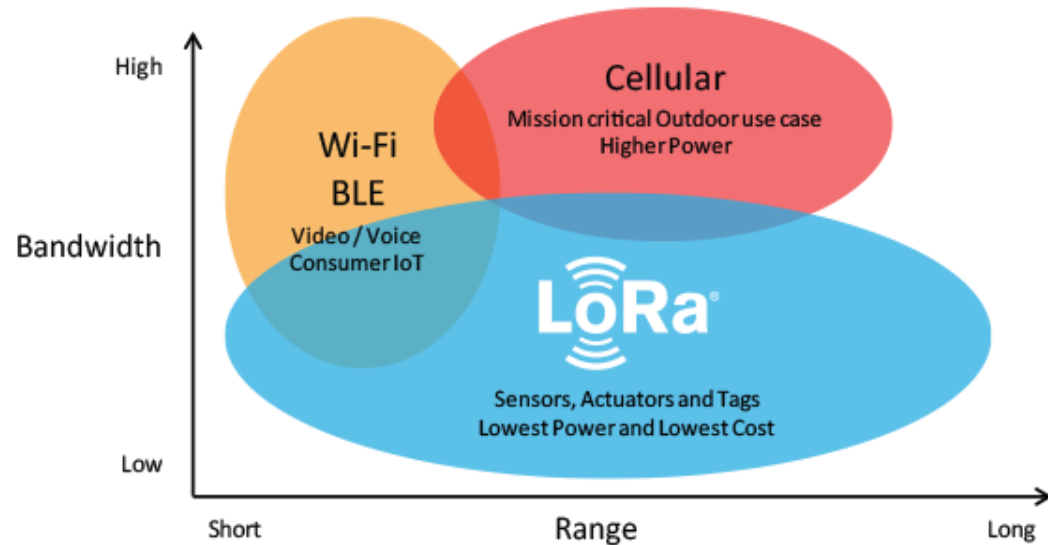


LoRa IoT MREŽA TELEKOMA SRBIJA

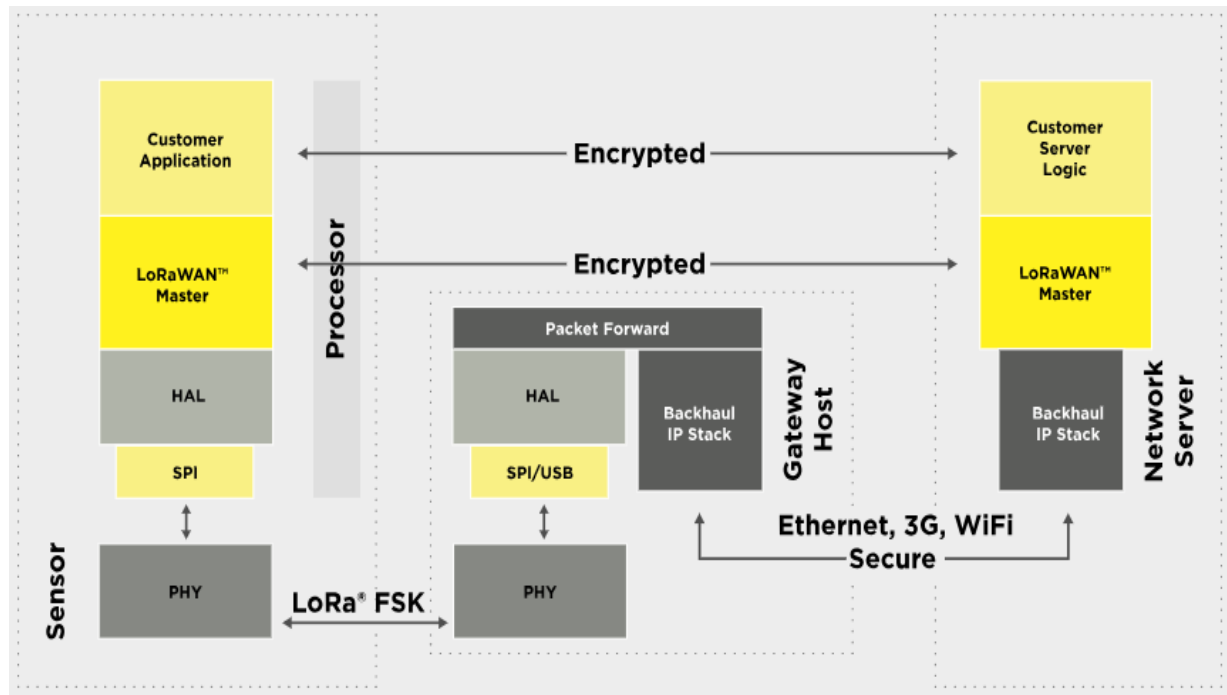
Nada Petrović

Primena LPWAN (Low Power Wide Area Networks) u domenu IoT (Internet of Things)



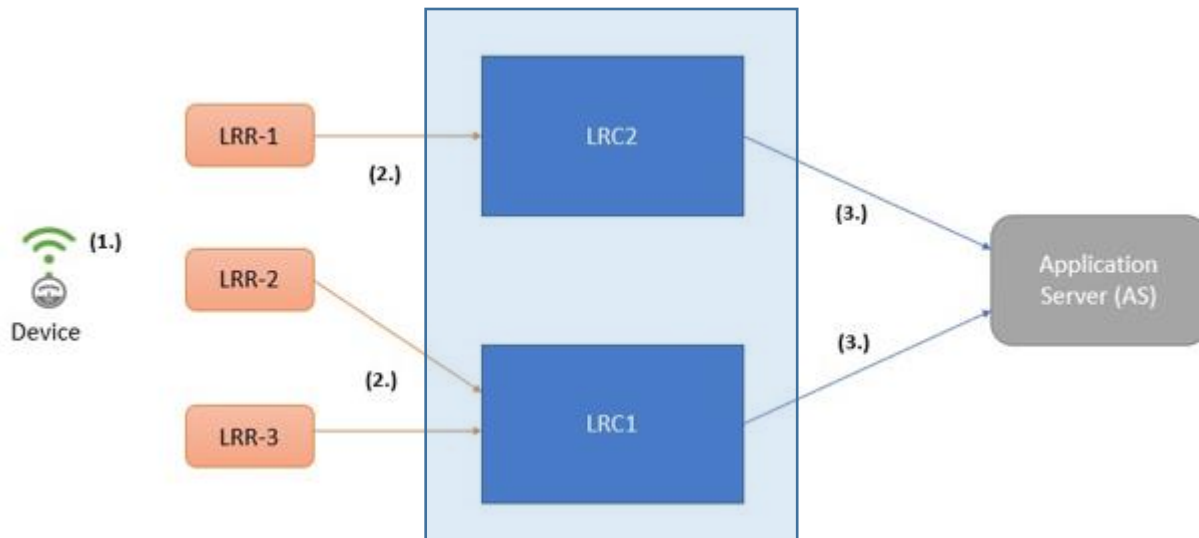
