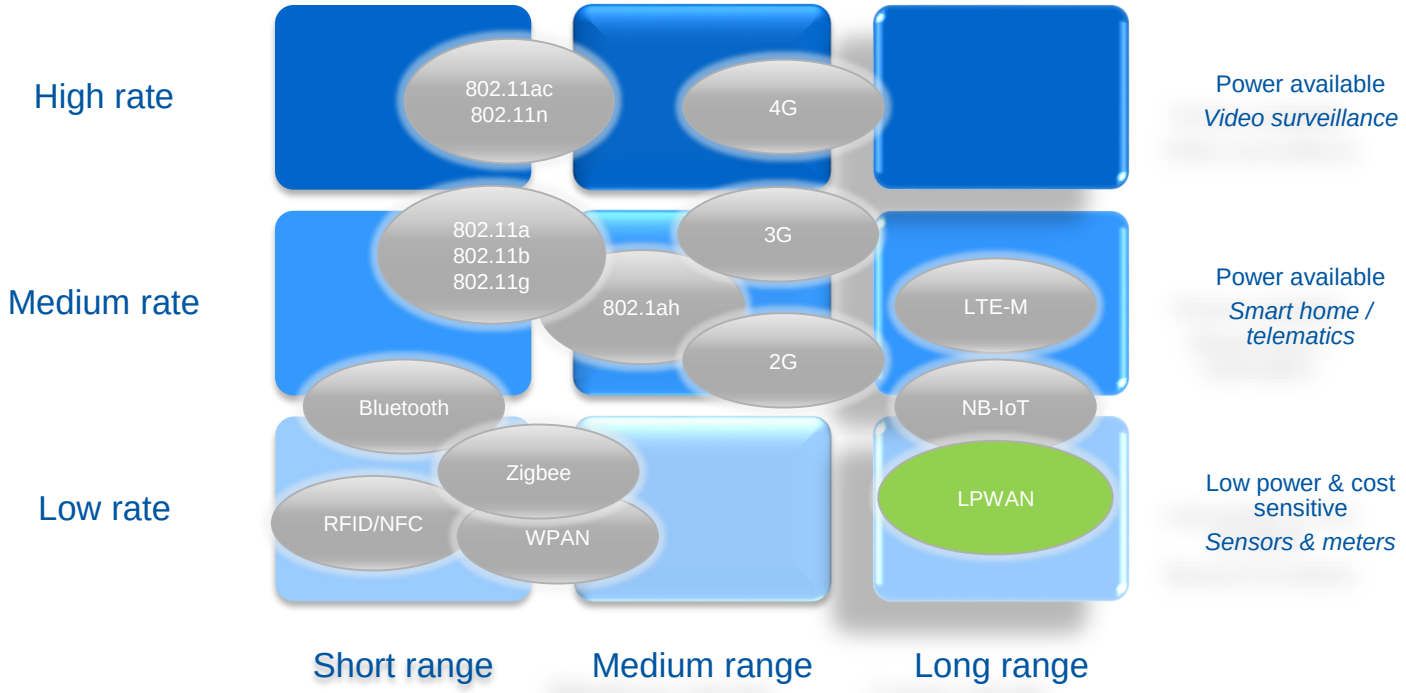
CERN Smart Networking

Rodrigo Sierra

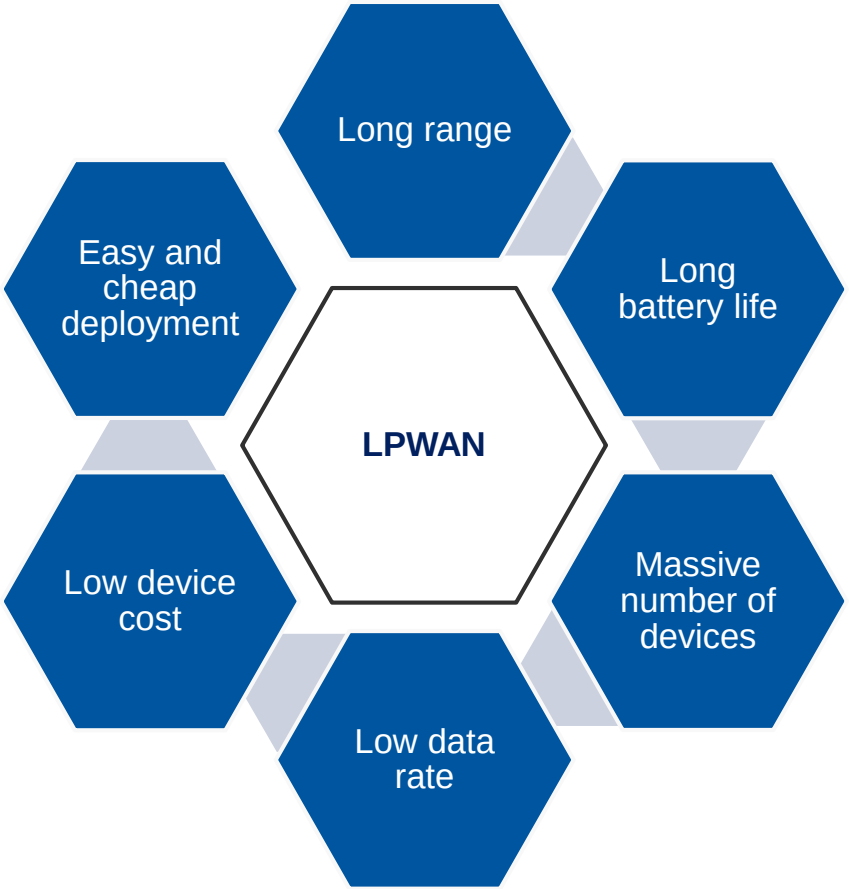
IoT networking

- Range
- Data rate
- Latency
- QoS
- Traffic pattern
- Power
- Mobility
- Number of ’things’
- Price
- Security
- Area
- Spectrum

IoT networking…



LPWAN


Long range
Long battery life
Massive number of devices
Low data rate
Low device cost
Easy and cheap deployment
LPWAN

LPWAN Solution study

- Low power
- Low cost for nodes
- Radio features (link budget, sensitivity, BW…)
- Security & privacy (encryption, identity)
- Reliability
- Scalability
- Standards compliance
- Adoption
- Access to technical information
- Backend features
- Business model
- Easy to deploy & to use

LoRa

- LoRa Alliance (Semtech, Orange, IBM, Cisco… up to 500)
- Mature: several national-wide and private networks deployed
- Unlicensed spectrum: independent of national operators (and borders)
- High sensitivity (-137dBm): indoor coverage
- Datarate between 0.3 and 50 kbps
- Symmetric encryption and authentication using AES
- Downlink capabilities (although primarily uplink)

