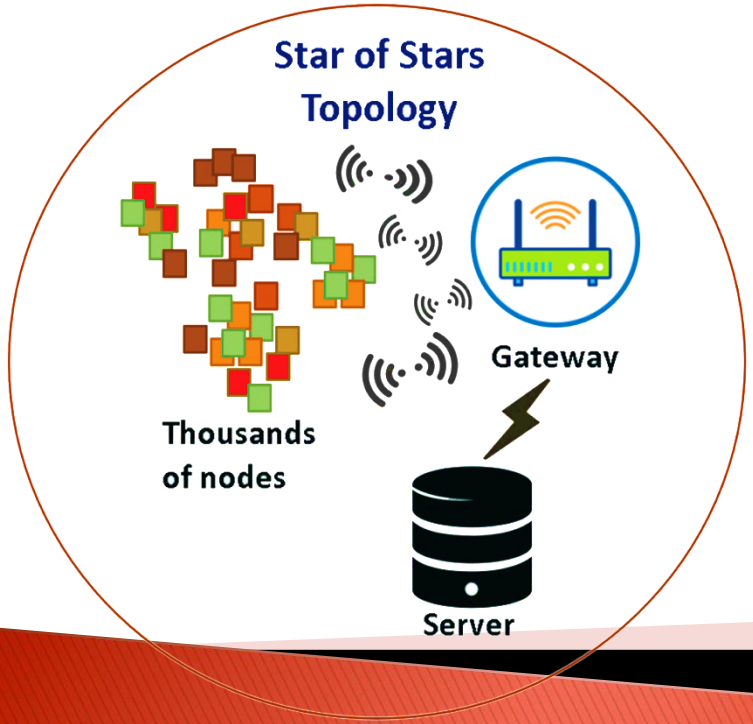
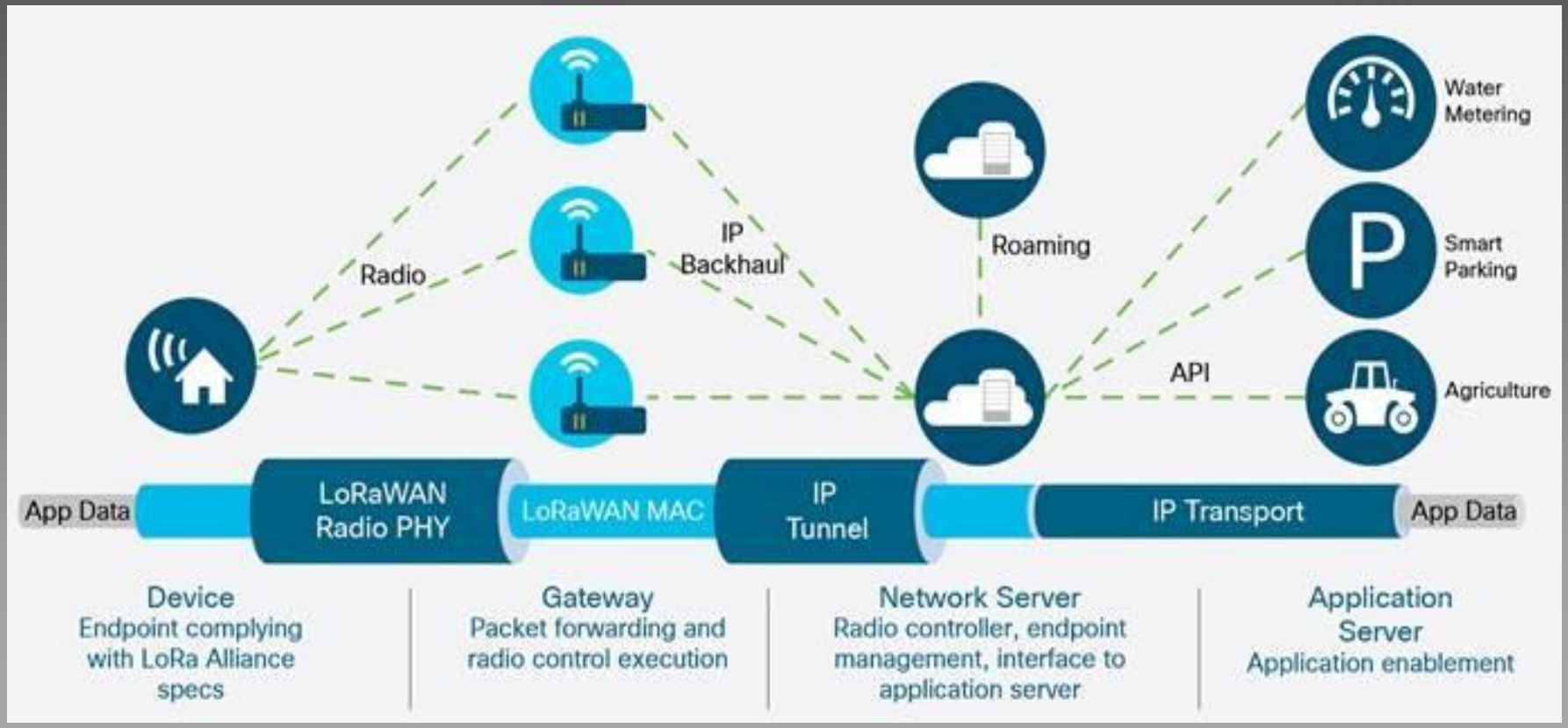
Building a Simple LoRaWAN Network



