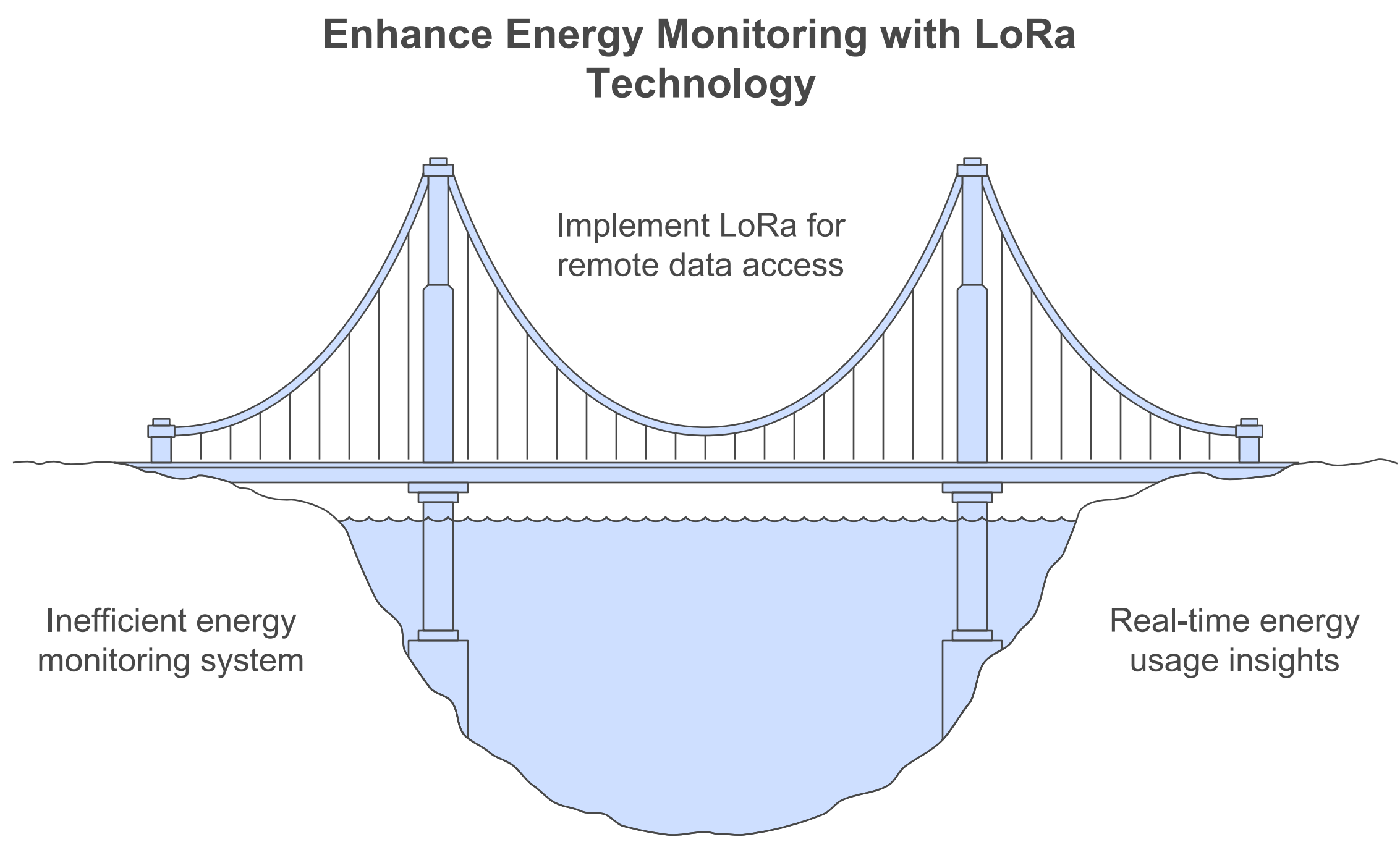


LoRa-Based Multi-Node Energy Meter Reading with Grafana Dashboard



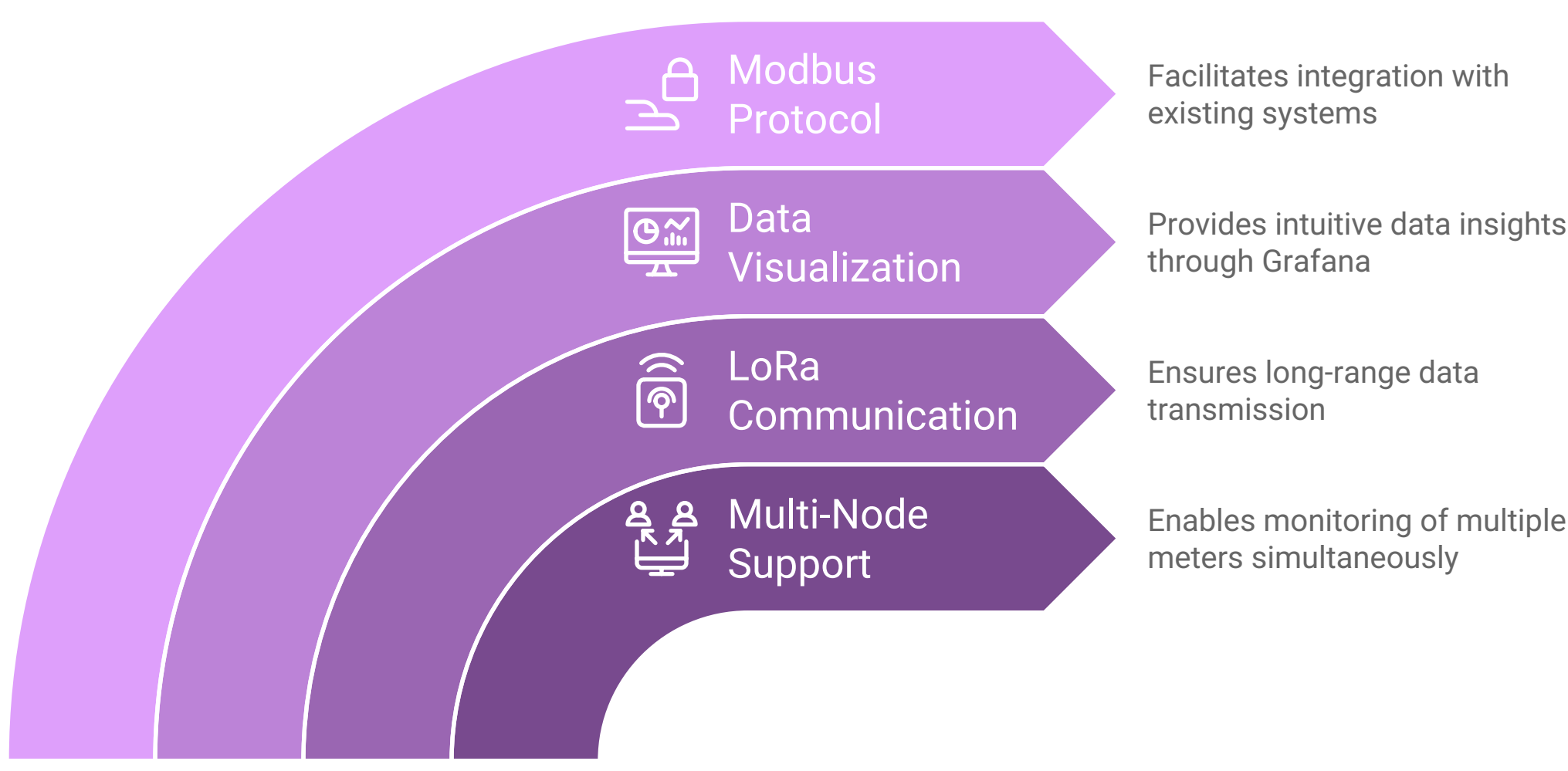
This document provides a detailed overview of a comprehensive solution for remotely monitoring energy usage across multiple nodes using LoRa (Long Range) technology.

The system is designed to facilitate efficient communication between energy meters and a central gateway, enabling users to access real-time data through a Grafana dashboard. Key features include multi-node support, reliable LoRa communication, intuitive data visualization, and compatibility with Modbus-enabled energy meters.

Key Features

- **Multi-Node Support:** The system can monitor multiple energy meters simultaneously, making it scalable for various applications.
- **LoRa Communication:** Utilizes LoRa technology for long-range data transmission, ensuring reliable connectivity even in challenging environments.
- **Data Visualization:** Integrated with Grafana for intuitive and insightful data visualization, allowing users to track energy consumption trends and patterns over time.
- **Modbus Protocol:** Compatible with Modbus-enabled energy meters, facilitating seamless integration with existing infrastructure.

