EE4500 – Design Project

LoRaWAN & The Things Network

JAMES COOK UNIVERSITY
AUSTRALIA

LoRaWAN

- Introduction to LoRaWAN
- LoRaWAN Architecture
- Key Features
- Technical Details
- Use Cases
- Summary

What is LoRaWAN?

- Long Range Wide Area Network (LoRaWAN)
- A low power, wide area networking protocol
- Designed for IoT applications

Why LoRaWAN?

- Long range communication
- Low power consumption
- Secure data transmission
- Supports a large number of devices

LoRaWAN Architecture

- End Devices
- Gateways
- Network Server
- Application Server

LoRaWAN Architecture

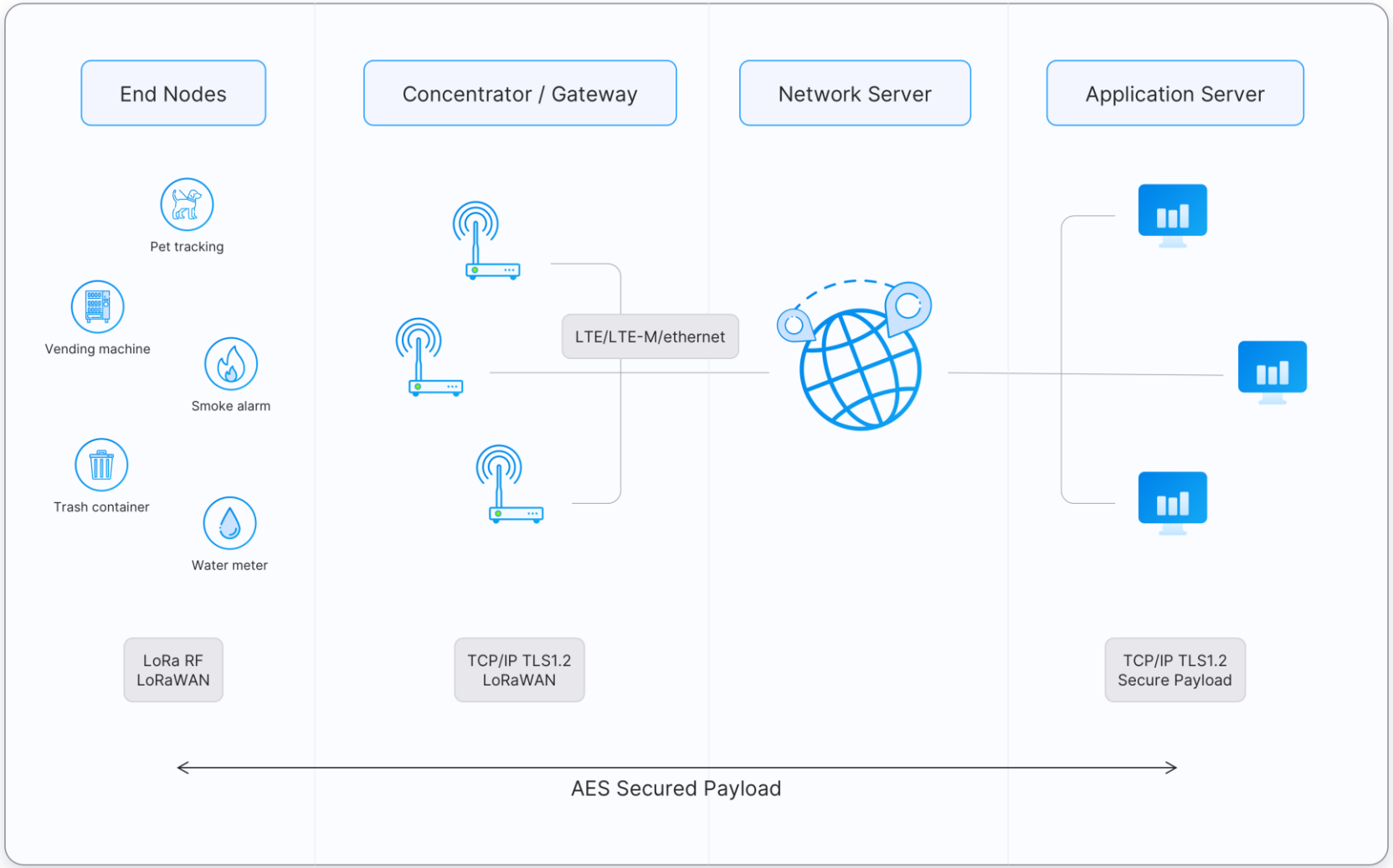
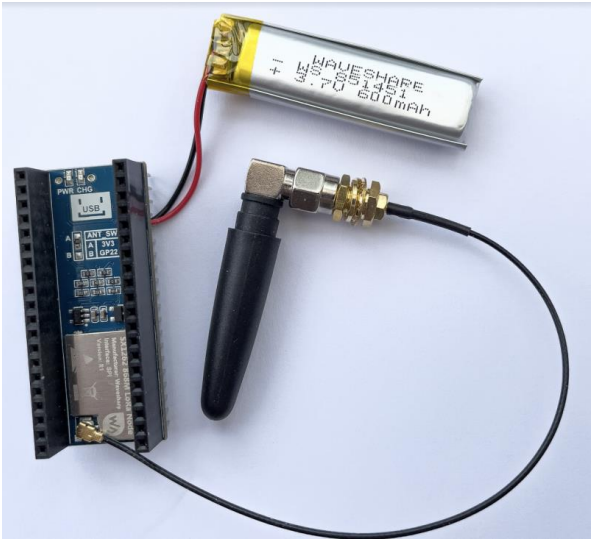