https://github.com/LoRaWAN-workshop/tutorial

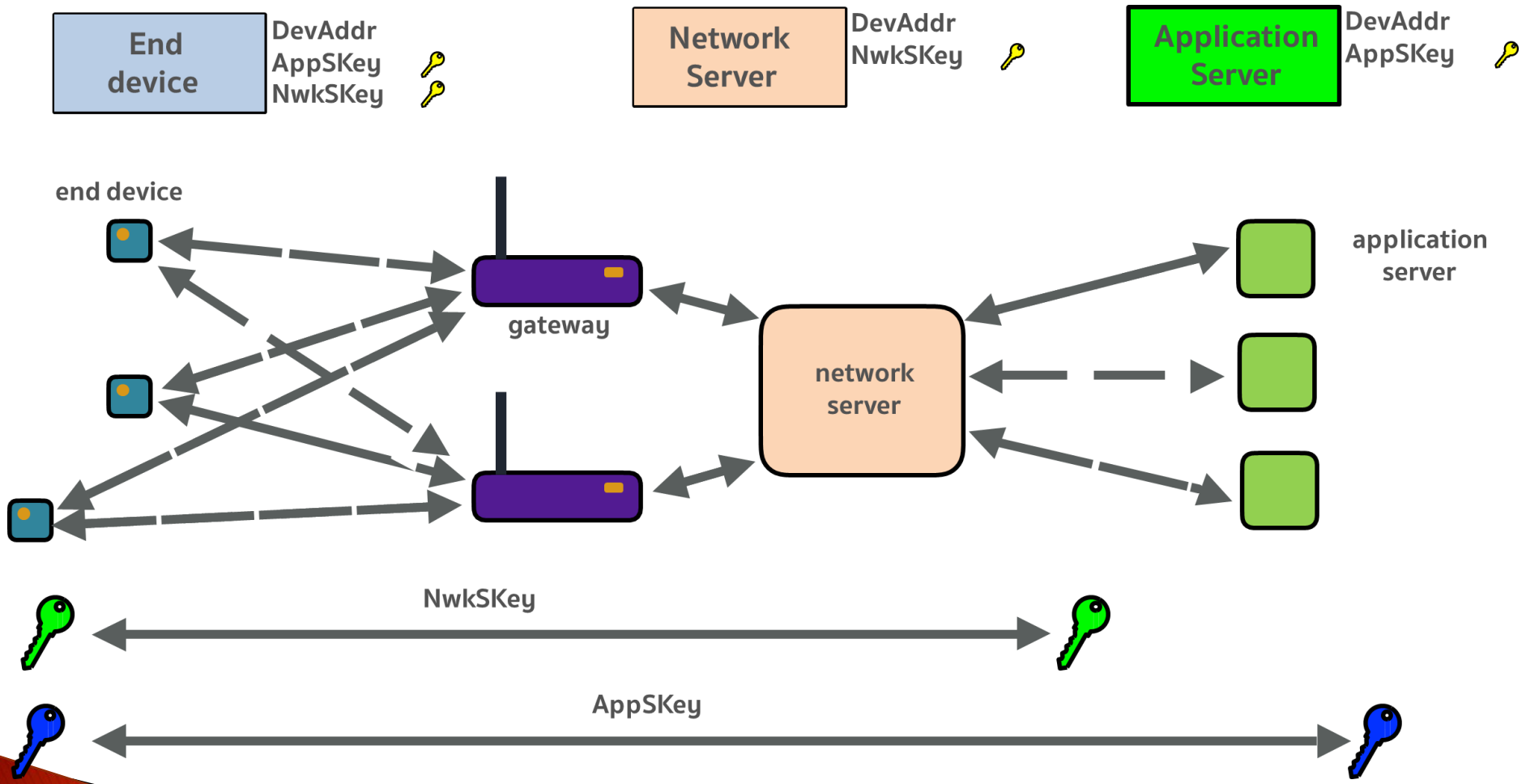
LoRaWAN 1.0.3



Network Encryption | Application Encryption | Data

From: https://www.digitalmatter.com/Solutions/Whitepapers/LoRaWAN-Introduction

ABP (Activation-By-Personalization)