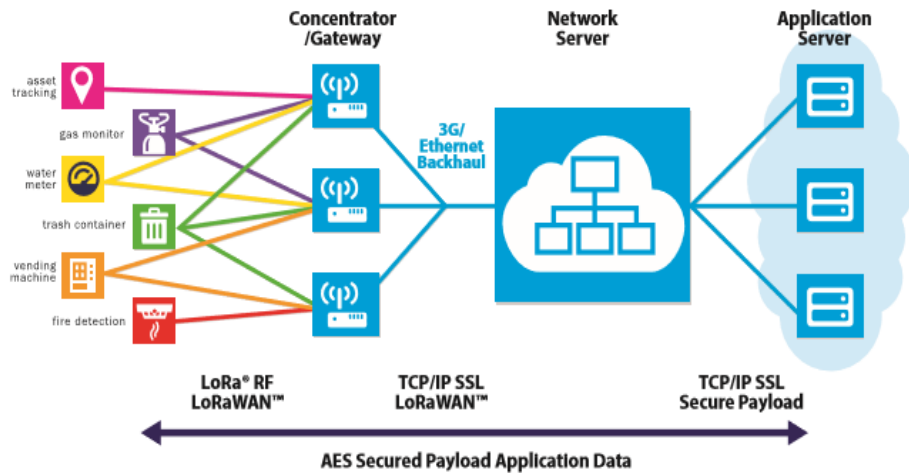
- Autonomno napajanje uređaja i višegodišnji životni vek baterije
- Podrška za velika rastojanja između krajnjeg i pristupnog uređaja (>10km)
- Visoka osetljivost na nivo signala

