

SMART MESH NETWORK SUPPLY-CHAIN MONITORING



The clockwork operation behind the global economy

In **2018** the value of global goods traded was just under **19.5 trillion USD**.

14 million containers are traded globally every month - with a total volume of **169 million** containers annually.

Shipping is the engine behind the global economy. Making sure every product is safely & efficiently delivered from production to customer across the world - is the key for an optimized & growing economy.

How important is trade for the modern global economy? In 2018 the value of global goods traded was just under 19.5 trillion USD, that's an over 20% rise from 16.1 trillion USD just 10 years earlier.

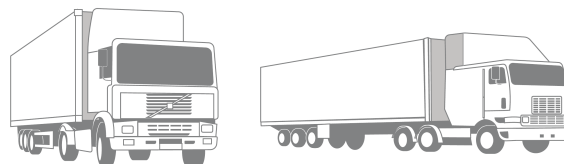
All this ever growing trade around the world requires massive logistical enterprises to run the show. Every product goes through a number of stages in its journey from production to customer, including local pickup, packaging, warehouse, journey to port, shipping, customs, journey to local distribution center and finally journey to customer doorstep.

Here's the problem

The long and complex logistical process of international shipping is not managed by one company. Which is a good thing.

But that means there's almost no control over the journey as a whole. Shipping and logistic companies are used by producing companies to haul their products around the globe, with little to no insight into how their product reacts to the different environments it passes through.

This goes both ways. Shipping and logistic companies manage goods of hundreds of companies on a daily basis, without the ability to closely control the state of the goods at all times. If a container arrives with damaged goods, there's no way of telling how it happened and at what stage of the journey.



Supply-Chain Management, Monitoring & the Mesh

Not so long ago, goods were had to be transported while producers and customers both had nothing to do but hope they arrived on time and in good condition. In many cases this is good enough. With more sensitive goods such as cars (which dominate a large chunk of global trade), food products, certain chemicals, electronics, machinery, and many others - monitoring the supply chain is crucial.

In recent years technology has taken a massive leap forwards. With implementing mesh networks of sensors across cargo packages or containers, the producing company, shipping service, and end customer can all monitor the state and conditions of the goods in real-time. This is especially important for making alterations to the supply-chain based on the data, understanding the state of the goods as they arrive and for damage control.

The key benefactions of such a system would be shipping, logistical and cargo delivery services who can provide this data in real-time as an added feature - aimed at reassuring both sides if the supply-chain.



Mesh Networks connected by powerful **Edge Gateway** devices are easy to deploy & maintain - at a relatively low price point.

ENVIRONMENT CONDITIONS

Some materials are sensitive to different temperatures, humidity or pressure, or could be sensitive to sudden or extreme changes in these conditions.

GEOGRAPHICAL LOCATION

Possibly the most basic data that can be gathered through the journey is the physical location of the goods. Tracking each step of the journey and making sure everything is in the right place at the right time.

DAMAGE CONTROL

An important set of sensors includes gyro, vibration, air pressure & others - aimed at monitoring any harm to the goods. These check for container falling, breaking or shaking - which could damage the cargo.

This is how it works

The basic network mesh at ground level consists of modules or sensor arrays, connected to the Wirepas Mesh as hop points, and at the heart of the mesh is the SolidSense gateway. The mesh provides the most optimal way for a large number of module to communicate over a large range, and by utilizing a high performance gateway, data can be locally processed and encrypted before transmission to the cloud.

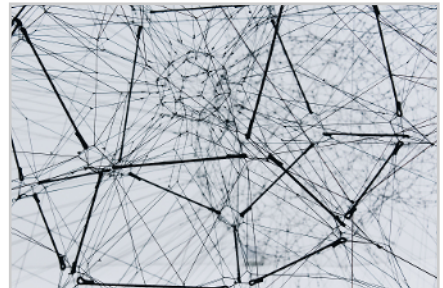
1. SENSORS

Each container or package has an array of internal/external sensors. These depend on needs and type of goods - ranging from humidity, motion, temperature, air pressure, location and so on.