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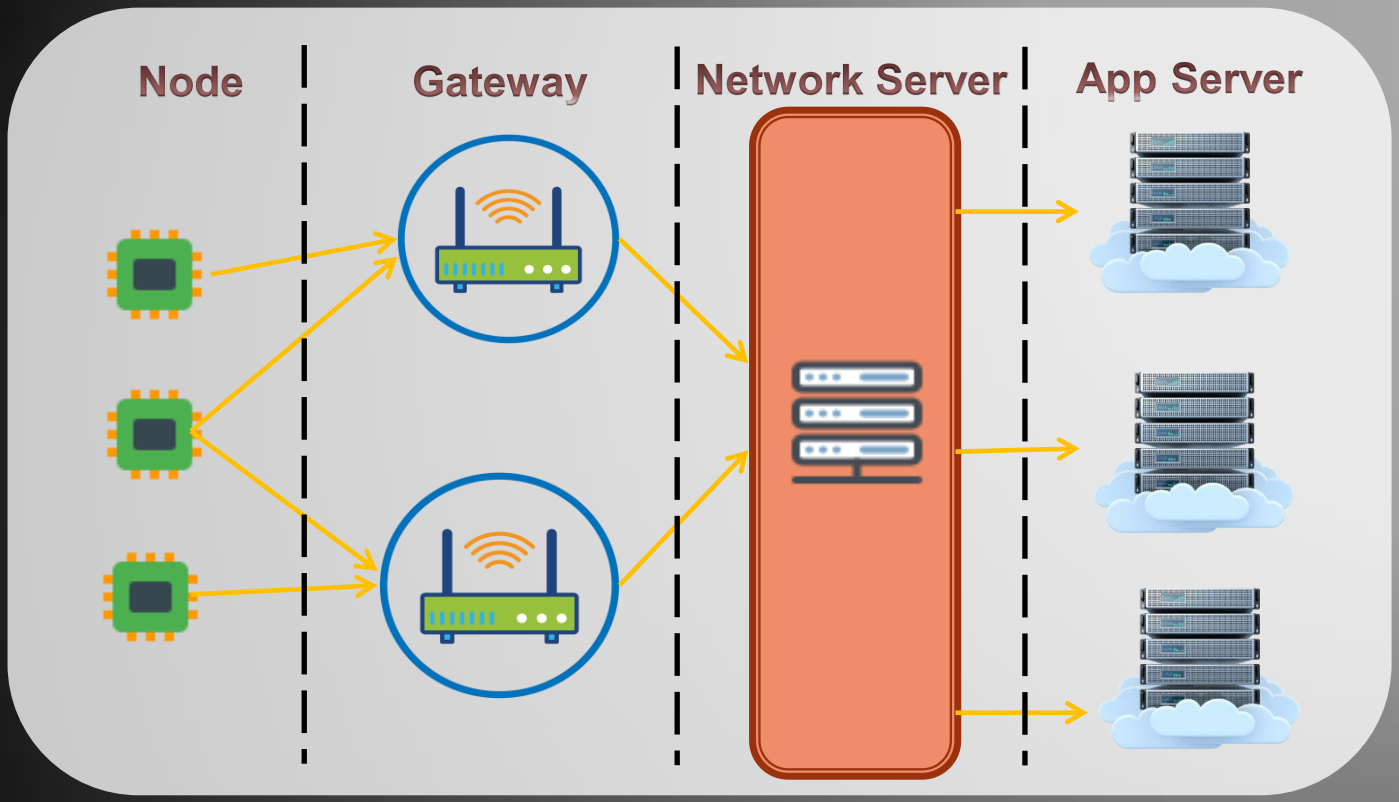
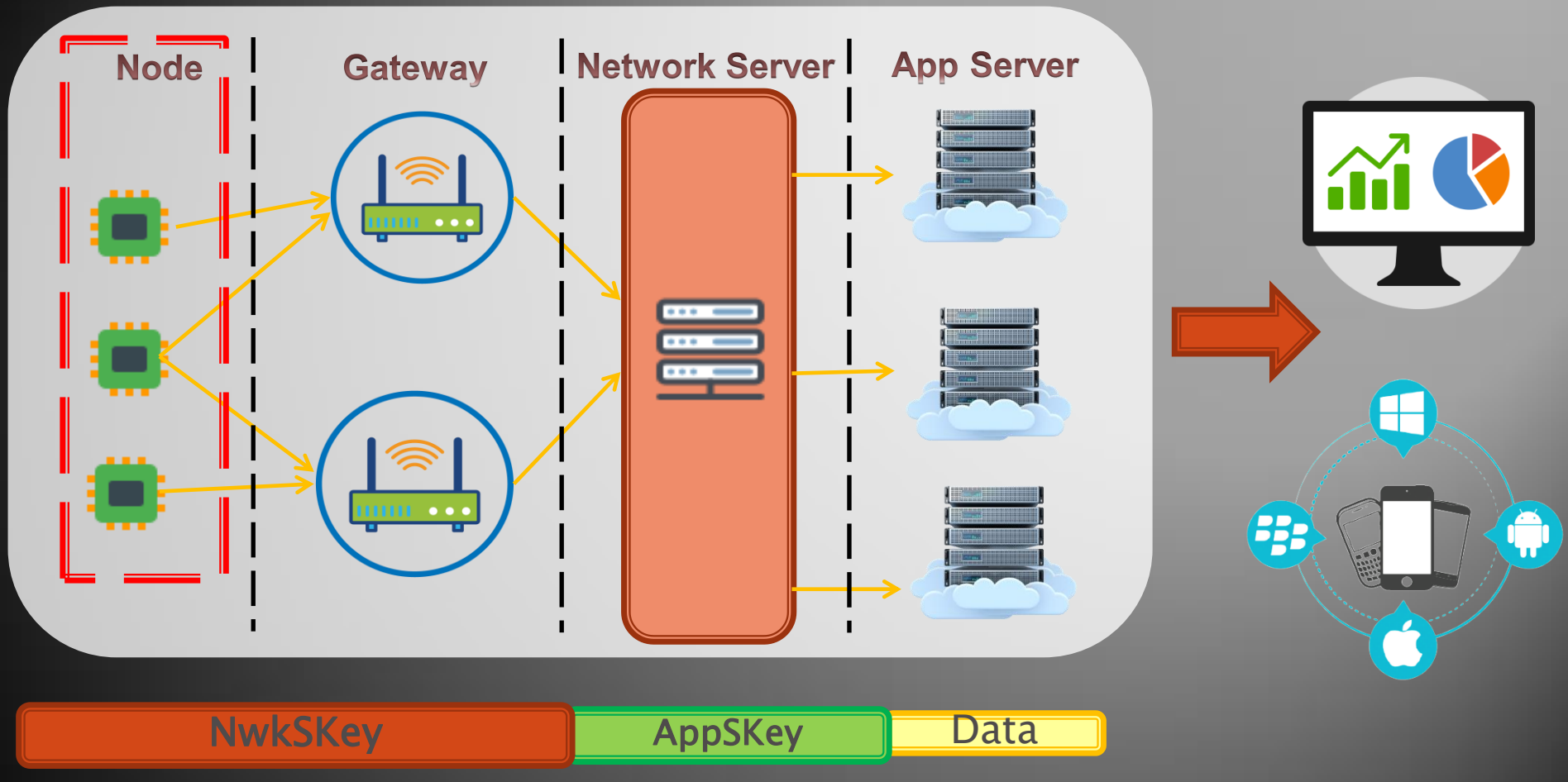