Arhitektura LoRa LPWAN



- *Gateway je Packet Forwarder* od krajnjeg uređaja do mrežnog servera
- Isti paket može da bude prenesen preko više GW-ja. Mrežni server vrši selekciju
- Mrežni server šalje pakete aplikativnom serveru, koji obavlja dekodovanje podataka

Komponente LoRa mreže TS



- LoRa GW-ji instalirani uz bazne stanice, sa omnidirekcionim antenama
- ~200 GW obezbeđuje signal na teritoriji Beograda - **Ufispac** LRR
- Transport kroz IP/MPLS mrežu Telekoma Srbija do mrežnog servera
- Mrežni server – **Actility ThingPark Wireless** LRC (active/standby)
- Aplikativni serveri i baze u *Cloud* infrastrukturi i kod partnera

Parametri radio pristupne mreže

Transmitter side:

- **Conducted Power:** TX Power out of the radio board, at antenna connector
- **ERP:** Equivalent Radiated Power, antenna gain expressed in dBd relative to half wave dipole antenna. $ERP = \text{TX Power} - \text{cable loss} + \text{antenna gain (dBd)}$
- **EIRP:** Equivalent Isotropically Radiated Power, antenna gain expressed in dBi relative to isotropic antenna radiating in all directions. $EIRP = \text{TX Power} - \text{cable loss} + \text{antenna gain (dBi)}$
 - $EIRP = ERP + 2.15\text{dB}$

Receiver side:

- **SNR:** Signal To Noise Ratio = $S/(I+N)$ => determines the quality of the reception
- **ESP:** Estimated Signal Power = received signal strength = S
 - $ESP = \text{Tx EIRP} - \text{Path Loss} + \text{Rx antenna gain}$
 - $ESP = \text{RSSI} - 10 \cdot \text{LOG}(1 + 10^{(-\text{SNR}/10)})$
- **RSSI:** Received Signal Strength Indicator = $S + I + N$



Radio pristupna mreža – teorijske vrednosti

$$P_{Sensitivity} = -174 + NF + 10 \cdot \log_{10}^{BW} + SNR$$

Thermal noise in dBm (points to -174)
System Bandwidth (points to $10 \cdot \log_{10}^{BW}$)
Noise Figure (points to NF)
Signal To Noise Ratio (points to SNR)

3.12.1 125kHz mode: IF8, IF[0 to 7] paths

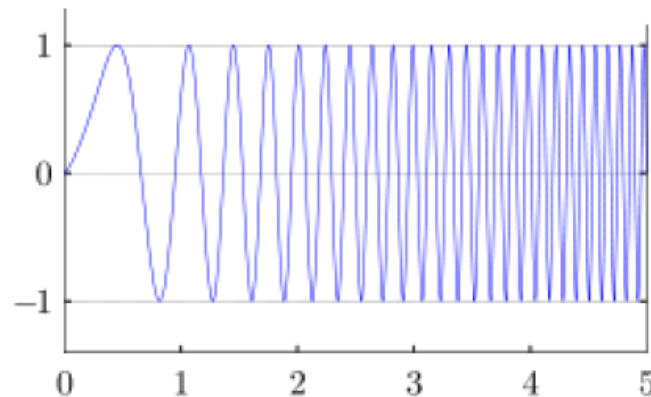
SF	Data rate (bit/sec)	Sensitivity (dBm)
7	5469	-126.5
8	3125	-129.0
9	1758	-131.5
10	977	-134.0
11	537	-136.5
12	293	-139.5

