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EMPOWERING ENTERPRISE IOT WITH LORA & EDGE INTELLIGENCE

CONNECTIVITY CHALLENGES IN REMOTE MINE SITES

The primary challenge revolved around the reliable collection of sensor data in areas with limited or no network connectivity. Traditional solutions like Wi-Fi and GSM, reliable in urban settings, proved inadequate for the remote mine sites where our client operated.

Unreliable Connectivity:

- Remote mine sites lack consistent network coverage.

Wi-Fi & GSM Limitations:

- Effective in urban areas but fail in harsh, remote terrains.

Operational Impact:

- Inconsistent data flow affects real-time monitoring and decision-making.

Critical Parameters at Risk:

- Temperature, humidity, pH, voltage, wind speed, and dust.

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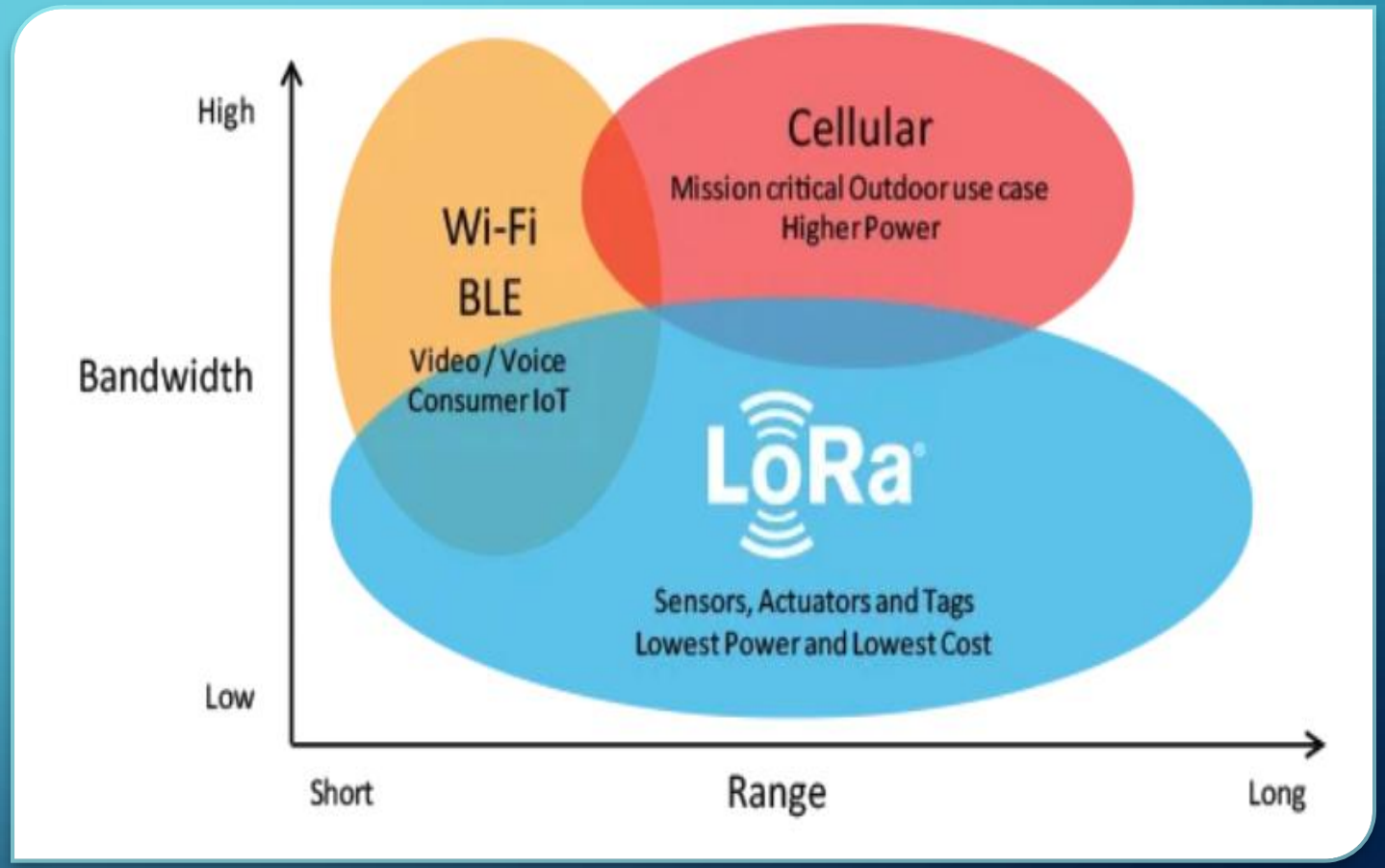
Why is LoRaWAN so awesome ?

