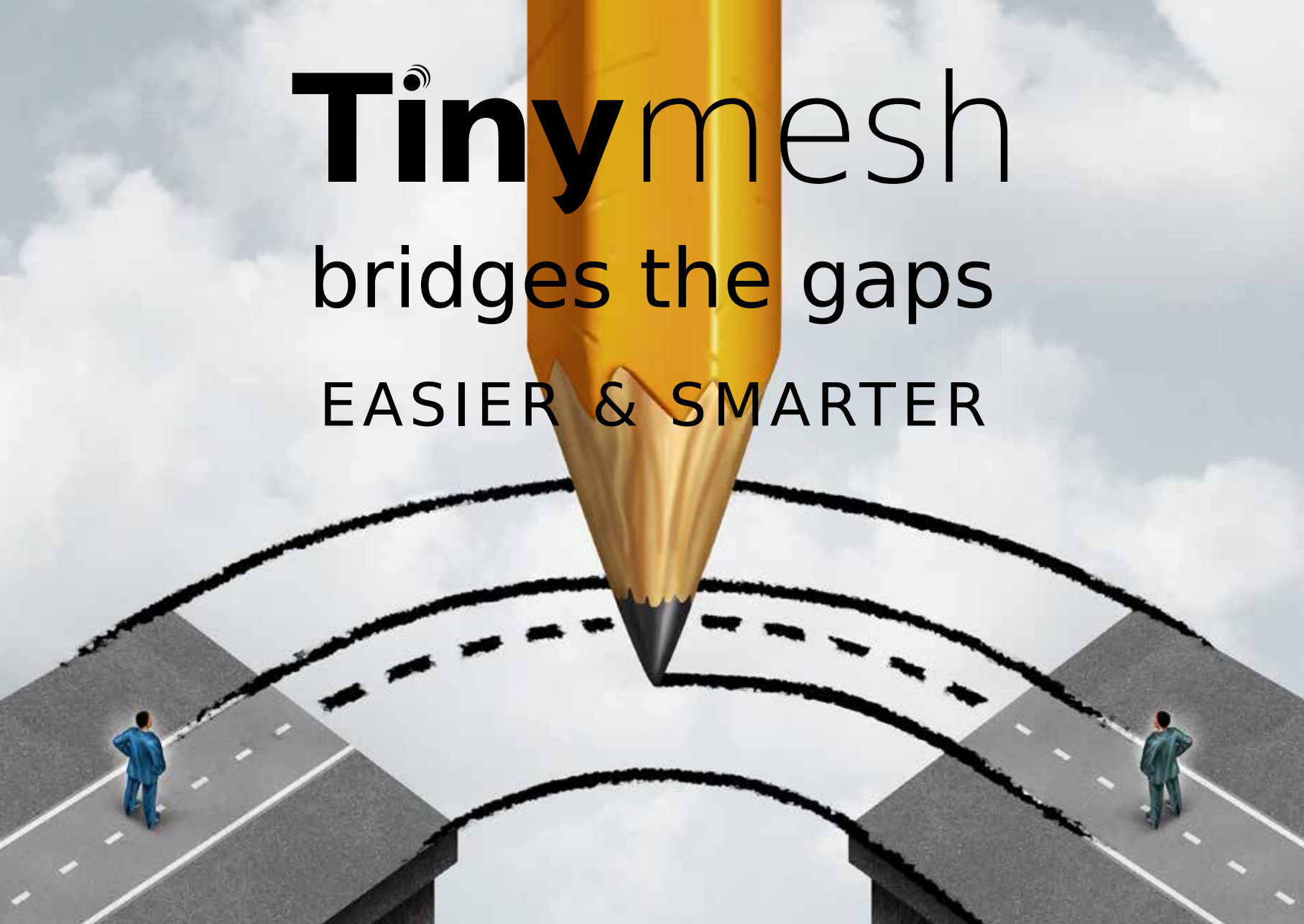


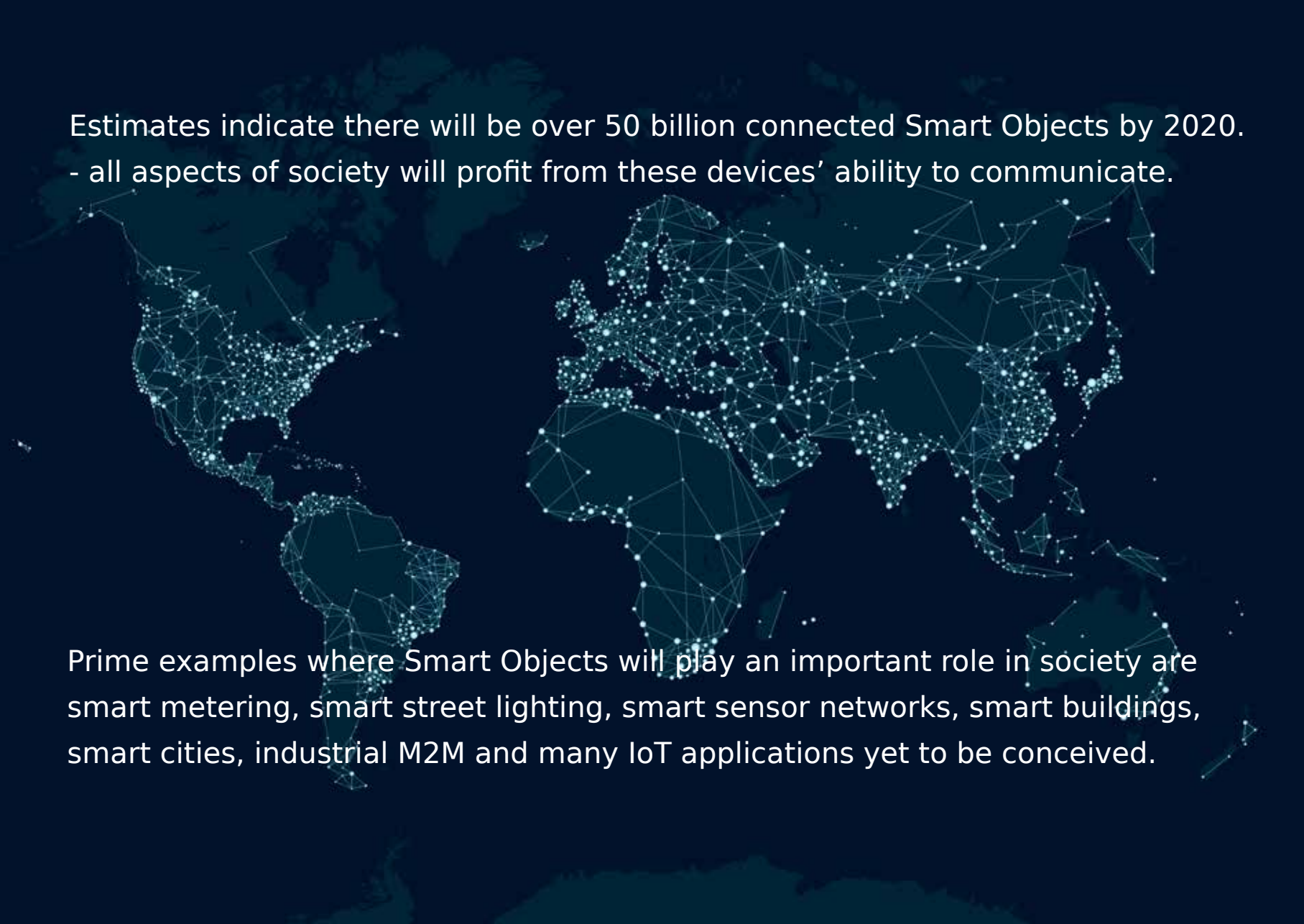
# Tiny mesh

bridges the gaps

EASIER & SMARTER



Estimates indicate there will be over 50 billion connected Smart Objects by 2020.  
- all aspects of society will profit from these devices' ability to communicate.