Node
Gateway
Network Server
App Server

NwkSKey
AppSKey
Data

LoRaWAN 1.0.3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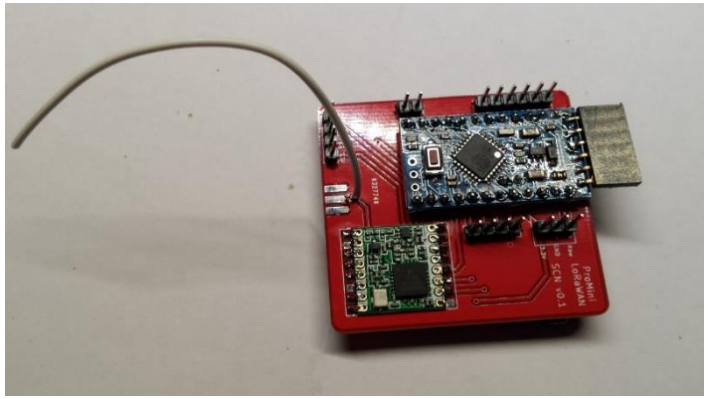
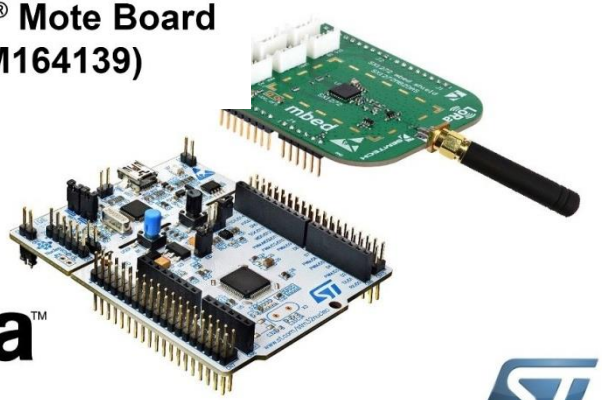
Examples of LoRaWAN Node

LoRa Shield + Arduino



DIY LoRa Shield + Arduino

RN2903 LoRa® Mote Board
(Part # DM164139)