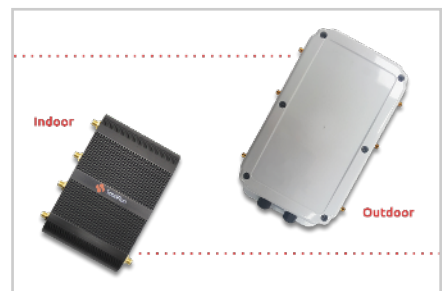
2. MESH NETWORK

Sensor arrays are all connected to a single network mesh. This allows data to travel at the most optimal way, as each module is also a router - creating a fast network with a much wider range than a simple wireless network.



3. GATEWAY

At the heart of the network mesh is the SolidSense gateway which collects data from all modules in real-time, processes, encrypts, and sends it to the cloud for monitoring and managing.



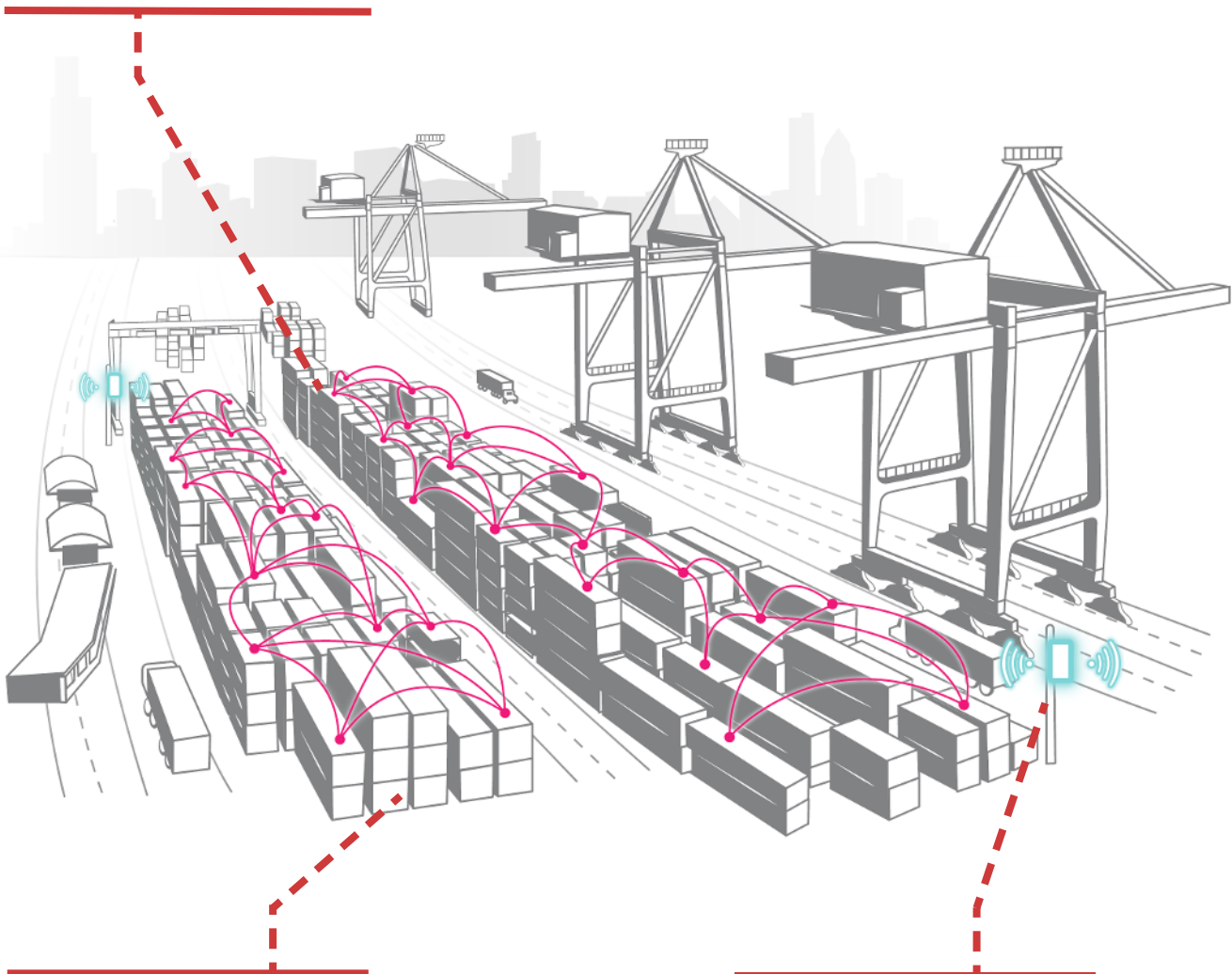
4. DEVICE & NETWORK MANAGEMENT