A world map where the continents are outlined by a network of glowing blue dots and lines, representing a global network of smart objects. The dots are concentrated in major population centers and urban areas, with lines connecting them to form a complex web. The background is a dark, textured blue.

Prime examples where Smart Objects will play an important role in society are smart metering, smart street lighting, smart sensor networks, smart buildings, smart cities, industrial M2M and many IoT applications yet to be conceived.

## Smart Objects offer huge potential, but there are huge gaps to be bridged.

It is not until an object can talk and listen and action messages received that it becomes a Smart Object. Until now, the first gap has been to develop an uncomplicated way to take the information the object has and interface this information to a suitable carrier, or Smart Object Network, so that information can be transmitted not just back to the host, but bidirectionally.

Until now, the second gap has been to develop a complete infrastructure to transport all the potentially high resolution information going to and from all the hundreds or thousands upon thousands of Smart Objects you may have in your Smart Object Networks, in a secure and timely fashion. Such an infrastructure is not complete without an uncomplicated way to deliver, receive and store these huge amounts of data in a meaningful format at both ends.

Until now, the third gap has been to develop an uncomplicated way to rapidly prototype and bring to market applications that make use of the information generated by Smart Objects. Information you can use to save costs and trigger actions, reports and revenues by monetizing your services.

Until now, anyone wanting to take advantage of the huge potential of Smart Objects has either had to try to bridge all three gaps alone, or seek out three totally separate sources and do the work of integrating these.

That was before Tinymesh™

Tinymesh™ is specifically designed for applications that need to transport short, technical messages, such as control commands, instructions, conditional responses, metered data, measurements and similar types of information.

Tinymesh™ is a complete, uncomplicated, out-of-the-box solution designed to make all kinds of objects smart and connect you to them - anywhere in the world, no matter how isolated they may be.

# Tinymesh

EASIER & SMARTER

# Tinymesh™ CLOUD SERVICE



## Your Business Application

Make use of the information generated by your Smart Objects. Information that can save costs and trigger actions, reports and revenues by monetizing your services.

## Rapid Prototyping and Roll-out

Like many others, at Tiny Mesh we think of The Internet as The Cloud. We offer a Cloud Service that is designed to help you rapidly prototype and bring to market applications that make use of the information generated by your Smart Objects AND transports all the information going to and from all the hundreds or thousands upon thousands of Smart Objects you may have in your Tinymesh™ Smart Object Wireless Networks, in a secure and timely fashion. The Tinymesh™ Cloud Service has five main components: The Tinymesh™ Workbench, the Tinymesh™ API, Tinymesh™ Cloud Connectivity, Tinymesh™ Connector Software and Tinymesh™ Gateways.

## Tinymesh™ Workbench

The Tinymesh™ Workbench is a ready to use control panel built on Web 2.0 frameworks and runs in your browser. It provides a real-time overview of all your Tinymesh™ Wireless Networks. All the capabilities of the Tinymesh™ Cloud Service are readily available in an easy-to-use graphical web-interface. Rapidly prototype and build your own application by getting data from the API that you can use to build your own application.

- User and security management
- Dashboard for your Tinymesh™ Wireless Networks and Smart Objects
- Real-time query capabilities
- Tools deployment monitoring