Table 12 Sensitivity with 125 kHz mode

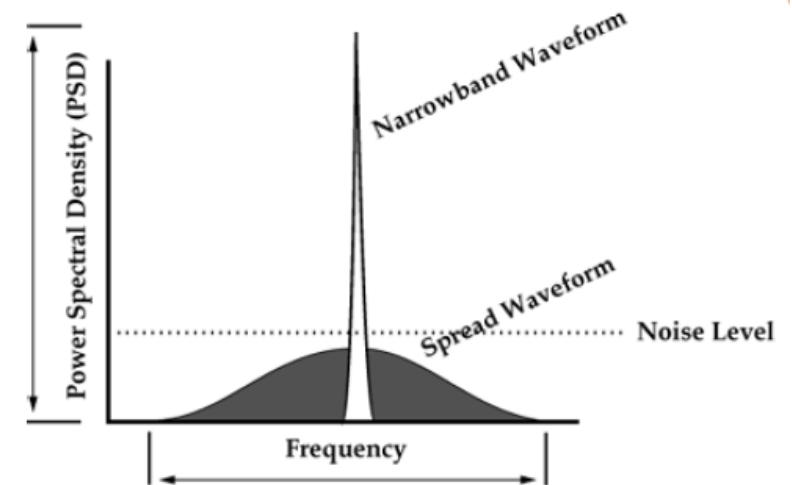
SpreadingFactor (RegModulationCfg)	Spreading Factor (Chips / symbol)	LoRa Demodulator SNR
6	64	-5 dB
7	128	-7.5 dB
8	256	-10 dB
9	512	-12.5 dB
10	1024	-15 dB
11	2048	-17.5 dB
12	4096	-20 dB

Radio pristupna mreža - modulacija

- Spread Spectrum technique is highly immune against interference and allows operating at very low SNR ranges (down to -20dB)
- Chirp Spread Spectrum (CSS) is adopted by LoRa™ modulation, where spreading is achieved by generating a chirp signal that continuously varies in frequency
- Chip Rate (R_c) = Bandwidth (125KHz)
- Symbol Rate (R_s) = $R_c / 2^{SF}$
 - SF = Spreading Factor (7...12)
 - SF are orthogonal on each other => no interference
- Bit Rate (R_b) = $R_s * SF * CR$
 - CR = Code Rate = 4/5