Image: The Things Network

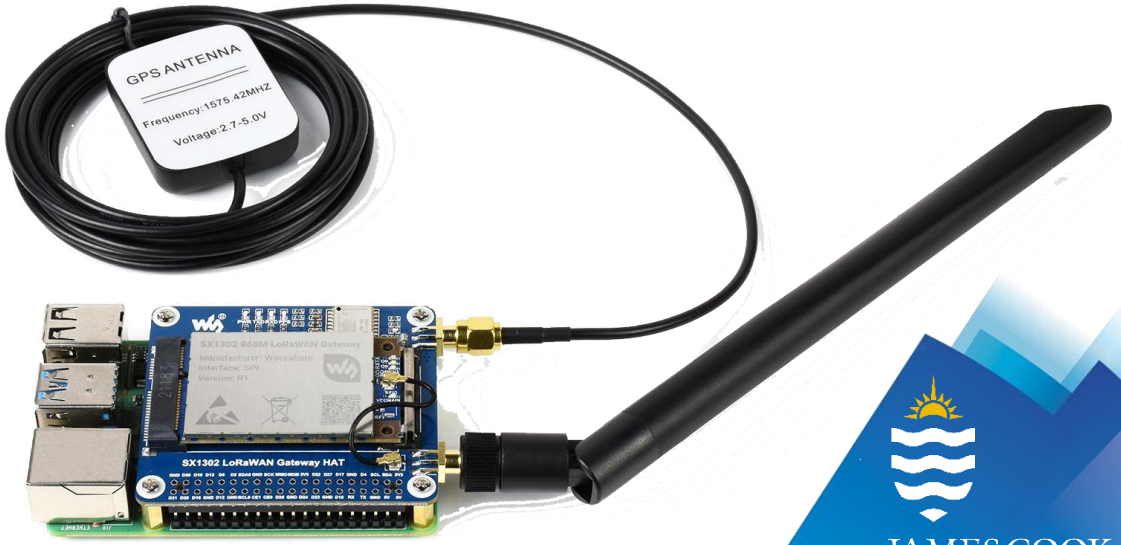
End Devices

- Sensors or actuators
- Communicate with gateways
- Low power and long battery life



Gateways

- Act as a bridge between end devices and network server
- Forward data from end devices to network server



Network Server

- Manages the network
- Handles data routing and security
- Ensures reliable communication

Application Server

- Processes and stores data
- Provides data to end-user applications

Key Features of LoRaWAN

- Long Range:
  - Communication up to 15 km in rural areas
- Low Power:
  - Devices can last up to 10 years on battery
- High Capacity:
  - Supports millions of messages per base station
- Security:
  - End-to-end encryption

Technical Details

- Frequency Bands:
  - Operates in unlicensed ISM bands
  - Different frequencies for different regions (e.g., EU, US, AU)
- Modulation:
  - Chirp Spread Spectrum (CSS)
  - Robust to interference
- Data Rates:
  - Adaptive data rates for optimal performance

LoRa Chirp

Watch:

https://www.youtube.com/watch?v=dxYY097QNs0&t=1s

Spreading Factors in Australia

- LoRa operates in the 915-928 MHz band in Australia
- Spreading Factors: SF7 – SF12