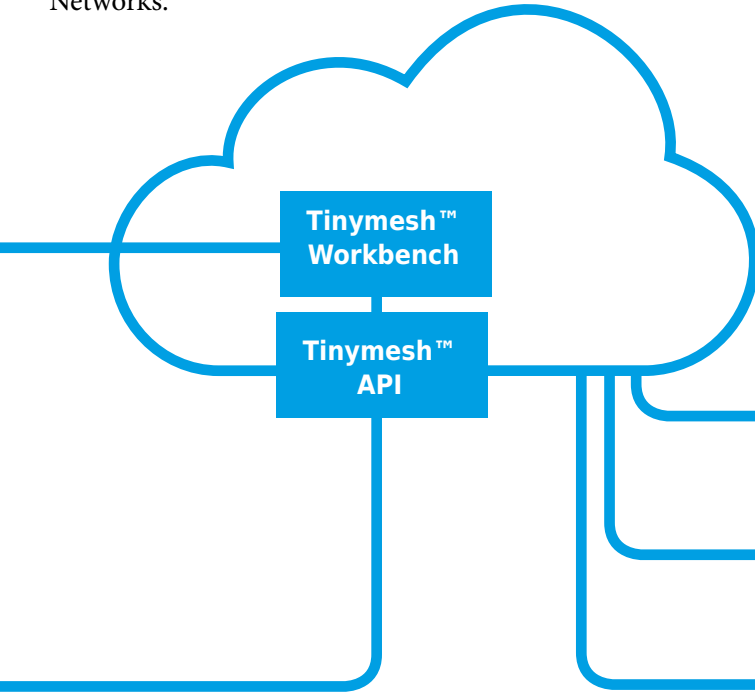
## Tinymesh™ API

Traditional device communication uses serial ports or involves electrical signals. With the Tinymesh™ Cloud Service you can interact through a modern REST-API, sending or retrieving packets. By describing your application using REST methods you can integrate Tinymesh™ with your favorite technology.

- Quickly get an overview of all your Tinymesh™ Smart Objects
- Configure any Tinymesh™ Smart Object right from your browser
- Monitor the state of your Tinymesh™ Smart Object Wireless Networks
- Easily integrate with third-party services

## Tinymesh™ Workbench

Enables rapid development, testing, configuration and support of your Tinymesh™ Smart Object Wireless Networks.



## Tinymesh™ API

Connects your application to the Tinymesh™ Cloud Service.

Simplifies interfacing to servers and databases, and eliminates many implementation problems and operational costs.

## Tinymesh™ Cloud Connectivity

An uncomplicated way to transport huge amounts of data passing between your Business Application and your Smart Objects. Supports a virtually unlimited number of Tinymesh™ enabled Smart Objects by supporting multiple Tinymesh™ Smart Object Wireless Networks through multiple Tinymesh™ Connectors and Gateways. Traditional DCUs (Data Concentrator Units) are replaced by Tinymesh™ Connectors that feed data to a single central concentrator in the Cloud.

- Built in end-to-end security
- Supports redundancy
- Supports retry
- Supports buffering
- Supports data storage



## Tinymesh™ Connector Software

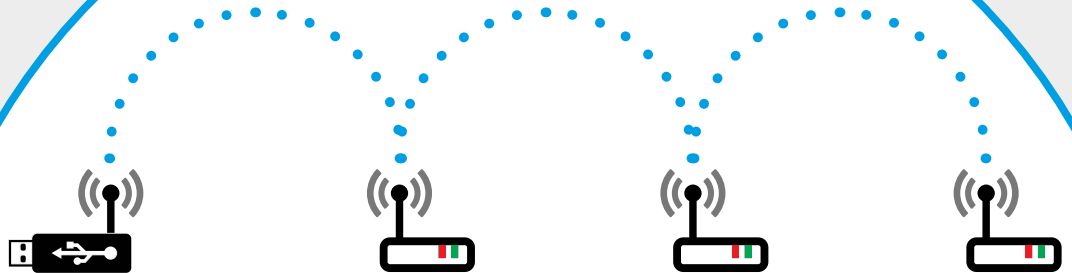
The Tinymesh™ Connector Software ensures safe and reliable data-transport between your Tinymesh™ Wireless Networks and the Tinymesh™ Cloud Service.

A flexible message bus allows Tinymesh™ Connector Software to easily be extended with third party functionality when needed.

- Transparent data-transfer logic
- Flexible plugin system using the message bus
- Seamlessly integrates Tinymesh™ USB Gateways with the Cloud Service

# Tinymesh™

## SMART OBJECT WIRELESS NETWORKS



### Tinymesh™ Connector Software

Tinymesh™ Cloud Service to Tinymesh™ Smart Object Wireless Network interface.  
Use with Tinymesh™ USB Gateways or your own Tinymesh™ Gateway Board for direct connectivity.