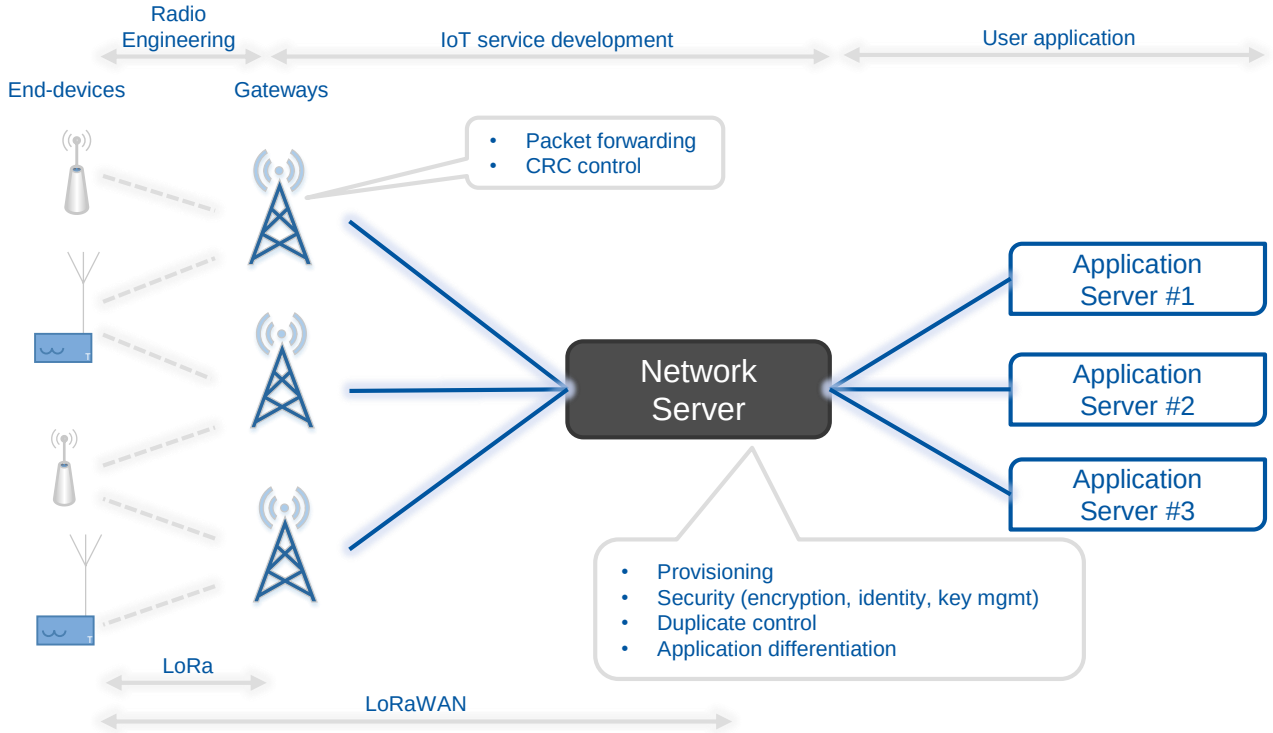
LoRa — Physical layer

- Enables long-range link
- Proprietary modulation technology from Semtech

LoRaWAN — Medium Access Control

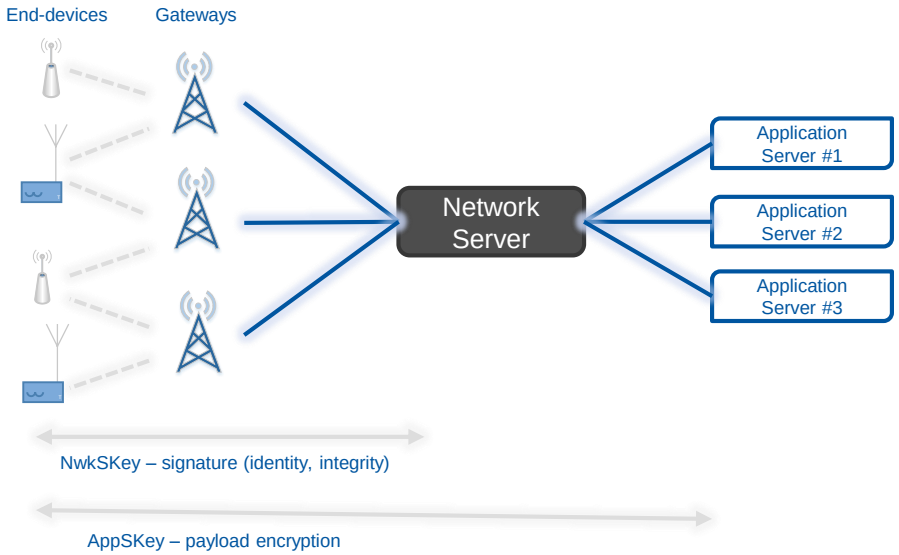
- Open standard developed by the LoRa Alliance