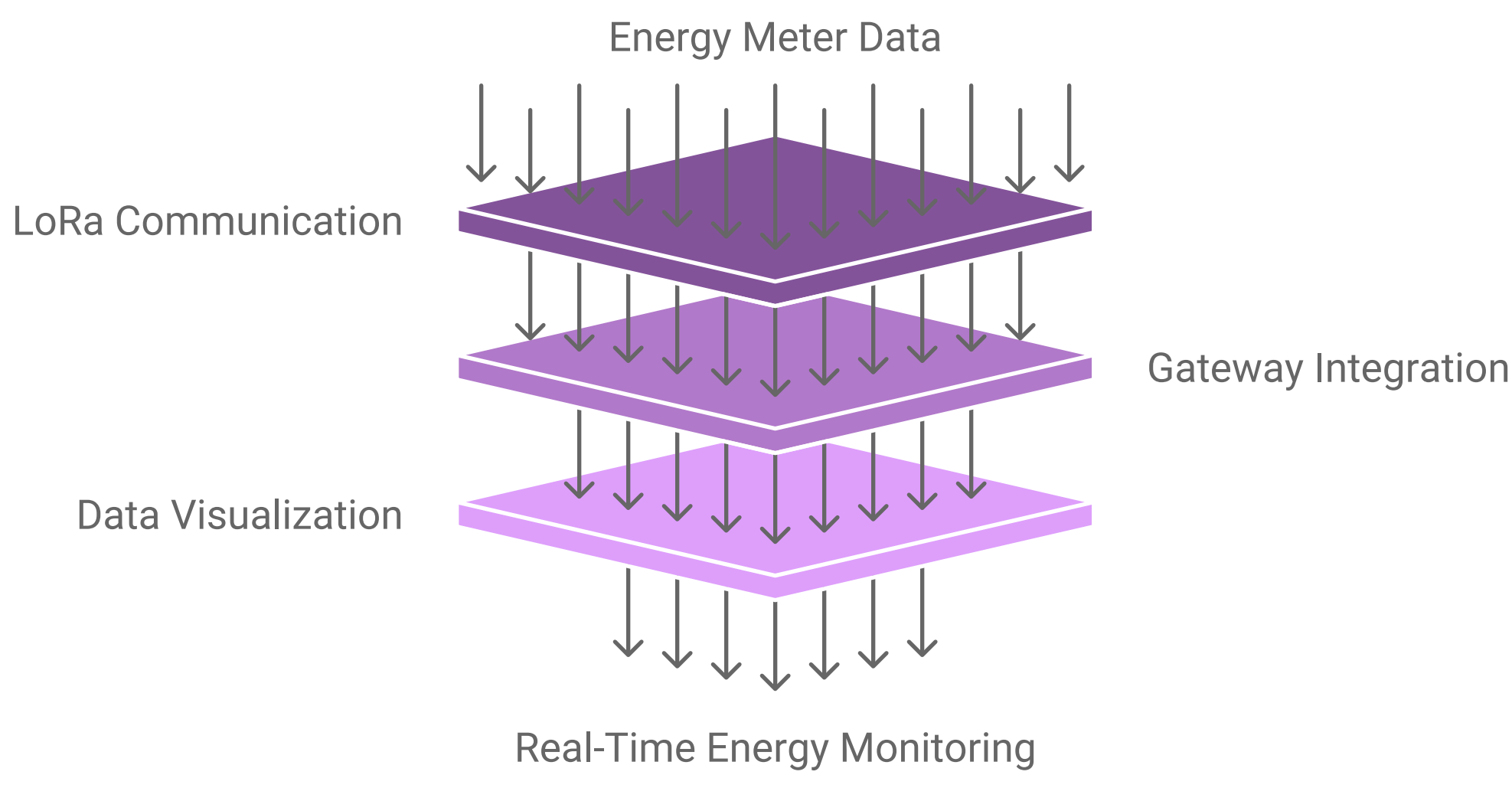
Key Features of LoRa-Based Energy Meter System