### Tinymesh™ Smart Object Wireless Networks

Self-forming, self-optimizing, self-healing multi-hop mesh networks built with Tinymesh™ RF Transceivers embedded in your Smart Objects.

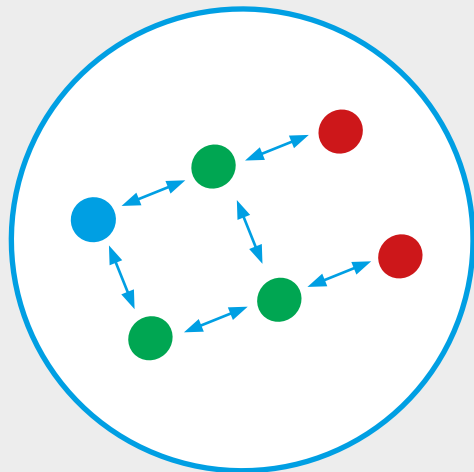
### Reach the most isolated places

As an alternative to the Tinymesh™ Connector Software and USB or your own Tinymesh™ Gateway Board, you can use a Tinymesh™ GPRS modem access point, readily available as an integrated unit with a slot-in Tinymesh™ Card in Gateway mode to facilitate easy connection between your application and your Tinymesh™ Wireless Network via the Tinymesh™ Cloud Service.



## Maximum flexibility

Each Tinymesh™ enabled Smart Object is user configurable for Gateway, Router or low-power End Node operation.



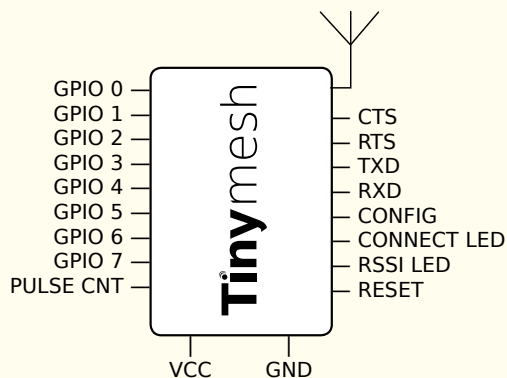
- Gateway
- Router
- End Device

## Tinymesh™ Multi-hop Protocol Stack

Tinymesh™ firmware includes the Tinymesh™ multi-hop protocol stack. This is a full-function, secure and robust multi-hop wireless mesh protocol stack for remote data collection and two-way control. It includes features that eliminate the need for an additional micro-controller. With Tinymesh™ you get:

- Bi-directional wireless communication
- Self-forming, self-optimizing and self-healing capabilities
- Flexible input/output control
- Analog, digital, PWM, pulse counter and serial ports
- Individual, Group or Broadcast addressing
- Transparent serial or packet mode communication
- AES 128 encryption
- Configurable sleep mode and End Device operation

# Tinymesh™ PROTOCOL STACK



## I/O features

- Configurable digital input and output and analog inputs
- Dimming control (0-100% PWM)
- Transparent Wire Replacement or packet communication
- Serial Port with bit rates to 230,400 bps, full software and hardware handshake
- Pulse counter with configurable de-bounce timing, sampling intervals, trigger hysteresis and detection feedback output
- Time generated, input level triggered and event triggered status messages
- Serial Data Streaming support with block counter function
- Locater Function for asset tracking applications
- Polled or triggered alerts
- Input and Output configurations settable through network commands

## No micro-controller needed

Tinymesh™ enabled Smart Objects can be directly connected and controlled by a Tinymesh™ RF Transceiver with no additional micro-controller or firmware needed.

Tinymesh™ has built-in network configurable I/O capabilities that include analog, digital, serial port, pulse counting and dimming functions.