The higher cloud level offers sophisticated gateway and network management tools, including Wirepas's WNT tool and Kura remote device management. This allows users simple integration, data monitoring and remote management



Container Deployment of Mesh Network

Sensor arrays fitted to inside and/or outside of containers. Different types of sensors, depending on client's needs, all have the Wirepas Mesh framework installed for communication and data transferring.

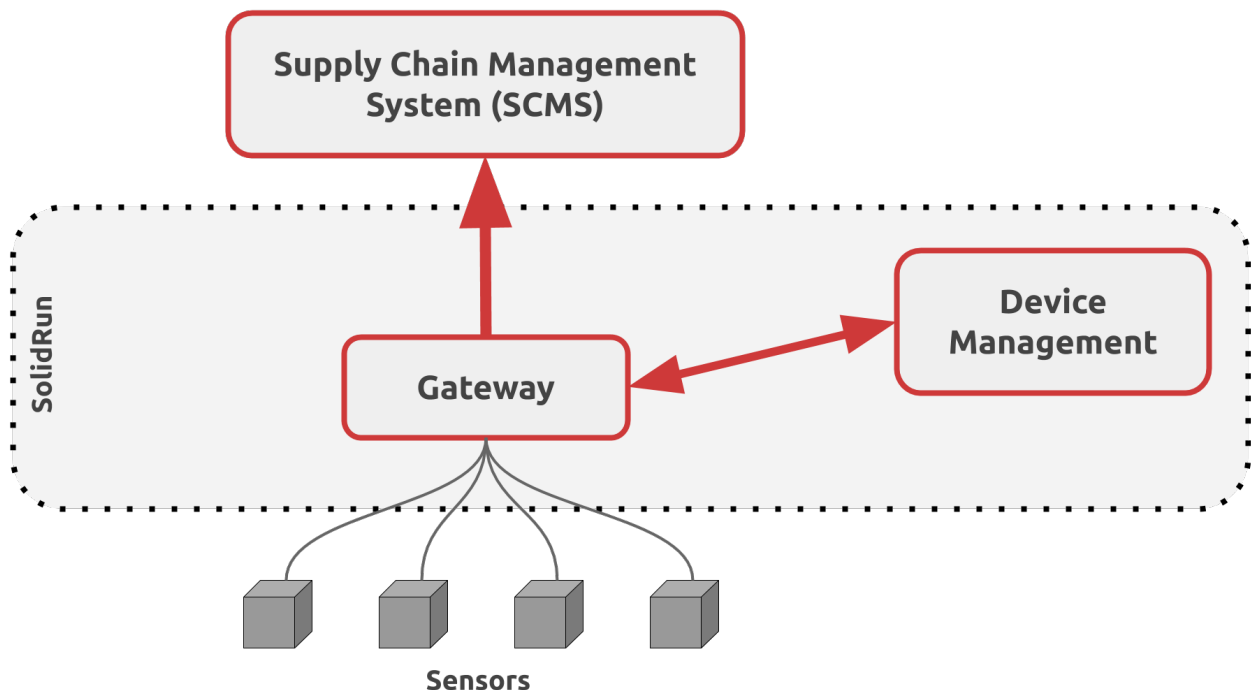


Each sensor in the sensor clusters acts as a hop station for the **Wirepas Mesh**. These transfer data automatically between modules - eventually reaching the SolidSense gateway in the fastest and most optimized route.

