LoRa Network Architecture :-

END NODES   GATEWAYS   NETWORK SERVER   APPLICATION SERVER
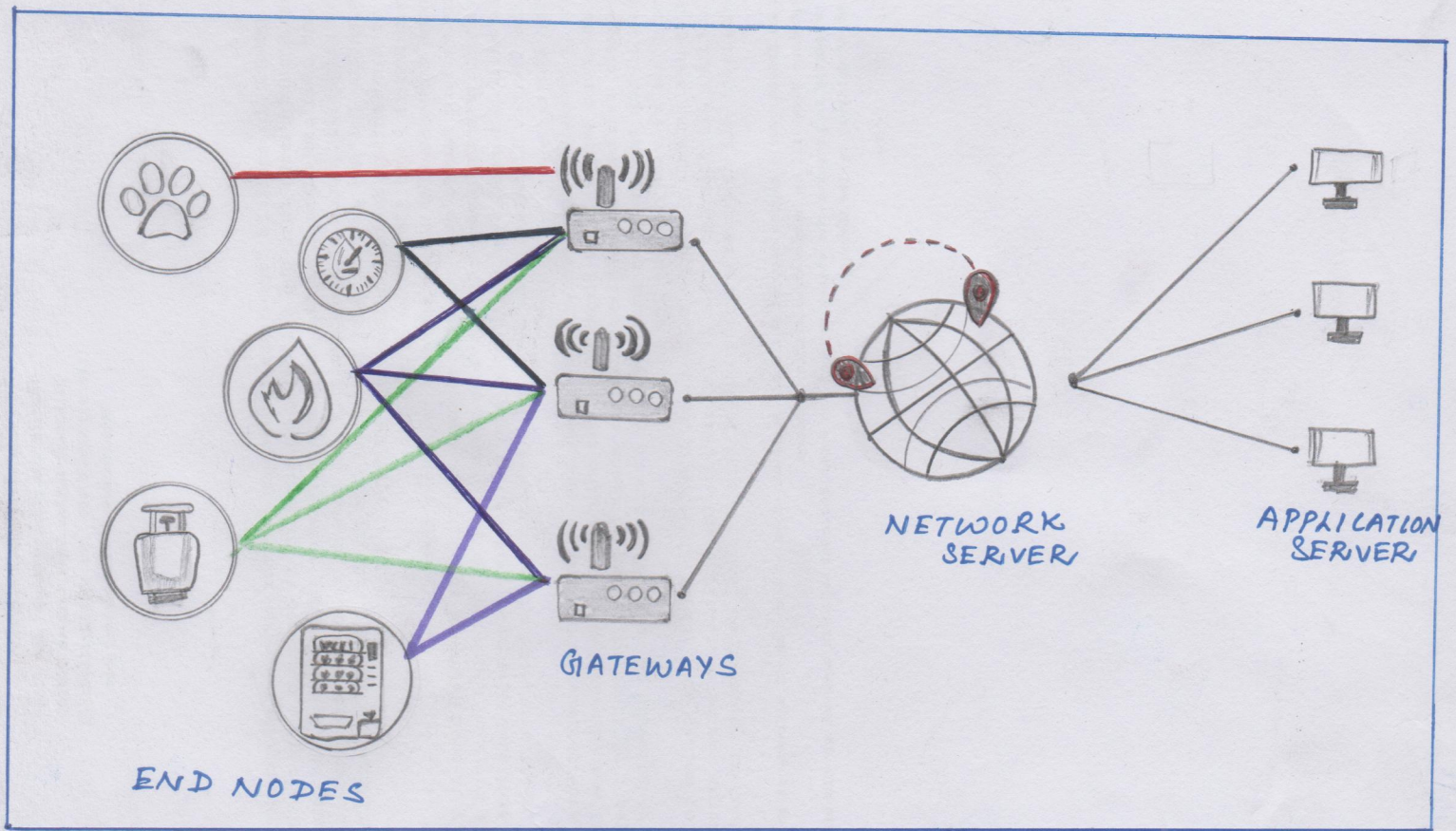
       LoRa network uses a star topology in which an end node can send messages to multiple gateways that communicate with the network server. Since an end node does not belong to a specific gateway, more than one gateway can receive a message sent by an end devices. The gateways and network server are connected via standard IP connections.

