Communicating with your hive using the Internet of Things
Connecting hivescales via LoRaWAN and The Things Network

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Introduction

Hive scales provide useful information about colony performance and nectar flow. Reporting data from electronic scales via the Internet allows remote monitoring, facilitating hive management.
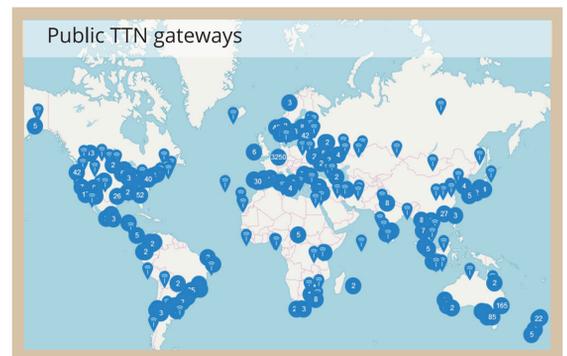
The Internet of Things embodies sensors and smart devices networked together through connection to the 'Internet cloud'. It allows interactions and intelligent responses to be made to sensor readings and events. Connection to the Internet can be achieved by both wired and wireless technologies.

LoRaWAN

LoRA (Long Range) radio tranceivers communicate using unlicensed radio spectrum. They have low power requirements making them suitable for battery powered sensor transmissions. Arduino microcontroller compatible boards with integral LoRa modems are readily available, allowing assembly of low cost devices.

The Things Network (TTN)

TTN[1] is an open source project that uses LoRaWAN (wide area network protocol) to connect devices with public network gateways. Many thousands of existing TTN gateways are available for any user to transfer data to the 'Internet cloud'. Each gateway allows connection with many nodes.


Public TTN gateways

Internet cloud

Hive Scale

A Sodaq Explorer™ microcontroller[2] was connected to 4 x 50 kg load cells[3] using an HX711 Load Cell Amplifier[4]. Power was supplied with a small solar panel via a LiPo battery. The microcontroller is put into a low current consumption 'sleep' mode between measurements. The load cells are mounted in pairs to support the hive bottom board.

Messages are transmitted to any within-range TTN gateway and decoded by the specified TTN application.

LoRa Range

LoRa radio signals can be absorbed and reflected by obstructions and thus range is dependent on radio "line of sight". In typical urban environments, range is 2-3km but 5-7km can be achieved in rural or unobstructed areas. The map shows signal reception from a gateway located on a multistory building in Melbourne with over 4km reception.

Results and Discussion

The hivescale successfully transmitted hive weights to a TTN gateway throughout the trial. The gateway for the test was located less than 1km from the device so this was well within reception range.

Throughout the trial the solar panel comfortably maintained battery charge, indicating that battery life is effectively unlimited with just a few hours sunshine per week.