The **SolidSense** gateway receives all the data from the connected mesh network and transmits aggregated data packs in periodical time frames to the cloud for monitoring, managing and storing.

Value of the SolidSense Supply Chain System

SolidSense was developed to offer both modularity and simplicity in implementing complex automated networks. The combination of a rich software offering with the SolidSense cloud applications, delivers a ready to use IoT infrastructure for industrial and business applications.



SOLIDSSENSE GATEWAY

The SolidSense gateway is the focal point of the system. It features a rich software offering for effortless system integration. SolidSense is designed to offer robust compute with a wide variety of connectivity options, housed in a reliable outdoor industrial grade enclosure.

DEVICE MANAGEMENT

SolidSense is offered with an added level of cloud based device management which allows for centralized control over modules across the network.

SUPPLY CHAIN MANAGEMENT

The highest level of the supply chain monitoring system is the management platform, which integrates all collected data onto a user created management software platform. By harnessing the variety of flexible SW solutions provided with SolidSense, makes robust system integration very simple.

SolidSense N6 Edge Gateway



Indoor

- Ethernet RJ45
- WiFi and BT 2.0
- Dual BLE 4.2
- LTE CAT4/CAT1 + GPS
- 4 x USB 2.0
- up to 2GB DDR3
- eMMC
- RS-485
- 120x80x30mm

SolidSense N6 Indoor Edge Gateway is an enterprise Internet of Things gateway designed for servicing a local network of IoT devices with a range of solutions and business applications.



Outdoor

- Ethernet RJ45
- WiFi and BT
- BLE 4.2/5.0
- LTE CAT4/CAT1 + GPS
- USB 2.0
- up to 2GB DDR3
- eMMC
- 222x146x55mm

SolidSense N6 Outdoor Edge Gateway is a robust gateway designed for rugged, industrial & outdoor applications offering a feature-rich high connectivity platform.

Wirepas Mesh

The Wirepas Mesh framework provides the devices connected to the network with decentralized, autonomic and intelligent communication with the gateway. End-devices, such as sensors, become intelligent with the ability to decide on the optimum frequency and energy usage with which to communicate with the gateway and network in real-time.



Another key feature of the Mesh technology is adaptive multi hopping, making every device in the network a possible router for communication. Devices choose the best way to send information with the option of using multi hop routing, the role of each device isn't predefined – instead it changes automatically in real-time, depending on the needs of the network around it.

SolidRun is a partner and licensee of Wirepas, thus enabling shipping of SolidSense gateways pre-flashed from factory with Wirepas software – simplifying the development process and business model.

About SolidRun

SolidRun is a global leading developer of embedded systems and network solutions, focused on a wide range of energy-efficient, powerful and flexible products. Our innovative compact embedded solutions are based on ARM and x86 architecture, and offer a variety of platforms including SOMs (System-on-Module), SBCs (Single Board Computer) and industrial mini PCs.

We offer a one-stop-shop for developers and OEMs, providing a complete service from hardware customization, to software support and even product branding and enclosure design. Our mission is to simplify application development while overcoming deployment challenges, and so we can proudly offer our customers faster time-to-market and lower costs.



NRE Projects



Software Support



Project Support



High Production Standards

Powerful Global Partnerships



SolidRun reserves all rights to this document and the information contained herein. Products, names, logos and designs described herein may in whole or in part be subject to intellectual property rights. The information contained herein is provided "as is". No warranty of any kind, either express or implied, is made in relation to the accuracy, reliability, fitness for a particular purpose or content of this document. This document may be revised by SolidRun at any time. For most recent documents, please visit www.solid-run.com