## Perfect for Smart Metering

Tinymesh™ can interface directly to the serial port of energy meters, allowing meters to go online with minimal effort. Transparent mode operation allows direct transition from wired MODBUS to wireless mesh without rewriting a single line of code.



### HW features

- Selectable Gateway, Router or low power End Node configuration
- Signal Strength LED and Network connection LED outputs for simplified field installation
- 256-byte serial data input buffer for MODBUS RTU compatibility
- Two-wire UART interface for easy RS 232/422/485 wire replacement
- Small size, available for SMD mounting or as Plug-in Board
- No external components
- Wide supply voltage range, 2.0 - 3.9V
- Connects to existing or new hardware without external MCU or additional firmware
- Built in temperature and voltage sensors

### RF/Stack features

- Embedded Tinymesh™ networking protocol with bi-directional RF data transfer
- Self-forming, self-healing and self-optimizing mesh network
- AES 128 encryption
- “Walk-by” mode for low power data logging and metering applications
- Group, Broadcast or Individual addressing modes
- Clustered Node Detection and Network Congestion Avoidance (CND/NCA™)
- RF Jamming Detection and Alarm, with alarm output and network alarm messaging
- Network Busy Detection for ad hoc networks with multiple, roaming Gateway Devices

### Perfect for Smart Street Lighting

Tinymesh™ is ideal for street lighting applications when large numbers of message hops, connection redundancy and multi-Gateway support are required for reliable operation. Together with the built-in configurable I/O and PWM dimming, Tinymesh™ provides a fully embedded control and monitoring solution. Set light dimming as a percentage value to the PWM output. Control on and off switching with a digital output. Monitor power level and tamper attempts directly with alarm-triggered inputs. Observe temperature and operational voltage with integration-ready Tinymesh™.

## Operate anywhere in any license free RF band

Tinymesh™ RF transceivers are pre-certified for operation worldwide in license free bands. Tinymesh™ transceivers are fully tested before shipping to customers. The benefits are:

- Little or no variance on delivered product
- Avoidance of yield problems and costs
- Regulatory compliance for every module
- No extensive testing needed at later stage
- Only functional tests need to be done to ensure your application is working properly



- Available for SMD mounting or as Plug-in Boards

## Choose a license free band:

License Free Band Selector / Requirements:	Tinymesh™ RF Transceiver
Conformity with EU R&TTE directive (EN 300 220, EN 301 489, EN 60950)	RC1140/80(HP)-TM
Conformity with regulations for operation under FCC CFR 47 part 15	RC1190-TM
Compliance with G.S.R.564(E) (G.S.R.168(E))	RC1170(HP)-TM
Compliance with EN 300 328 (Europe), FCC CFR 47 part 15 (US) and ARIB STD-T66 (Japan)	RC2500(HP)-TM
Compliance to IEEE 802.15.4.g PHY mode 0 encoding when configured for RF Data Rate 8	RC117x-TM & RC117xHP-TM
For Narrow Band applications meeting EN 300 220-2 requirements	RC17XXHP-TM

HP versions are only available for SMD mounting.

## Reach the most isolated places

Optional Tinymesh™ GPRS modem access points, readily available as an integrated unit with a slot-in Tinymesh™ Card in Gateway mode, facilitate easy connection between your application and your Tinymesh™ Wireless Network via the Tinymesh™ Cloud Service.

## Long Range Connectivity

Open up the full potential of your Smart Object Wireless Networks with Tinymesh™ Ultra Narrow Band. One of the many Tinymesh™ RF transceiver types available.