Chirp Signal



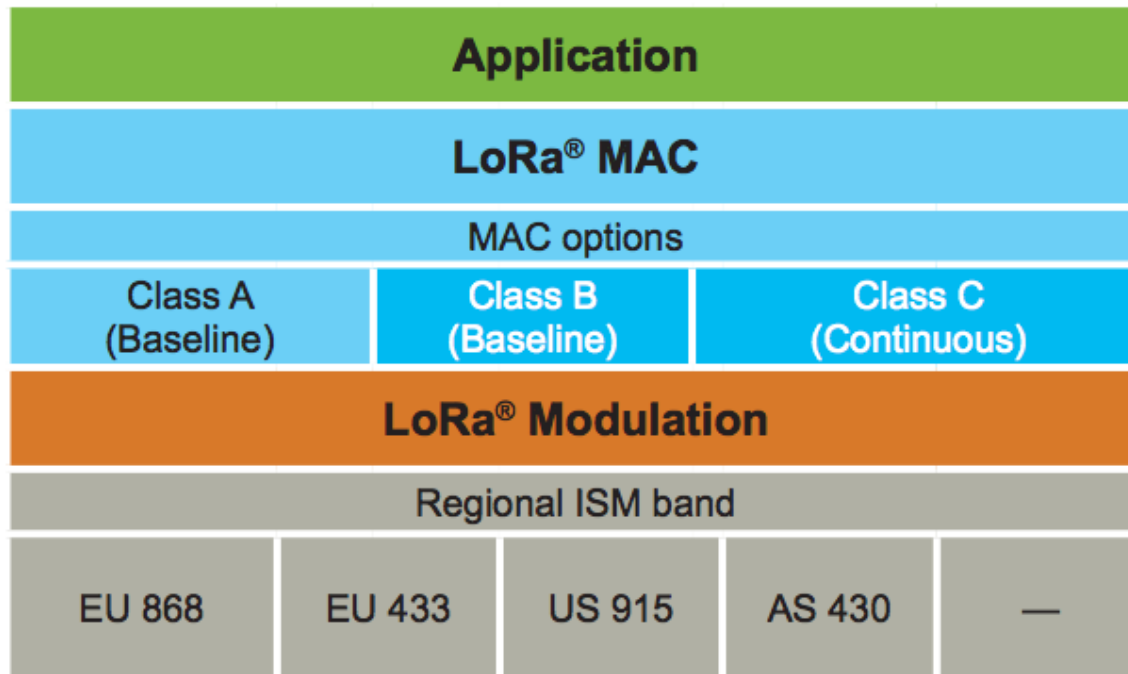
Parametri radio pristupne mreže

EU Data rate	Payload Data rate (bit/s)	Time on Air (ms)	Gateway sensitivity (dBm)	End-device sensitivity (dBm)
DR0 (SF12 / 125kHz)	293	1400	-147	-138
DR1 (SF11 / 125kHz)	540	740	-144.5	-135.5
DR2 (SF10 / 125kHz)	980	370	-142	-133
DR3 (SF9 / 125kHz)	1760	200	-139.5	-130.5
DR4 (SF8 / 125kHz)	3125	100	-137	-128
DR5 (SF7 / 125kHz)	5470	56	-134.5	-125.5
DR6 (SF7-250kHz)	11000	28	-131.5	-122.5
DR7 (FSK50)	50000	6	-116	-107

Gateway sensitivity figures assume +6dBi antenna

User applicative payload = 10 bytes

Osnovni slojevi LoRa komunikacionog uređaja



- Medium Access Control (MAC) sloj je zadužen za komunikaciju sa LoRaWAN mrežnim serverom

LoRaWAN klase uređaja

Class name	Intended usage
A (« all »)	Battery powered sensors , or actuators with no latency constraint Most energy efficient communication class. Must be supported by all devices
B (« beacon »)	Battery powered actuators Energy efficient communication class for latency controlled downlink. Based on slotted communication synchronized with a network beacon.
C (« continuous »)	Mains powered actuators Devices which can afford to listen continuously. No latency for downlink communication.