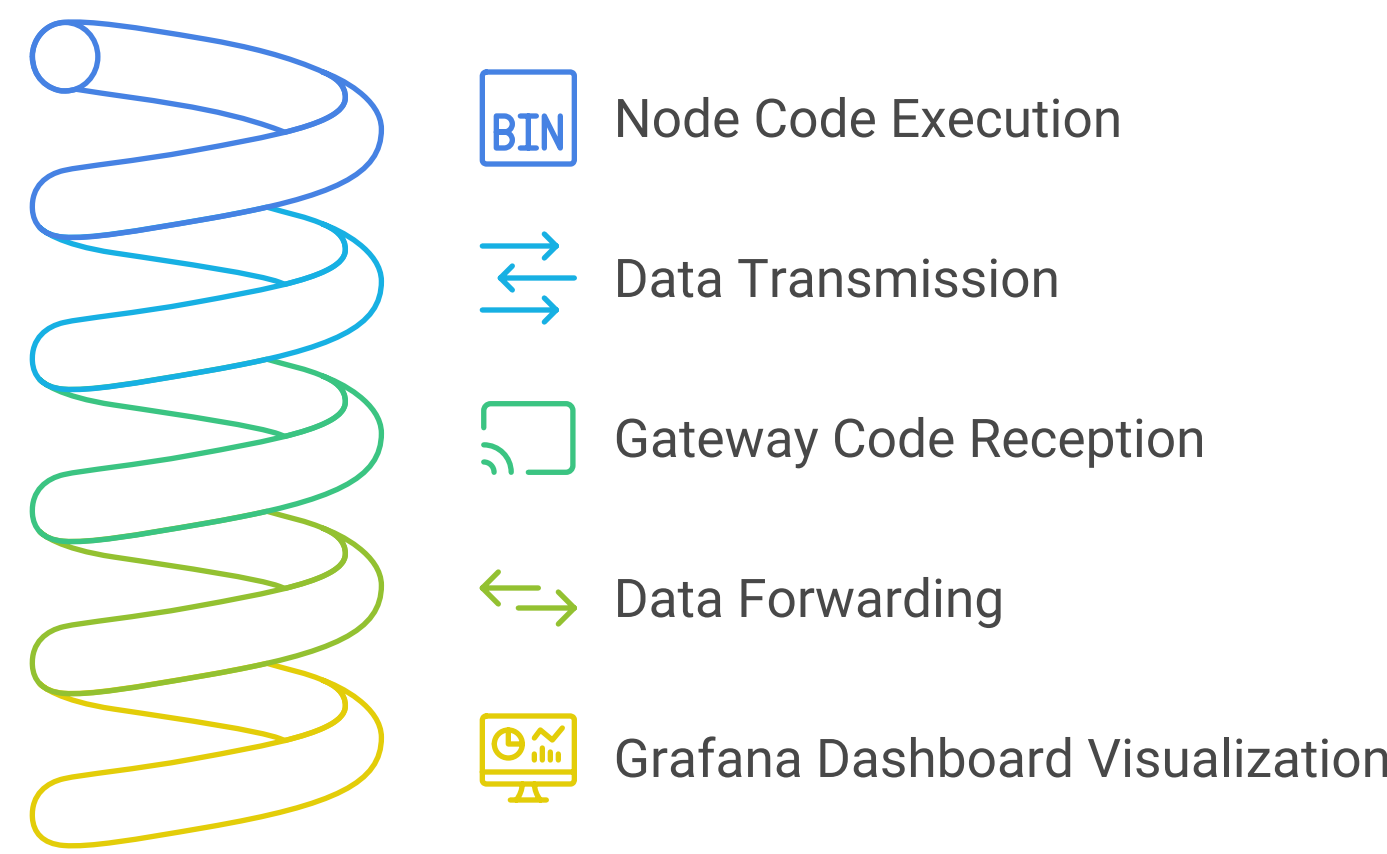
Project Structure

- **Node Code:** The firmware for each energy meter node, responsible for collecting data and transmitting it via LoRa.
- **Gateway Code:** The firmware for the central gateway, which receives data from nodes and forwards it to the Grafana dashboard.
- **Grafana Dashboard Configuration:** Instructions for setting up the Grafana dashboard to visualize the data collected from the energy meters.