Use Cases of LoRaWAN

- Smart Cities:
  - Street lighting, waste management, parking sensors
- Agriculture:
  - Soil moisture monitoring, crop management
- Industrial:
  - Asset tracking, predictive maintenance
- Environmental:
  - Air quality monitoring, weather stations

Summary

- LoRaWAN is a key technology for IoT
- Offers long range, low power, and secure communication
- Versatile use cases across various industries

The Things Network & The Things Stack

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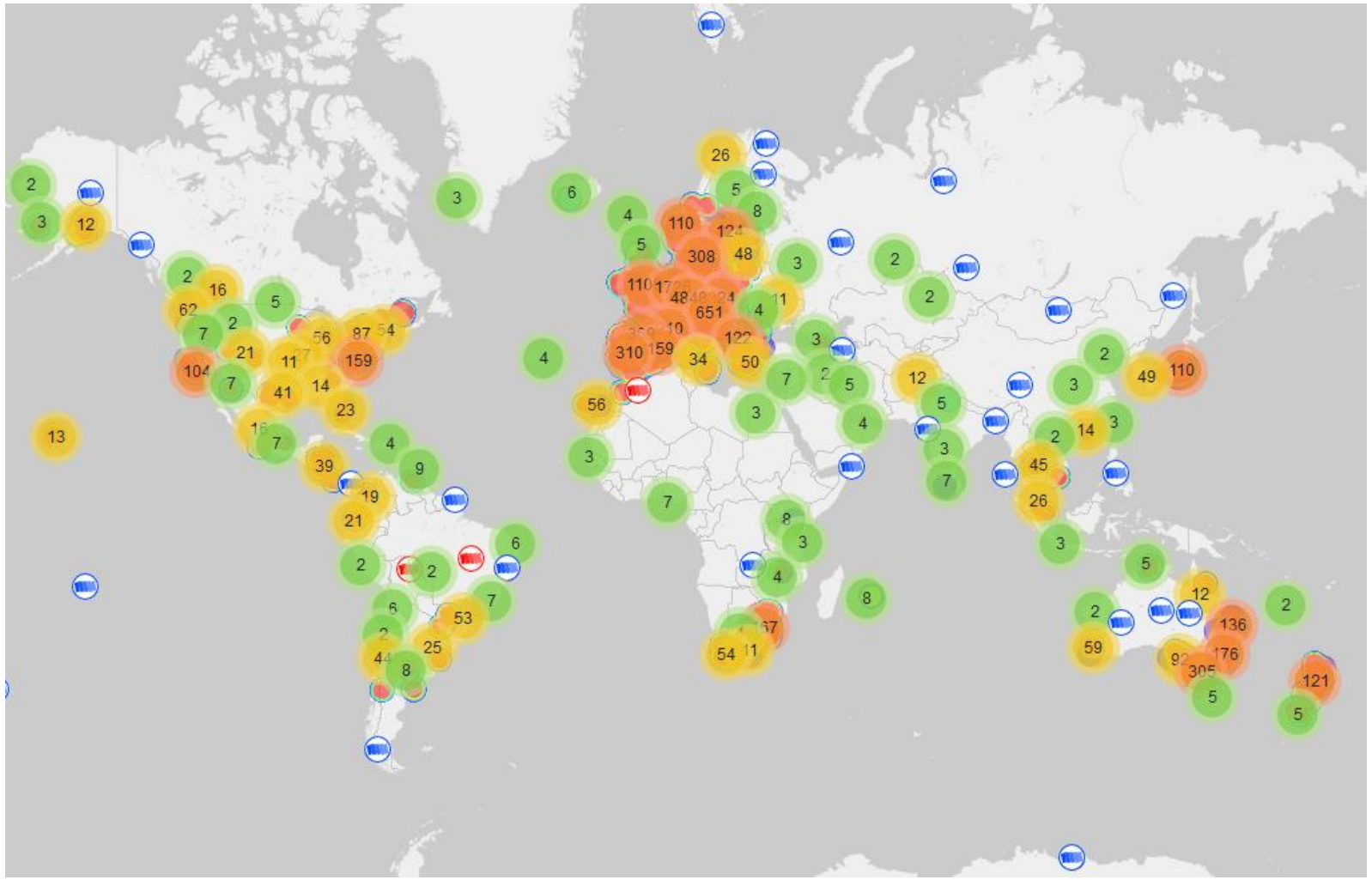
What is The Things Network (TTN)?

