

Two white and silver robotic hands are positioned on the left and right sides of the frame, reaching towards the center. The background is a dark blue gradient with a faint, glowing network of lines and dots, suggesting a digital or IoT theme.

Internet of Things

LORAWAN

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Introduction to LoRa and LoRaWAN

LoRaWAN (LoRa Wide Area Network): This is a network protocol and architecture built on LoRa. While LoRa is the physical signal, LoRaWAN defines how devices communicate, manage security, and route data.

Essentially: LoRa = the signal, LoRaWAN = the rules and network.

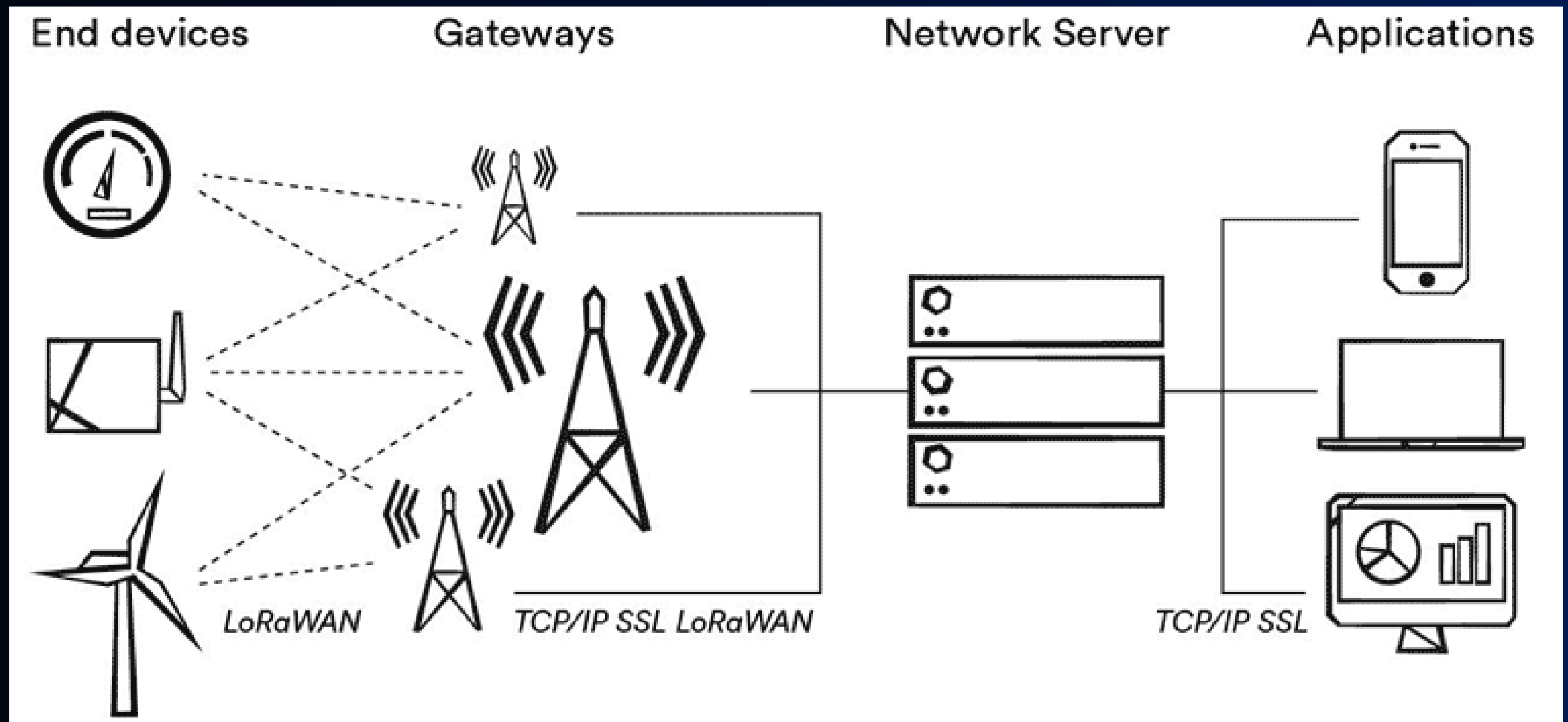
LoRa (long range): It's the radio modulation technique used to send data wirelessly. Think of it like the "language" the devices use to talk over long distances.

Its key strength is long-range communication with very low power, unlike Wi-Fi or Bluetooth which are short-range.

LoRaWAN Architecture

Layers:

1. **End Devices (Nodes):** sensors or actuators that collect data.
2. **Gateways:** relay data from nodes to network servers.
3. **Network Server:** manages data routing, device authentication, and security.
4. **Application Server:** processes and visualizes data for users.



Need for LoRaWAN

Why IoT devices need LoRaWAN:

- Many IoT sensors are far from power sources or need to operate for years on a small battery.
- They also need long-range communication, because devices could be spread across a city, farm, or industrial area.

Comparison:

- Wi-Fi: high speed but short range, drains batteries fast.
- Bluetooth: short-range, great for wearables but not city-wide.
- Cellular (3G/4G): can cover large distances but consumes a lot of power and can be expensive.
- LoRaWAN: combines long range + very low power, ideal for massive IoT networks.

Applications:

- Smart cities: managing lights, parking, waste bins.
- Agriculture: soil moisture sensors, irrigation control.
- Environmental monitoring: air quality, flood detection.

Communication and Modulation

LoRa modulation (CSS):

- Uses Chirp Spread Spectrum, which spreads the signal over a wide frequency range.
- Benefits: resistant to interference, can reach 10–15 km in rural areas.

Frequency Bands:

- Operates in unlicensed ISM bands, e.g., 868 MHz in Europe, 915 MHz in the US.
- No need to pay spectrum fees.

Trade-off:

- Spreading Factor (SF): higher SF → longer range but lower data rate.
- Useful because distance vs speed must be balanced depending on the application.

Advantages and Limitations

Advantages and Limitations of LoRaWAN

Advantages of LoRaWAN

- 👍 Longer range
- 👍 Low power equals more battery
- 👍 Simple architecture
- 👍 Better compared to Sigfox
- 👍 Fast deployment

Limitations of LoRaWAN

- 👎 Not ideal for large data payloads
- 👎 Unlicensed radio networks
- 👎 Less secure

Conclusion

- LoRaWAN is ideal for IoT applications that need low power, wide area coverage, and scalability.
- Future trends: integration with 5G, satellite LoRaWAN, hybrid IoT networks for global coverage.

THANK YOU