Energy Monitoring System Process



LoRa-Based Energy Meter Data Flow



Gateway Code Overview

The gateway code is crucial for connecting to AWS IoT and publishing energy data from multiple energy meter nodes. It employs the AWS IoT Core MQTT protocol for reliable message delivery. Below is a breakdown of the key components of the gateway code:

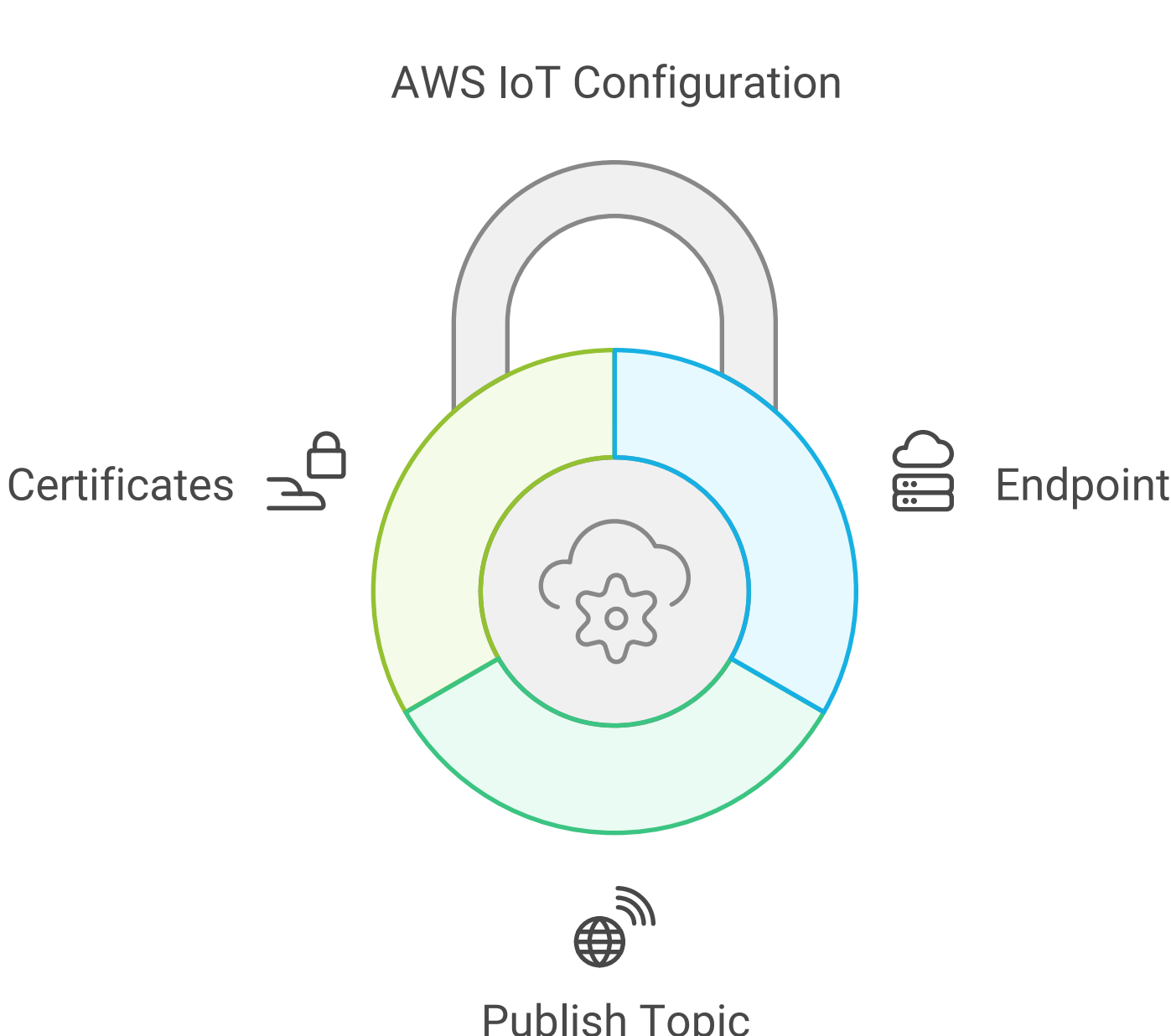
Gateway Code Sequence for AWS IoT



AWS IoT Configuration

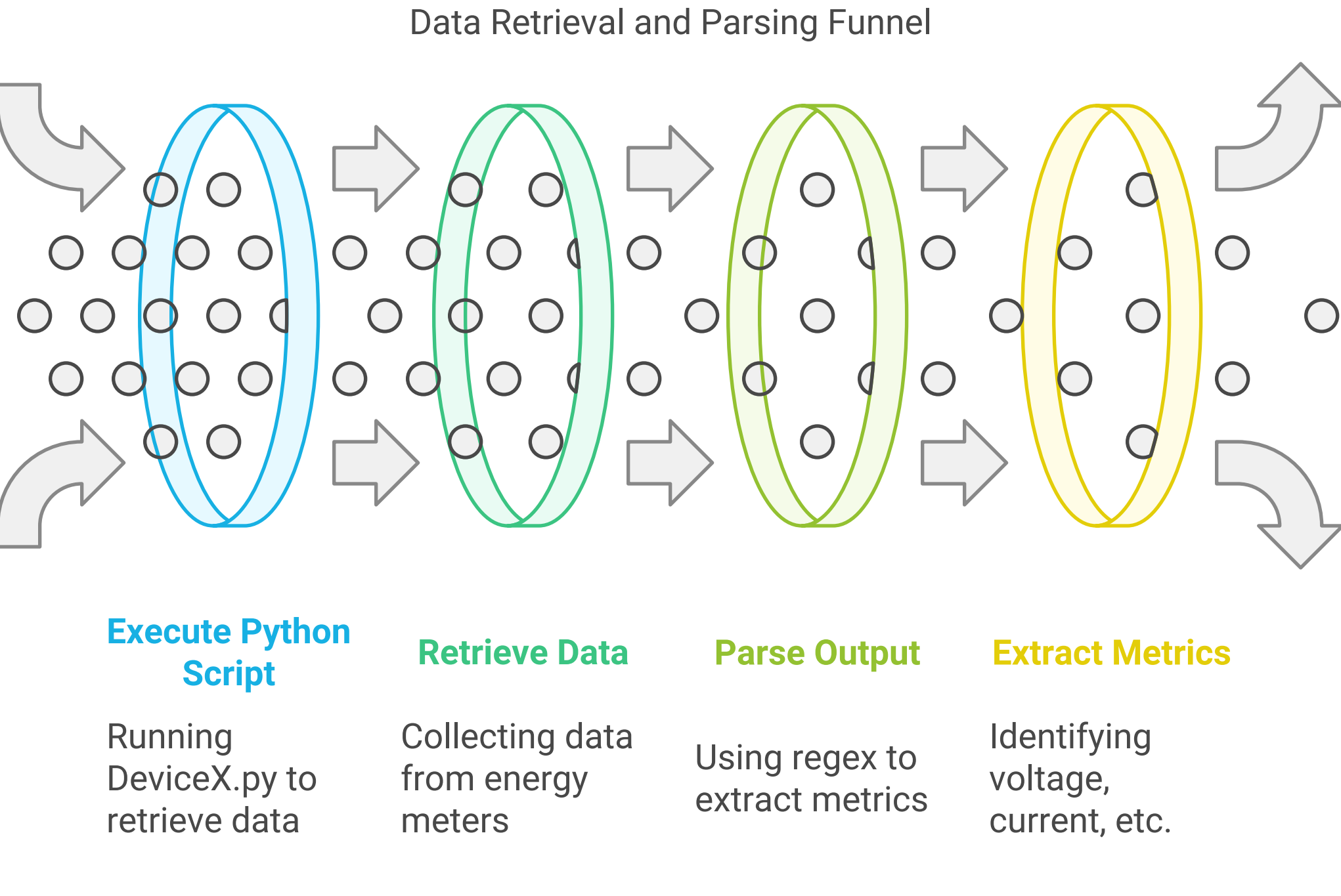
Each energy meter node has its own AWS IoT configuration, which includes:

- **Endpoint:** The AWS IoT endpoint to which the gateway connects.
- **Publish Topic:** The topic under which the energy meter data will be published.
- **Certificates:** Each device has its own certificate, private key, and CA file for secure communication.



Data Processing

The gateway retrieves data from each energy meter by executing a Python script (DeviceX.py) using the subprocess module. It parses the output using regular expressions to extract relevant metrics such as voltage, current, power factor, and frequency.



Publishing Data

The parsed data is formatted into JSON and published to the respective AWS IoT topic. The gateway handles potential errors during the publishing process and logs the results.