Hourly weights were transferred via TTN and recorded using ThingSpeak[5]. Data were collected over the course of 5 weeks during the Australian summer. There were approximately 700 readings, recording an increase in total hive weight of 8.8 kg representing a significant nectar flow.
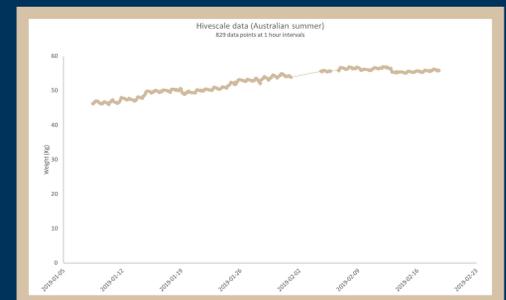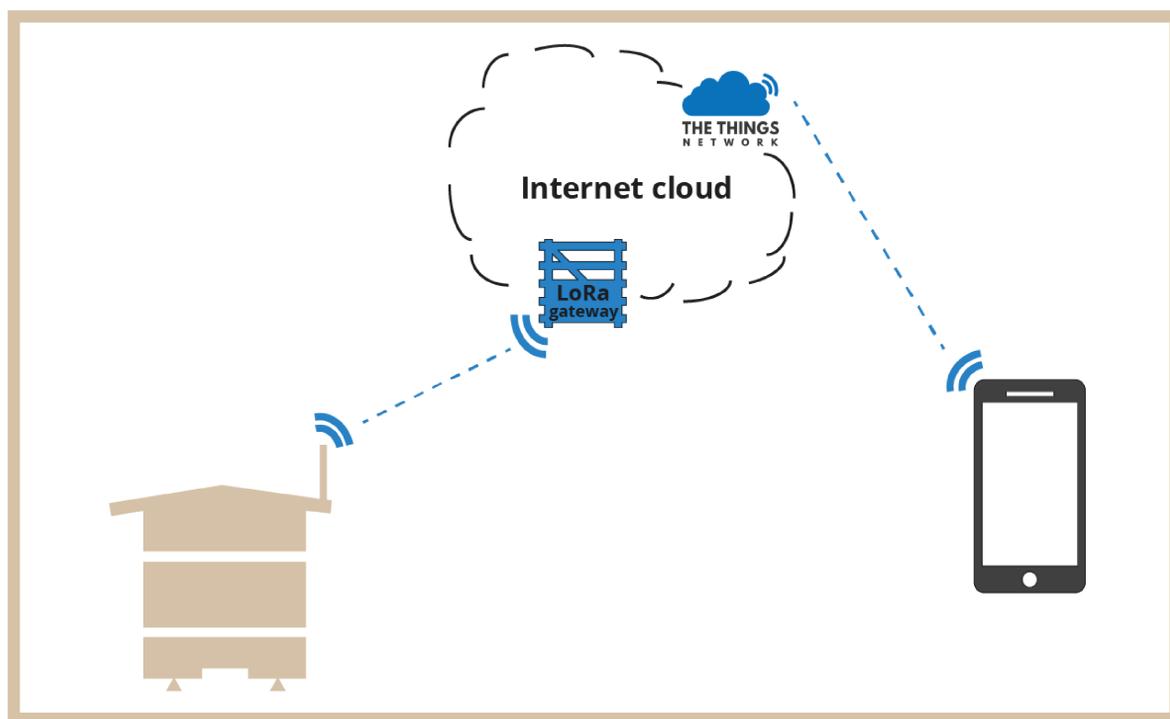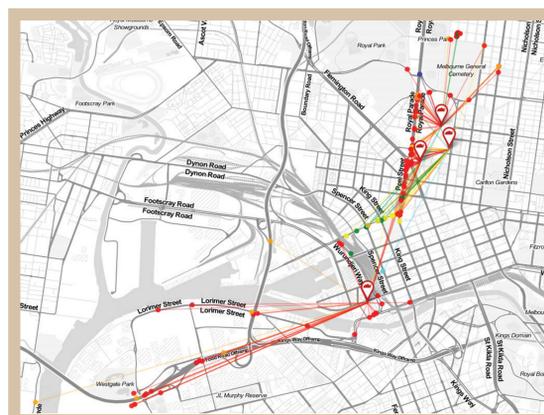

The hivescale described with its LoRa communication capability provided a low cost and practical solution for remote monitoring of hive weight. These data are readily accessible via a mobile phone or web browser.

LoRaWAN communication is reliable and affordable. It offers an alternative to cellular or WiFi networks and is particularly suited for low power battery devices.

Furthermore, LoRaWAN can provide a cost-effective solution in remote areas where cellular network communications are unavailable, since data from a large number of hives within a few km radius can be collected by a LoRaWAN gateway connected to the Internet with a satellite modem.

1 The Things Network (www.thethingsnetwork.org)

2 Sodaq, Hilversum, The Netherlands (www.sodaq.com)

3 Guangdong SouthChinaSea Electronic Measuring Technology (www.chinesesensor.com)

4 Sparkfun, Colorado, USA (www.sparkfun.com)

5 ThingSpeak is an IoT cloud storage platform (www.thingspeak.com)

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