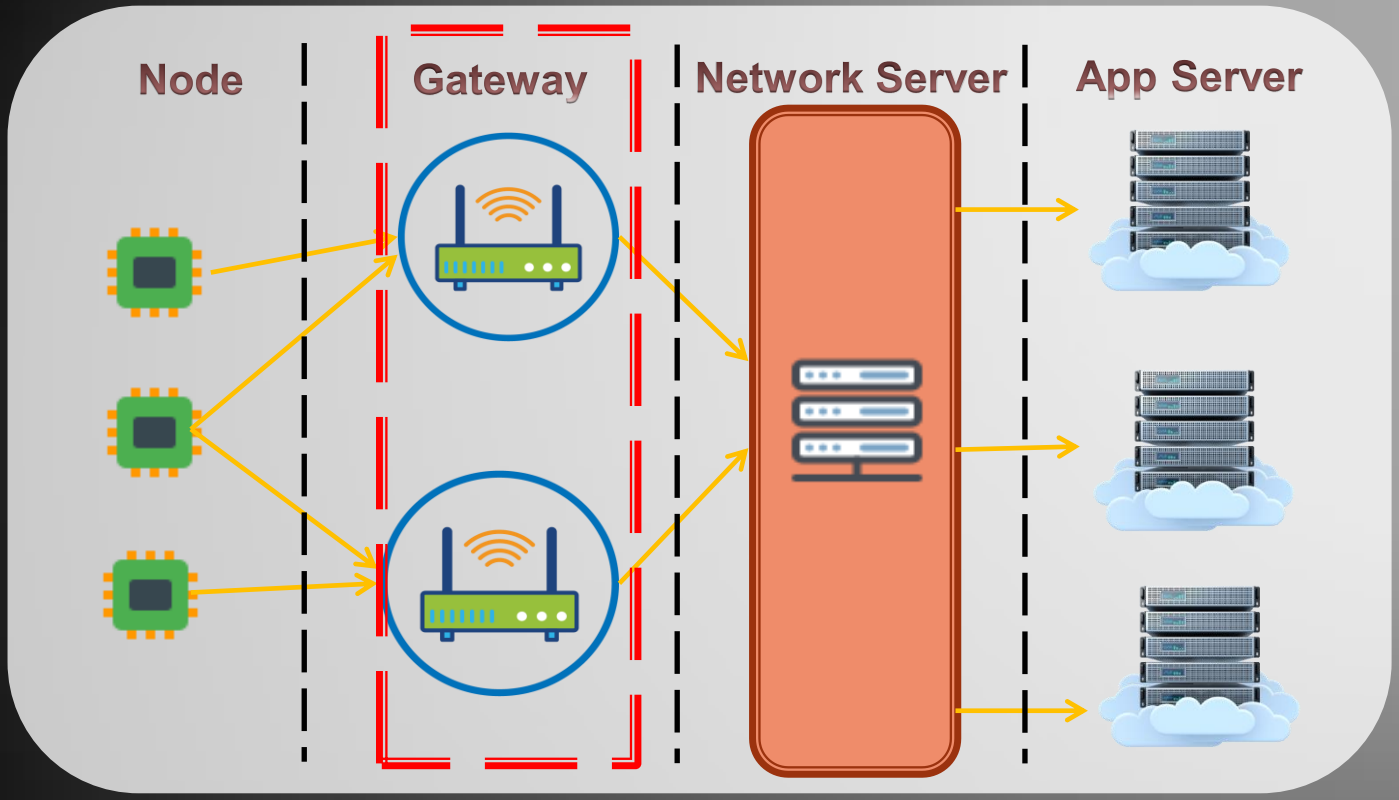


LoRa™

STM32 Nucleo-64 board+LoRa

LMIC : https://github.com/matthijskooijman/arduino-lmic-v1.5