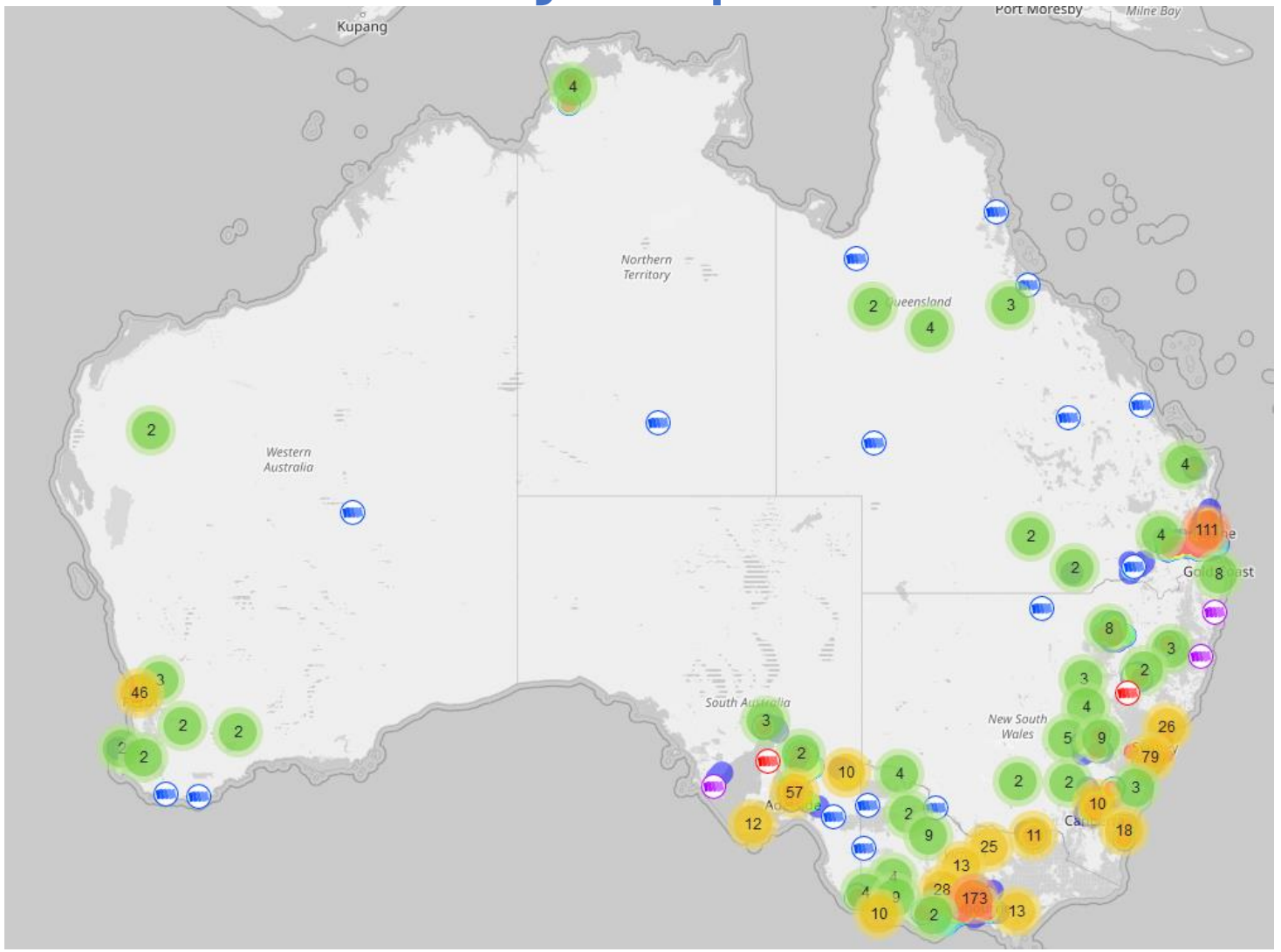
- A global, open, crowdsourced IoT data network
- Uses LoRaWAN technology
- Community-driven with thousands of contributors

TTN Global Gateway Map



TTN Coverage @ 16-Jul-2024 (ttnmapper.org)

TTN Australian Gateway Map



TTN Coverage @ 16-Jul-2024 (ttnmapper.org)

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Why The Things Network?