- Ultra low power
- Deep indoor penetration
- License free spectrum
- High capacity
- Public and private deployments
- End-to-end security
- Roaming
- Low cost



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END-TO-END LORA SOLUTIONS FOR ENTERPRISE IOT

LoRa Node Development	Development of scalable and reliable LoRa nodes designed for diverse enterprise IoT applications and environments.
Gateway Integration	Seamless integration of LoRa gateways to ensure robust network connectivity and data transmission across enterprise sites.
Backend Analytics and Edge Intelligence	Advanced backend analytics combined with edge computing for intelligent data processing and improved operational insights.
Enterprise IoT Security and Reliability	Strong focus on security protocols and reliable connectivity to support critical smart infrastructure applications.

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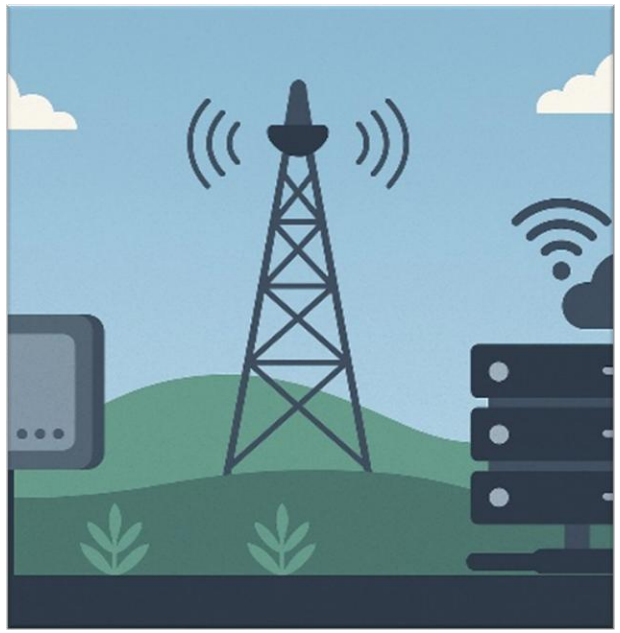

Node Devices:

SX1278/SX1262 and STM32WL series

Applications: Smart agriculture, remote metering, environmental monitoring

LoRaWAN Gateways:

SX1302/SX1303 concentrators

Backhaul: Ethernet, Wi-Fi, GSM/4G LTE

Cloud & Network Integration:

Compatible with **TTN and ChirpStack**

End-to-end Azure IoT Hub integration for analytics and management

Security & Reliability:

Hardware Security Module (HSM) for encryption

OTA updates, remote configuration, diagnostics

LORA & LORAWAN CAPABILITIES

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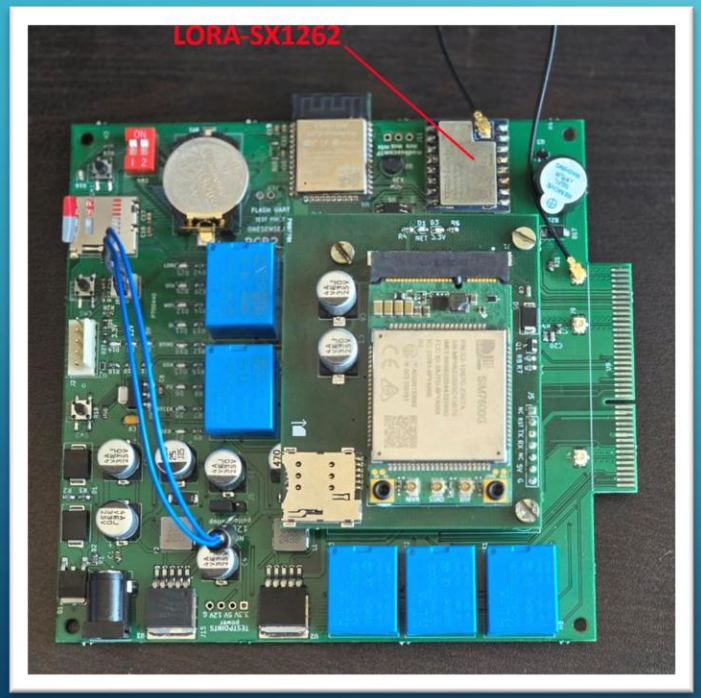
LORA NODES