LoRaWAN 1.0.3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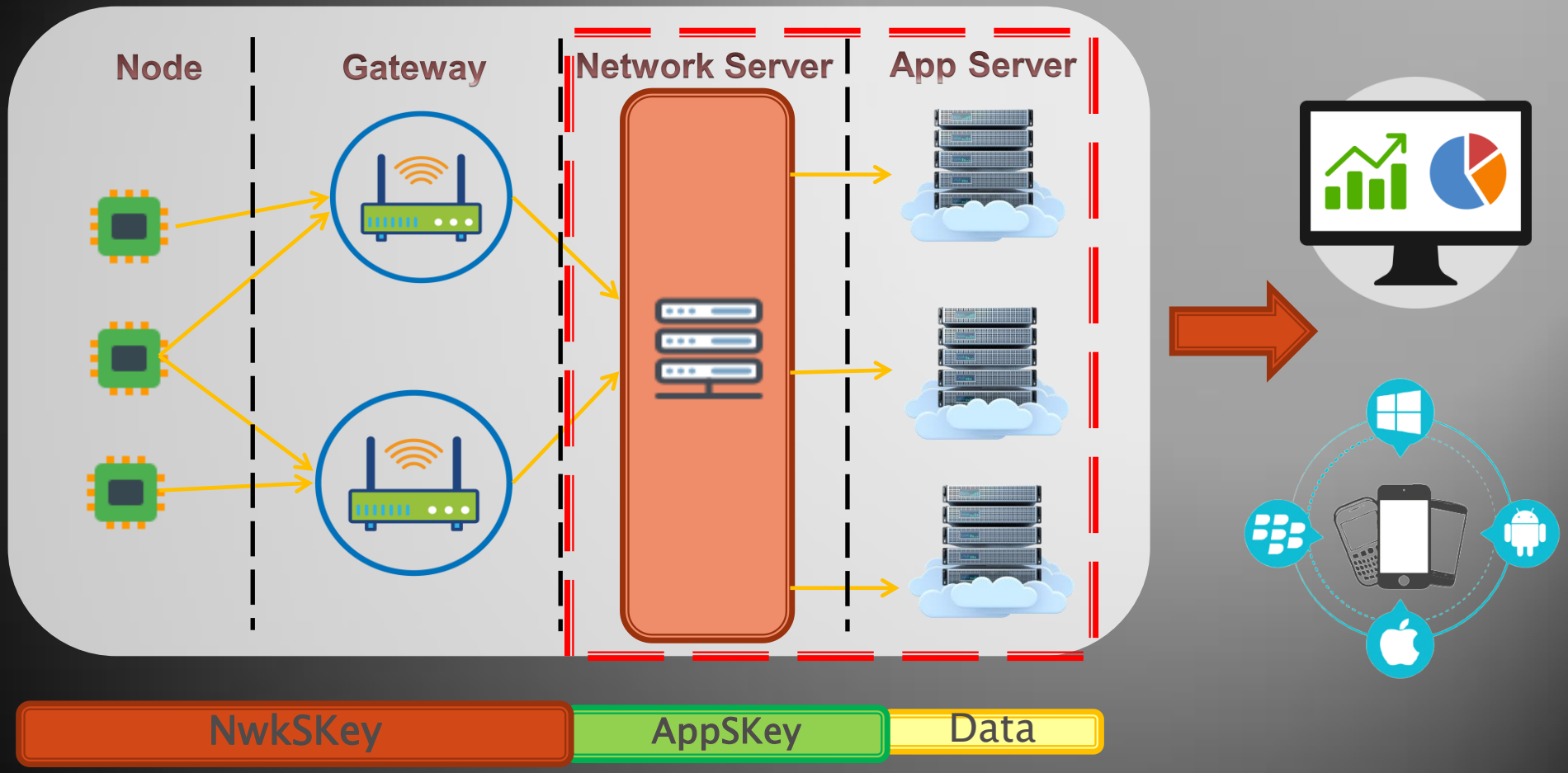
Examples of LoRaWAN Gateway

