wireless UART
- SerialNet AT commands (binary only)
- SerialNet Extensions

Additional sample applications are available for download in MeshNetics Customer Support Center

Developer Environment

Eclipse IDE, AVR Studio, GNU gcc tool chain or the industry-standard IAR compiler tools.

MeshNetics

Easy Wireless for Things

Stack Parameters and Performance*

Parameter	Value	Notes
application payload throughput	91 kbps	maximum packet payload, peer to peer configuration
time to send a packet	2 ms	
time to receive a packet	1 ms	
time to encrypt/decrypt a packet	TBD	maximum packet payload
one hop latency	6 ms	under default CSMA parameters
stack wakeup time	850 µs	external interrupt to application
minimum active period for sleeping devices	11 ms	wakeup, connect to router, send 1 packet, and return to power save mode
size of stack in flash/RAM (gcc toolchain)	94 KB/6 KB	RAM consumption based on 7 device neighbor table, 6 end devices and 2 routers per router device, and route table size of 3
size of stack in flash/RAM (IAR toolchain)	TBD	

* Prelimanary information, stack parameters and performance are subject to change

Availability, User Support & Training

ZigBeeNet is available as part of MeshNetics ZigBit Development Kit and MeshNetics ZigBit Amp Development Kit. Users with Complete support package are entitled to 1 year of free ZigBeeNet software upgrades, professional application design consultation, and access to online customer service center with a direct hotline to our software and hardware experts. All current eZeeNet customers are encouraged to switch to ZigBeeNet. MeshNetics will provide eZeeNet to ZigBeeNet application porting assistance under the terms of a user's current support agreement.

If you wish to attend one of our regularly scheduled hands-on training seminars, please email training@meshnetics.com for information on pricing and training locations. Our trainings are designed to jump start your development effort, and teach you everything you need to design successful wireless products with ZigBeeNet and ZigBit.

Not yet a customer, but have a technical question about ZigBeeNet? You are welcome to contact us at support@meshnetics.com.

Licensing

ZigBeeNet is available under a royalty-free, non-transferable, commercial license, which is included with every MeshNetics Development Kit (unless specified otherwise in your SLA). For commercial licensing on platforms other than those listed above or porting to additional platforms, please contact our sales specialists at sales@meshnetics.com

MeshNetics

EMEA Am Brauhaus 12 01099, Dresden, Germany Tel: +49 351 8134 228, Fax: +49 351 8134 200 E-mail: info@meshnetics.com

USA 5110 N. 44th St., Suite L200 Phoenix, AZ 85018 USA Tel: +1 (602) 343-8244 Fax: +1 (602) 343-8245 E-mail: info@meshnetics.com

www.meshnetics.com

Russia Office

9 Dmitrovskoye shosse, Moscow, 127434, Russia Tel: +7 (495) 725-8125 Fax: +7 (495) 725-8116 E-mail: info@meshnetics.com

Doc. M-252~08 v.1.0