- Global coverage
- Open and free to use
- Large community support
- Rapid deployment for IoT solutions

Introduction to The Things Stack

- Next-generation LoRaWAN network server stack
- Developed by The Things Industries
- Offers advanced features and scalability

Key Features of The Things Stack

- Multi-tenancy
- End-to-end encryption
- Advanced security features
- Scalability for large deployments
- Integration with various cloud services

Architecture of The Things Stack

- Identity Server
- Gateway Server
- Network Server
- Application Server
- Join Server
- Console
- Command-line Interface (CLI)

Architecture of The Things Stack

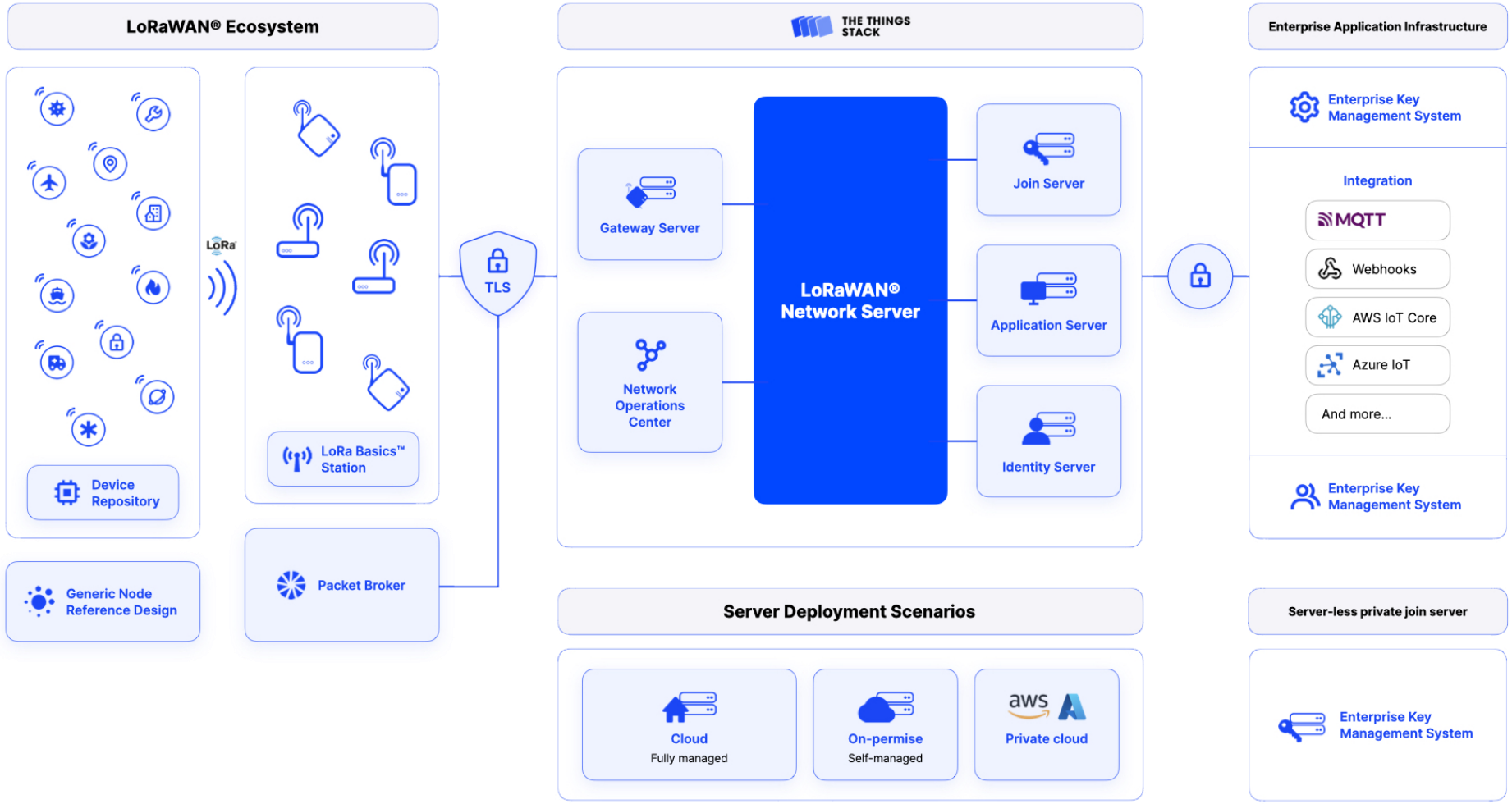
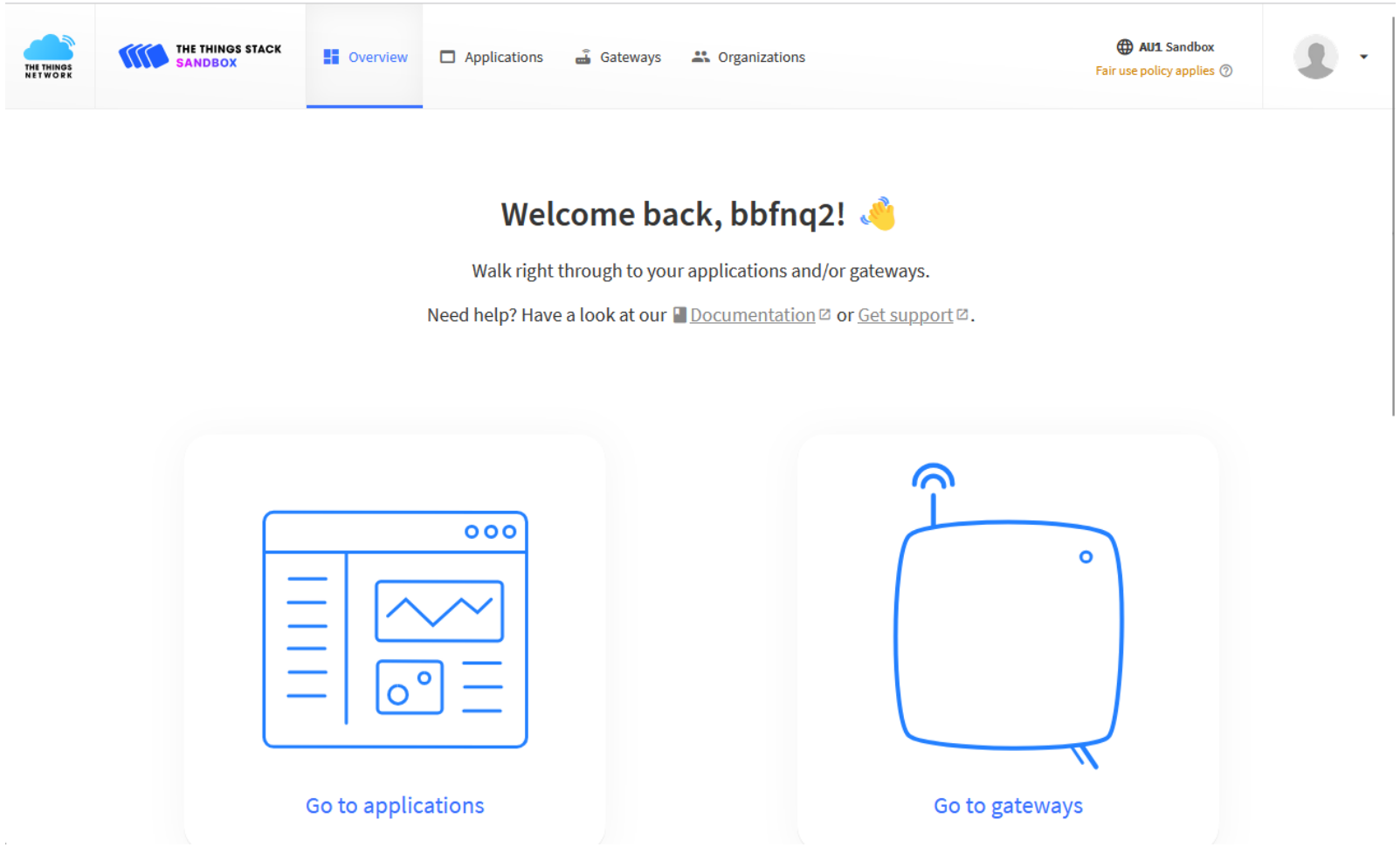


Image: The Things Induxtries

Management

- Console
  - Web-based interface for managing the network
- CLI
  - Command-line tool for advanced management and automation

Walkthrough



Summary

- The Things Network provides a global, open IoT network
- The Things Stack offers advanced features for scalable and secure deployments
- Friendly and helpful UI
- Versatile use cases across various industries

Next week
Business proposals

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