Gateway with Packet forwarder module

https://github.com/ttn-zh/ic880a-gateway/wiki

LoRaWAN 1.0.3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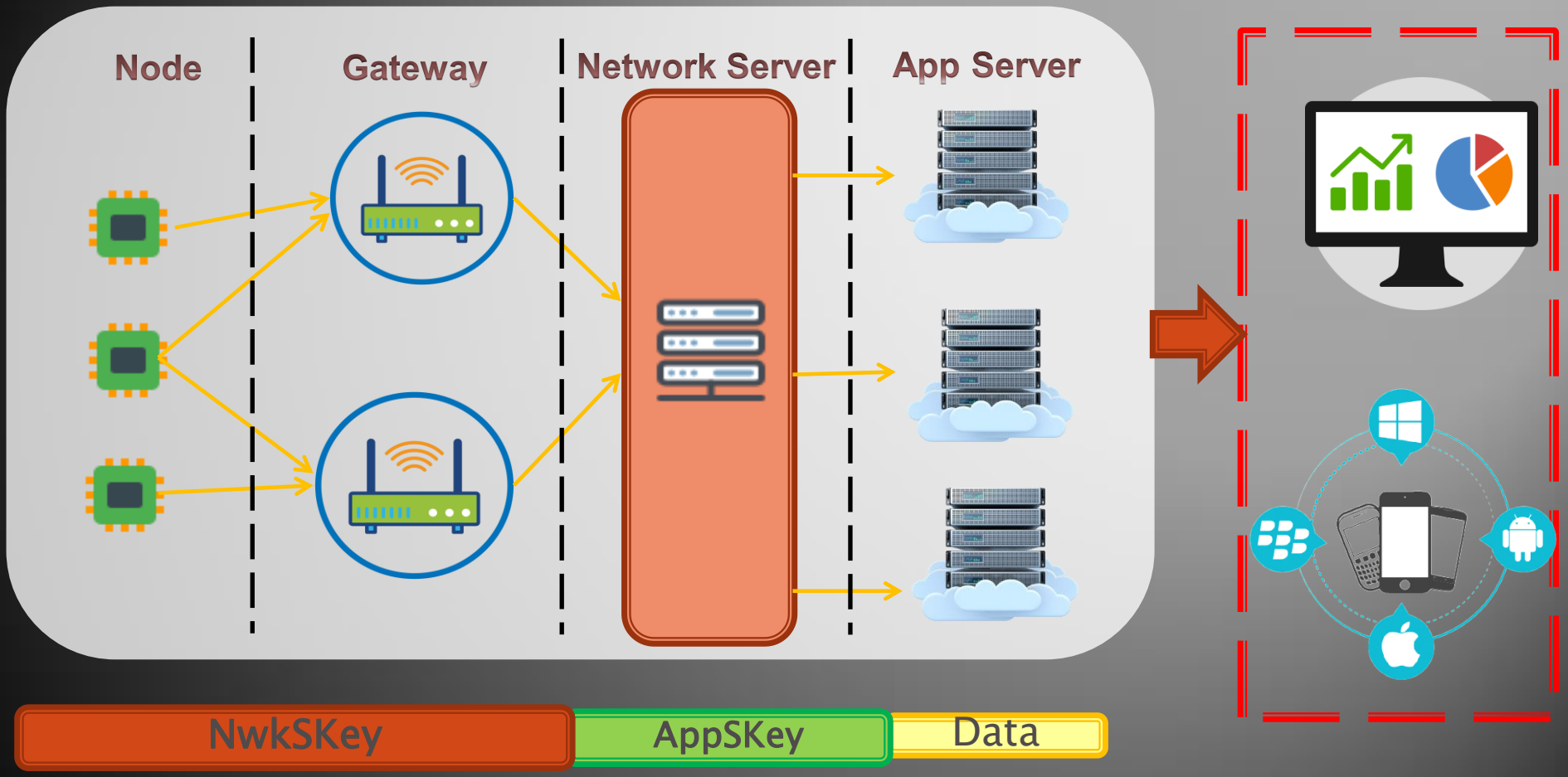
Examples of LoRaWAN Server

Private:

Public

LoRaWAN 1.0.3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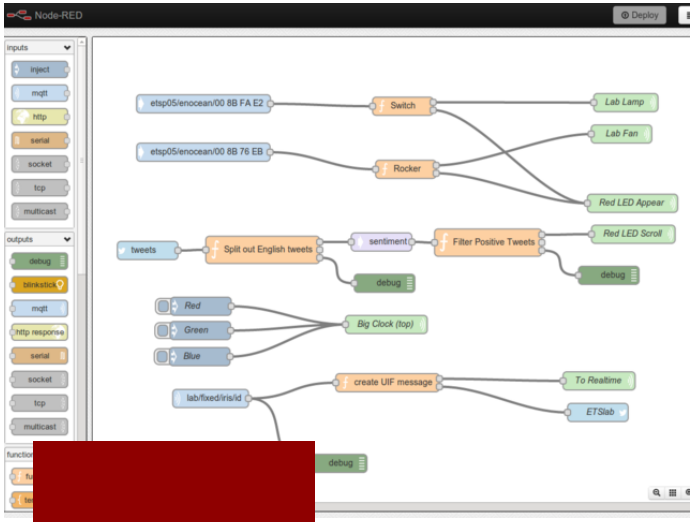
Example of Dashboards



Node-RED

Cayenne myDevices

Tago IO

ubidots

Procedures

Our LoRaWAN Server

Website:
https://www.thethingsnetwork.org/

Username: LoRaWAN-workshop
Password: 654321

Connect Gateway with THE THINGS NETWORK

Website:
https://www.thethingsnetwork.org/

Username: LoRaWAN-workshop
Password: 654321

Gateway EUI (MAC Address):
7276FF004501022D

Develop Node

- Hardware
  - Arduino Uno with RFM95
- Software
  - LMIC Library
- Complier
  - Arduino IDE