END DEVICE :   A LoRa end devices is used to send small amounts of data at low frequencies over long distances. It can be sensors, tracking devices, etc.

GATEWAY :   A LoRa gateway receives packets from the end node via a radio link and then forward them to the network server through the IP backhaul or 3G/4G/5G broadband connections.

NETWORK SERIVER: When network server receives packets, it removes the redundancy of packets and performs a security check and then determines the most suitable gateway to send back an acknowledgement message.

APPLICATION SERIVER: An application server is the end server where all data sent by the end device is post processes and necessary action being taken.

LoRa technology applications:

- Agriculture processing
- Air pollution monitoring
- Asset tracking
- Cattle tracking
- Energy management and sustainability
- Fall detection
- Fire detection
- Fleet management
- Home security
- Industrial temperature management
- Liquid presence detection
- Locating stolen vehicles
- Medical refrigerator monitoring
- Parking management
- Radiation leak detection
- Water management and protection
- Wireless gas-level monitoring

LoRa - Security mechanism:

As security is a fundamental need in all the innovative, low-power, low-cost, smart applications, it has been designed into the LoRaWAN specification from the very beginning itself. And these security are designed to fit general design criteria like low-power consumption, low implementation complexity, low-cost and high scalability. Also mutual authentication is established between a LoRaWAN end device and the LoRaWAN networks. This ensures that only genuine and authorized devices will be joined to authentic networks.

LoRaWAN MAC and application messaging are origin authentic, integrity protected, replay protected and encrypted. This protection combined with mutual authentication, ensures that network traffic has not been altered, is coming from legitimate device, is not comprehensible to eavesdroppers and has not been captured and replayed by rogue actors.

LoRaWAN security futher implements end-to-end encryption for application payloads exchanged between the end-devices and application servers.

PHYSICAL SECURITY: AppKey and the derived session keys are persistently stored on a LoRa devices and their protection depends on the device physicall security.

BACKEND INTERFACES SECURITY: HTTPS and VPN technologies are used for securing the communication among critical infrastructure elements.

CRYPTOGRAPHY: AES is used in the standardised CTR mode which makes use of XOR crypto operations. This strengthens the AES algorithm by using a unique AES key for each block cipher.

LoRa Vs LoRaWAN :

- LoRa is a radiofrequency carrier signal used in the physical layer of the telecom device. By using a LoRa modem we can convert our data into the radiofrequency signal.

- Using a modulation technique known as CSS (chirp spread spectrum), the LoRa signal can vary depending on the message it carrying. It is also uses the entire channel bandwidth for broadcasting allowing it to be more robust to noise and frequency offsets.

- LoRa contains only the link layer protocol and is perfect to be used in P2P communications between nodes.

- LoRa modules are little cheaper than LoRaWAN modules.

- The LoRa module implements a simple link protocol, created by Libelium.

- LoRaWAN is the technology that links the LoRa signal to the application. In combination with LoRa radiofrequency signals, LoRaWAN has made it possible to create low-powered, cost effective, long-range and bidirectional telecommunications solutions for use in a wide range of situations.

- Also LoRaWAN has the ability to reduce the number of Gateways needed.

- LoRaWAN includes the network layer too, so it is possible to send the information to any base station already connected to a cloud platform.

- LoRaWAN modules can able to work in different frequencies by just connecting the right antenna to its socket.

- LoRaWAN module runs the LoRaWAN protocol which is more richer and more advanced protocol created by the LoRa Alliance.