Katalog LoRaWAN profila uređaja na TS mrežnom serveru

commercialName	ID	typeMAC	vendor/commer	vendor/ID	connectivity	macMi	defaultsmBands-name
LoRaWAN 1.0.2 - class C - Rx2_SF12	LORA/GenericC.1_KR920_Rx2-SF12	LoRaMAC	Generic	generic	LORAWAN	4	KR920-923 (KR920)
PM2.5 Temp Humidity - LS-113 - class A	GLBSAT/LS-113_A.1_EU	LoRaMAC	GlobalSat	globalsat	LORAWAN	3	EU863-870 (EU868)
LoRaWAN 1.0.2 - class A - Rx2_SF12	LORA/GenericA.1_CN470_Rx2-SF12	LoRaMAC	Generic	generic	LORAWAN	4	CN470-510 (CN470)
PM2.5 Temp Humidity - LS-113 - class C	GLBSAT/LS-113_C.1_EU	LoRaMAC	GlobalSat	globalsat	LORAWAN	3	EU863-870 (EU868)
LoRaWAN 1.0.2 - class C - Rx2_SF12	LORA/GenericC.1_CN470_Rx2-SF12	LoRaMAC	Generic	generic	LORAWAN	4	CN470-510 (CN470)
PM2.5 Temp Humidity - LS-113 - class A	GLBSAT/LS-113_A.1_US	LoRaMAC	GlobalSat	globalsat	LORAWAN	3	US902-915 (US915)
LoRaMote EU fw4 - class A	SMTC/LoRaMoteA.1_EU	LoRaMAC	Generic	generic	LORAWAN	3	EU863-870 (EU868)
PM2.5 Temp Humidity - LS-113 - class C	GLBSAT/LS-113_C.1_US	LoRaMAC	GlobalSat	globalsat	LORAWAN	3	US902-915 (US915)
LoRaMote EU fw4 - class C	SMTC/LoRaMoteC.1_EU	LoRaMAC	Generic	generic	LORAWAN	3	EU863-870 (EU868)
Combox L - CI-B	SLVRA/COMBOX-L_CI-B_A.1_EU	LoRaMAC	Solvera Lynx	solvera	LORAWAN	3	EU863-870 (EU868)
Watteco fw 3.2 - Generic - class A (deprecated)	WECO/GenericA.3.2_EU	WattecoMAC_3.2	Watteco/NKE	watteco/nke	LORAWAN	3	EU863-870 (EU868)
Combox L - DI-B	SLVRA/COMBOX-L_DI-B_A.1_EU	LoRaMAC	Solvera Lynx	solvera	LORAWAN	3	EU863-870 (EU868)
Watteco fw 3.2 - Generic - class C (deprecated)	WECO/GenericC.3.2_EU	WattecoMAC_3.2	Watteco/NKE	watteco/nke	LORAWAN	3	EU863-870 (EU868)
Combox L - 2T-B	SLVRA/COMBOX-L_2T-B_A.1_EU	LoRaMAC	Solvera Lynx	solvera	LORAWAN	3	EU863-870 (EU868)
Watteco fw 3.2 - Generic - class A (deprecated)	WECO/GenericA.3.2_US	WattecoMAC_3.2	Watteco/NKE	watteco/nke	LORAWAN	3	US902-915 (US915)
Smove	TWAVE/SmoveA.1_ETSI_Rx2-SF12	LoRaMAC	Twave Technolog	twave_tech	LORAWAN	3	EU863-870 (EU868)
Watteco fw 3.2 - Generic - class C (deprecated)	WECO/GenericC.3.2_US	WattecoMAC_3.2	Watteco/NKE	watteco/nke	LORAWAN	3	US902-915 (US915)
TBS-200	TBOTC/TBS200A.1_ETSI_Rx2-SF12	LoRaMAC	Turbo Technolog	turbo_tech	LORAWAN	3	EU863-870 (EU868)
Watteco fw 3.4 - Generic - class A	WECO/GenericA.3.4_EU	LoRaMAC	Watteco/NKE	watteco/nke	LORAWAN	3	EU863-870 (EU868)
Oyster Tracker	DMAT/OysterTrackerA.1_AS923_Rx2-SF10	LoRaMAC	Digital Matter	digital_matter	LORAWAN	4	AS923
Watteco fw 3.4 - Generic - class C	WECO/GenericC.3.4_EU	LoRaMAC	Watteco/NKE	watteco/nke	LORAWAN	3	EU863-870 (EU868)
FuelUp	FULLUP/FUELUPA.1_ETSI_Rx2-SF12	LoRaMAC	FullUp sprl	fullup	LORAWAN	3	EU863-870 (EU868)
Watteco fw 3.4 - Generic - class A	WECO/GenericA.3.4_US	LoRaMAC	Watteco/NKE	watteco/nke	LORAWAN	3	US902-915 (US915)
Watteco fw 3.4 - Generic - class C	WECO/GenericC.3.4_US	LoRaMAC	Watteco/NKE	watteco/nke	LORAWAN	3	US902-915 (US915)
Demonstrator	ADRF/DemonstratorA.1_EU	LoRaMAC	Adeunis RF	adeunisrf	LORAWAN	3	EU863-870 (EU868)
Test Device Profile	Test	LoRaMAC	Generic	generic	LORAWAN	3	
Field Test Device - class A	ADRF/FielTestDeviceA.1_EU	LoRaMAC	Adeunis RF	adeunisrf	LORAWAN	3	EU863-870 (EU868)
LoRaWAN 1.0.2 revA - class A - Rx2_SF12_Bitgear	Bitgear	LoRaMAC	Generic	generic	LORAWAN	4	EU863-870 (EU868)
Field Test Device - class C	ADRF/FielTestDeviceC.1_EU	LoRaMAC	Adeunis RF	adeunisrf	LORAWAN	3	EU863-870 (EU868)
Telekom Srbija MMD - 1.0.2 revA - class A - Rx2-SF12	TelekomSrbijaMMD1.0.2 revAclassA Rx2SF12	LoRaMAC	Generic	generic	LORAWAN	4	EU863-870 (EU868)
Field Test Device - class A	ADRF/FielTestDeviceA.1_US	LoRaMAC	Adeunis RF	adeunisrf	LORAWAN	3	US902-915 (US915)
mDot Box - class A - Agrosens	MT/mdotboxA.1_EU	LoRaMAC	Multitech	multitech	LORAWAN	3	EU863-870 (EU868)
Field Test Device - class C	ADRF/FielTestDeviceC.1_US	LoRaMAC	Adeunis RF	adeunisrf	LORAWAN	3	US902-915 (US915)
Telekom Srbija MMD - 1.1 - class A - Rx2-SF12	TelekomSrbijaMMD1.1class ARx2-SF12	LoRaMAC	Bitgear	bitgear	LORAWAN	10	EU863-870 (EU868)
Generic Sensors - class A	ADRF/SensorsA.1_EU	LoRaMAC	Adeunis RF	adeunisrf	LORAWAN	3	EU863-870 (EU868)