Choose the Tinymesh™ RF transceivers you want to embed in your Smart Objects:

- LP (Low Power)
- HP (High Power)
- Long Range, UNB-HP (Ultra Narrow Band - High Power)

Model ▶ Parameter	LP HP UNB-HP	RC1701HP-TM	RC114x-TM RC1740HP-TM	RC1760HP-TM	RC117x-TM RC117xHP-TM	RC1180-TM RC1180HP-TM RC1780HP-TM	RC1181TM	RC119x-TM RC119xHP-TM	RC2500-TM RC2500HP-TM	Unit
Frequency	LP HP UNB-HP	169	433 - 434 424 - 447	458-468	865 - 867 865 - 867	868 - 870 868 - 870 865 - 870	865 - 927	902 - 927 902 - 927	2400 - 2483 2400 - 2483	MHz
Channels	LP HP UNB-HP	13	17 173	239	15 15	18 18 94	83	50 50	83 83	
Data Rate	LP HP UNB-HP	0.3 - 100	1.2 - 100 0.3 - 100	0.3 - 100	1.2 - 100 1.2 - 100	1.2 - 100 1.2 - 100 0.3 - 100	1.2 - 100	1.2 - 250 1.2 - 250	1.2 - 100 1.2 - 100	Kbit/s
Max TX power	LP HP UNB-HP	27	11 14 / 27	14 / 27	11 27	11 27 14 / 27	11	11 27	1 18	dBm
Sensitivity 1.2 / 100 Kbit/s	LP HP UNB-HP	-118 / -102	-110 / -97 -118 / -102	-118 / -102	-110 / -97 -109 / -96	-110 / -97 -109 / -96 -118 / -102	-110 / -97	-110 / -97 -109 / -96	-105 / -89 -108 / -91	dBm
Supply voltage	LP HP UNB-HP	2.8 - 3.6	2.0 - 3.6 2.8 - 3.6	2.8 - 3.6	2.0 - 3.6 3.0 - 3.3	2.0 - 3.6 3.0 - 3.3 2.8 - 3.6	2.0 - 3.6	2.0 - 3.6 3.0 - 3.3	2.0 - 3.6 2.0 - 3.6	Volt
RX/TX Current	LP HP UNB-HP	31 / 407	24 / 35 31 / 318+63	31/297+72	24 / 37 24 / 560	24 / 37 24 / 560 31 / 297+72	24 / 37	24 / 37 24 / 560	25 / 27 30 / 155	mA
SLEEP Current	LP HP UNB-HP	0.6	0.3 0.6	0.6	0.3 3.4	0.3 3.4 0.6	0.3	0.3 3.4	0.4 1.3	uA
Temp. Range	LP HP UNB-HP	-30 to +85	-40 to +85 -30 to +85	-30 to +85	-40 to +85 -40 to +85	-40 to +85 -40 to +85 -30 to +85	-40 to +85	-40 to +85 -40 to +85	-40 to +85 -20 to +85	°C

HP versions are only available for SMD mounting.  
The use of RF frequencies, data rates, maximum allowed RF power and duty-cycles are limited by national regulations.

### Unique and innovative technology

The company behind Tinymesh™, Tiny Mesh AS of Norway, won the prestigious “Innovator of the Year” award, and has been nominated for the Rosing Smart IT Prize awarded by The Norwegian Computer Society. In the Smart IT category the jury emphasizes work where technology is an important prerequisite for energy efficiency or optimization of energy consumption, enabling improvement of existing processes or creating new or more sustainable businesses and processes.

### Easy integration

As well as Tinymesh™ RF transceivers for SMD mounting, Tinymesh™ Plug-in Boards for Smart Meters and other applications are available.



### Shortest possible in-design time

Required electrical connections are reduced to a minimum for easiest in-design and shortest time to market. For the minimum configuration all you need are:

1. VCC and GND
2. Single-pin antenna interface

### Simple Proof-of-Concept

A Tinymesh™ demo kit with a Tinymesh™ USB, the Tinymesh™ Connector Software and demo boards, is available for evaluation and development work. The kit provides out-of-the-box operation, enabling rapid evaluation, proof of concept and short in-design time.

### Focus on your core business

The powerful Tinymesh™ command structure and the versatile connection options let Tinymesh™ customers focus on their core business while relying on Tinymesh™ for secure and reliable connectivity in real-life environments.

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Smart Meters

Smart Street Lighting

Smart Sensor Networks

Smart Buildings

Smart Cities

Industrial M2M

IoT Applications

# Tinymesh

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