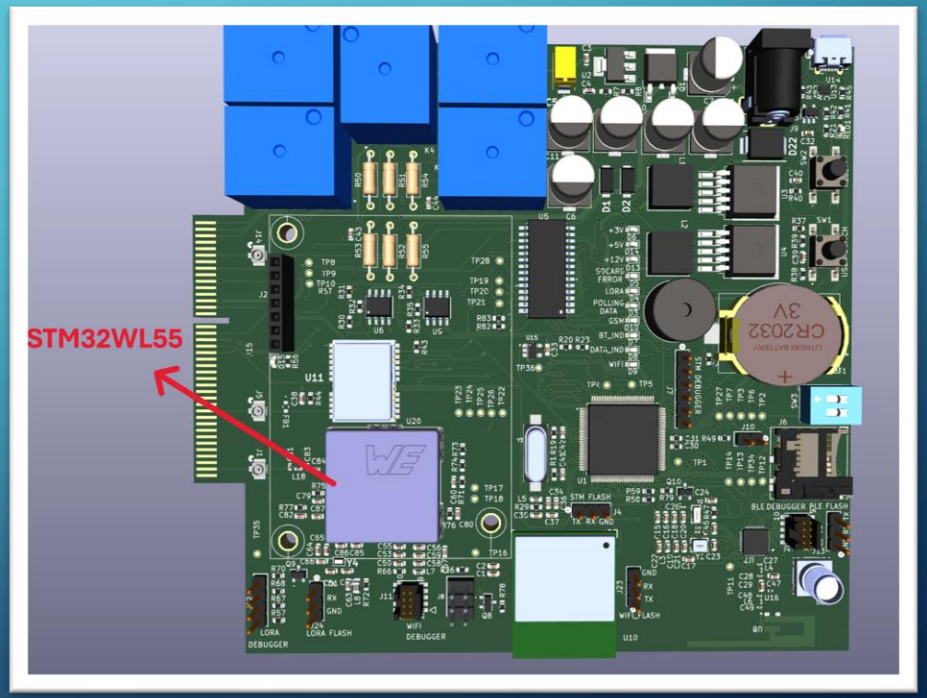
ESP32 + SX1262 LoRa Node

This combination was deployed in one of our projects as a **backup network**, ensuring continuous data transmission when primary networks were unavailable.



STM32 + STM32WL55

This LoRa node was chosen for its easy integration into existing devices, enabling LoRa capability with minimal hardware modifications.



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LORAWAN GATEWAY WITH EDGE INTELLIGENCE

This LoRaWAN Gateway solution highlights our technical strength in designing flexible, high-performance systems tailored for large-scale IoT applications. It combines advanced hardware with edge computing capabilities to deliver secure, reliable, and intelligent connectivity for LoRaWAN networks.

STM32MP1 (Dual-core ARM Cortex), Semtech SX1302 for high-performance multi-channel LoRaWAN packet processing

Fully compliant with **LoRaWAN 1.0/1.1** specifications

Seamless integration with **The Things Network (TTN)** or **ChirpStack** hosted on remote servers

Local packet forwarding and edge-based device management for low-latency applications

Ethernet for primary backhaul, **Wi-Fi** for wireless network integration, **GSM/4G LTE** for remote and backup connectivity