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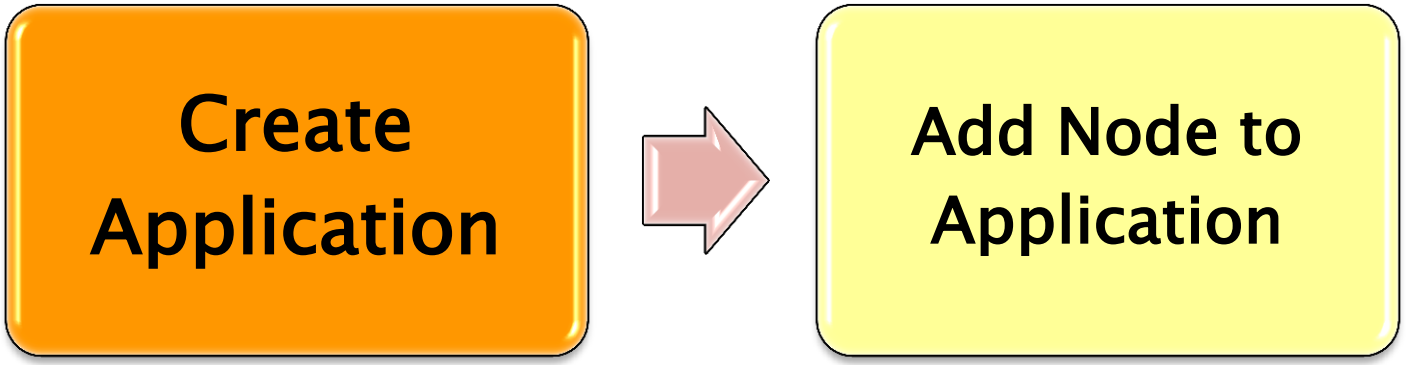


Let's Change some Parameters

- SF

  LMIC_setDrTxpow(DR_SFx,14);
  - DR_SF7 – DR_SF12

- Unconfirmed/Confirmed

  LMIC_setTxData2(1, mydata, sizeof(mydata)-1, x);
  - Unconfirmed = 0, Confirmed =1

AS923

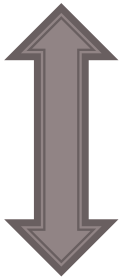
Data Rate	Settings	Bit Rate (bit/s)	Max MAC Payload Length (byte)
0	SF12/BW125kHz	250	59
1	SF11/BW125 kHz	440	59
2	SF10/BW125 kHz	980	59
3	SF9/BW125 kHz	1760	123
4	SF8/BW125 kHz	3125	230
5	SF7/BW125 kHz	5470	250
6	SF7/BW250 kHz	11000	250

Duration

- Maximum period = Airtime/dutycycle

Integration with Dashboard

THE THINGS
NETWORK



Cayenne
myDevices

Cayenne is a solution for building IoT applications based on known platforms

- Arduino
- Raspberry pi
- ESP8266
- Serial devices
- Wifi
- **Lora devices** → **CayenneLPP** http://mydevices.com/cayenne/docs/lora/#lora-cayenne-low-power-payload
- Mqtt client API

Requirement:

1. Node with CaynenneLPP Class
https://www.thethingsnetwork.org/docs/devices/arduino/api/cayennelpp.html

2. Integrate Application on TTN with Cayenne
(Integration Page)

3. Sign up and Create Dashboard at Cayenne
LoRa -> The Things Network -> Cayenne LPP

```
uint8_t addDigitalInput(uint8_t channel, uint8_t value);
uint8_t addDigitalOutput(uint8_t channel, uint8_t value);

uint8_t addAnalogInput(uint8_t channel, float value);
uint8_t addAnalogOutput(uint8_t channel, float value);

uint8_t addLuminosity(uint8_t channel, uint16_t lux);
uint8_t addPresence(uint8_t channel, uint8_t value);
uint8_t addTemperature(uint8_t channel, float celsius);
uint8_t addRelativeHumidity(uint8_t channel, float rh);
uint8_t addAccelerometer(uint8_t channel, float x, float y, float z);
uint8_t addBarometricPressure(uint8_t channel, float hpa);
uint8_t addGyrometer(uint8_t channel, float x, float y, float z);
uint8_t addGPS(uint8_t channel, float latitude, float longitude, float meters);
```

Device with 2 temperature sensors

Payload (Hex)	03 67 01 10 05 67 00 FF	
Data Channel	Type	Value
03 ⇒ 3	67 ⇒ Temperature	0110 = 272 ⇒ 27.2°C
05 ⇒ 5	67 ⇒ Temperature	00FF = 255 ⇒ 25.5°C

Type	IPSO	LPP	Hex	Data Size	Data Resolution per bit
Digital Input	3200	0	0	1	1
Digital Output	3201	1	1	1	1
Analog Input	3202	2	2	2	0.01 Signed
Analog Output	3203	3	3	2	0.01 Signed
Illuminance Sensor	3301	101	65	2	1 Lux Unsigned MSB
Presence Sensor	3302	102	66	1	1
Temperature Sensor	3303	103	67	2	0.1 °C Signed MSB
Humidity Sensor	3304	104	68	1	0.5 % Unsigned
Accelerometer	3313	113	71	6	0.001 G Signed MSB per axis
Barometer	3315	115	73	2	0.1 hPa Unsigned MSB
Gyrometer	3334	134	86	6	0.01 °/s Signed MSB per axis
GPS Location	3336	136	88	9	Latitude : 0.0001 ° Signed MSB
					Longitude : 0.0001 ° Signed MSB
					Altitude : 0.01 meter Signed MSB

Q&A

THANK YOU
IoT
TENTRACK
KMUTT
INNOVATION EXPERIENCE