LoRaWAN architecture



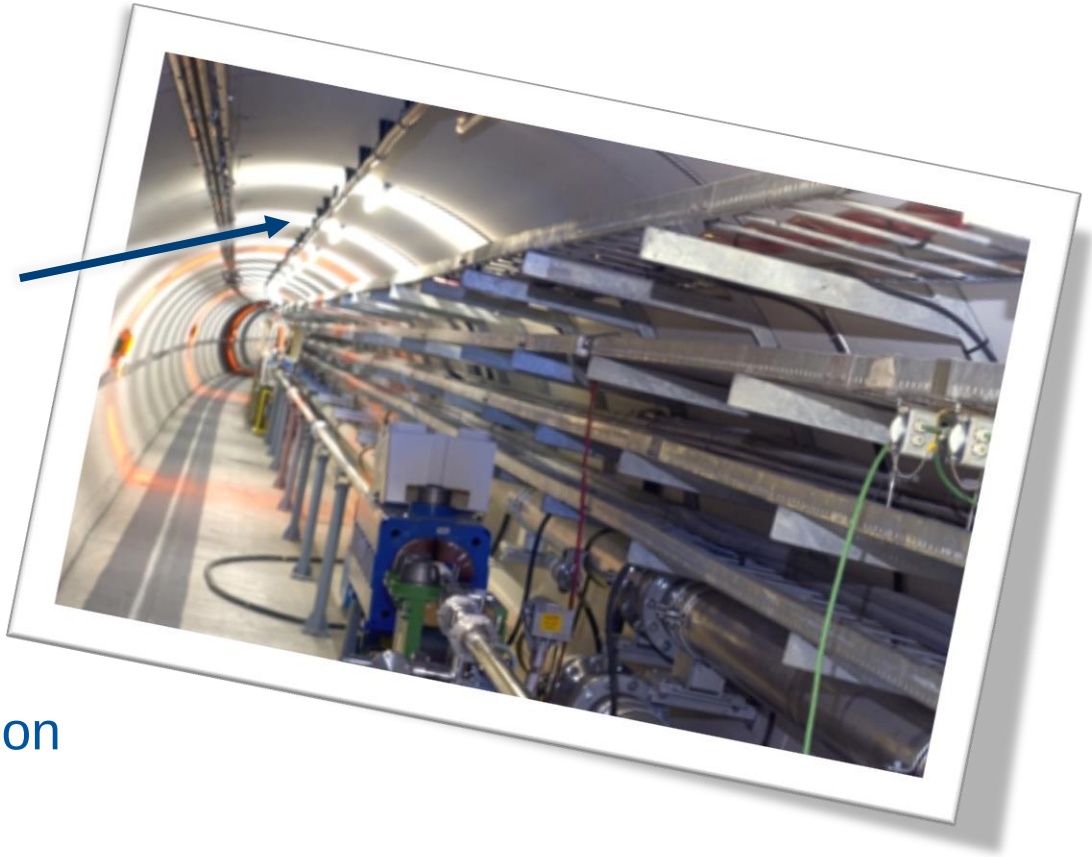
LoRa security

- 128-bit AppKey (AES128) creates:
  - Network Session Key (NwkSKey)
  - Application Session key (AppSKey)
- Frame counters
- Message payload is:
  - Encrypted (end to end)
  - Signed



Challenges

- Coverage
  - CERN campus
  - Indoor
  - Tunnels?
- Reliability & QoS
  - No real-time application
  - Interference



Challenges

- Network server
  - Open source or commercial
  - High availability
  - Agile infrastructure
  - CERN premises (GPN access)
- Provisioning & identity management
  - Integration with the existing tools
- Security & privacy
  - Certificates management
  - Join process

Planning

~~Requirements~~

~~Solution study~~

Design

- Radio engineering: Surface modeling, underground study, interference
- Service design: Gateway, network server, middleware

CERN pilot

Summary

- IoT has arrived to stay
- Multiple requirements – Multiple solutions
- LPWAN for battery powered sensors
  - LoRaWAN has been chosen at CERN
- Services should adapt to the new wave
- Security will give us some headaches


CERN

LoRa devices

Clase A	Listen only after transmission	No latency constraints	Energy efficient
Clase B	Listen at scheduled windows	Latency constraints of seconds	Energy optimized
Clase C	Always listens	Strong latency constraints	No power constraints

- Uplink messages can be sent at any time (randomly).
- Maximum duty cycle to be respected.