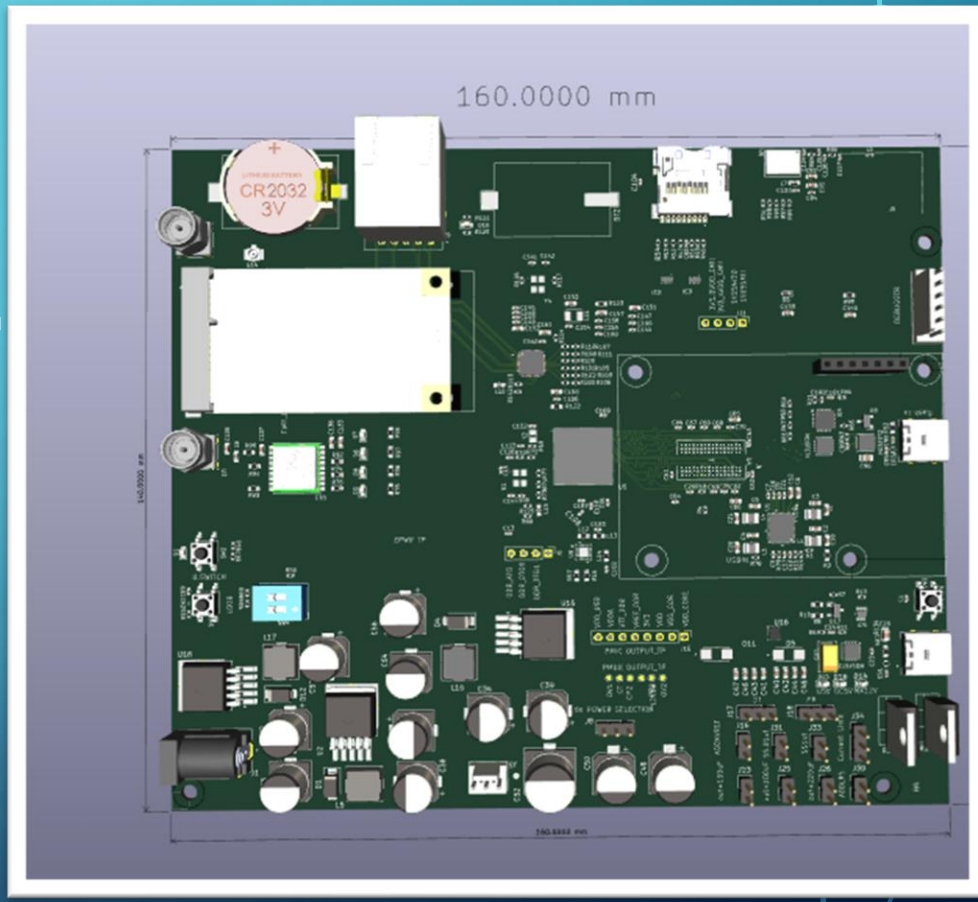
Runs **Azure IoT Edge modules** for local data processing, filtering, and analytics

Hardware Security Module (HSM) for key storage and encryption.

Secure boot, encrypted communication, and role-based access

Remote configuration and **OTA firmware updates**

Real-time diagnostics and health monitoring



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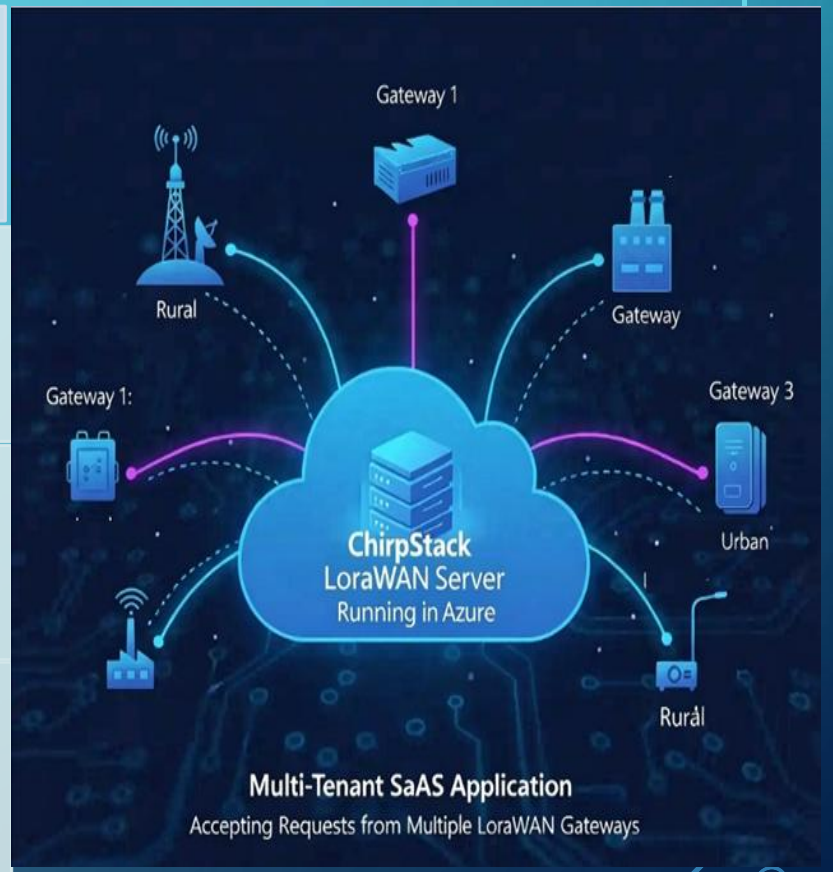
LORAWAN SERVER DEPLOYMENT ON AZURE (CHIRPSTACK AS SAAS)

ChirpStack on Azure — Scalable, Multi-Tenant LoRaWAN as a Service

LoRaWAN Network Server	Customized and containerized the open-source LoRaWAN Network Server for scalable cloud deployment in Azure.
Multi-tenant SaaS architecture	SAAS architecture to provide multi-tenant LoRaWAN services, enabling seamless onboarding of multiple customers.
Integration with Azure IoT services	Seamless data flow to Azure IoT Hub, Azure Data Explorer, for device monitoring.
Automated provisioning and management	Automated onboarding of Gateways, Devices, and network configurations for faster rollout.



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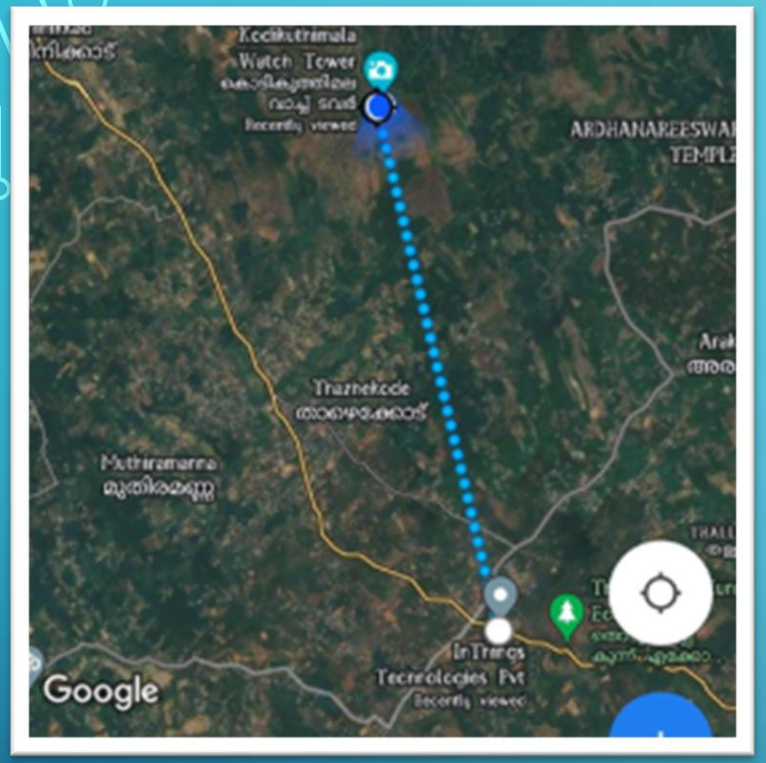

Enterprise-Scale Scalability — Supports thousands of LoRa nodes across multiple sites for large-scale IoT deployments.

Proven Reliability — A 4.4 km connectivity trial demonstrated strong signal integrity and minimal packet loss in real-world conditions.

Robust Security Measures — Security is ensured using Hardware Security Modules and encrypted communication protocols for safe data transmission.

Edge Intelligence & Analytics — Azure IoT Edge modules process data locally, reducing latency and enabling real-time analytics.

SCALABILITY, RELIABILITY, AND REAL-WORLD VALIDATION

Details : https://www.inthings.tech/case-studies-details?pid=112

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CONTACT US

www.inthings.tech

info@inthings.tech

+9196336 87401/+9189783 90303.

**Room No. 16/591, Karinkallathani,
Chethalloor-PO, Thachanattukara-II, Palakkad-
678583, Kerala, India.**

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