LoRaWAN 1.0.2 revA generic profile 868mhz

Type	ID	Vendor	Connectivity	Model	Description	LRC Reference	
[Custom]	LORA/GenericA.1_CN470_Rx2-SF12	Generic	LORAWAN	LoRaWAN 1.0.2 - class A - Rx2_SF12	Generic profile LoRaWAN 1.0.2 for CN470 clas...	TDP_IOT-OPE.55	
[Custom]	LORA/GenericA.1_AS923_Rx2-SF10_1.0	Generic	LORAWAN	LoRaWAN 1.0 - class A - Rx2_SF10	Generic profile LoRaWAN 1.0 for AS923 class ...	TDP_IOT-OPE.43	
[Custom]	LORA/GenericA.1_AS923_Rx2-SF10	Generic	LORAWAN	LoRaWAN 1.0.2 - class A - Rx2_SF10	Generic profile LoRaWAN 1.0.2 for AS923 clas...	TDP_IOT-OPE.37	
[Custom]	LORA/GenericA.1.0.2a_FCC_Rx2-SF12	Generic	LORAWAN	LoRaWAN 1.0.2 revA - class A - Rx2_SF12_US	Generic profile LoRaWAN 1.0.2 revA for FCC cl...	TDP_IOT-OPE.16	
[Custom]	LORA/GenericA.1.0.2a_ETSI_Rx2-SF12	Generic	LORAWAN	LoRaWAN 1.0.2 revA - class A - Rx2_SF12	Generic profile LoRaWAN 1.0.2 revA for ETSI ...	TDP_IOT-OPE.7	
[Custom]	ISECUR/CalypsoA.1_US	Finsecur	LORAWAN	Calypso	Smoke detector	TDP_IOT-OPE.112	
[Custom]	ISECUR/CalypsoA.1_EU	Finsecur	LORAWAN	Calypso	Smoke detector	TDP_IOT-OPE.109	

Device Profile Detail

Connectivity: * LoRaWAN

Device Profile ID: * LORA/GenericA.1.0.2a_ETSI_Rx2-SF12

Generic

TDP_IOT-OPE.7

Supported MAC command

Join-request:

LinkADRReq:

NewChannelReq:

RxTimingSetupReq:

DevStatusReq:

DutyCycleReq:

LinkCheckReq:

RxParamSetupReq:

DIChannelReq:

TxParamSetupReq:

BeaconFreqReq:

PingSlotChannelReq:

Device Radio Frequency boot parameters

LoRaWAN 1.0.2 revA - class A - Rx2_SF12

File Edit Insert View Format Table

Generic profile LoRaWAN 1.0.2 revA for ETSI class A devices with Rx2 s

MAC RX1 delay (ms): 1000

MAC RX2 delay (ms): 2000

MAC RX1 Data Rate offset: 0

MAC RX2 Data Rate: 0

Mac RX2 frequency: 869.525

MAC max Duty Cycle:

Join Accept delay 1 (ms): 5000

Join Accept delay 2 (ms): 6000

Supported ISM bands

ISM band name

EU863-870 (EU868)

Add Remove

Class type: * Class A

Profile MAC Type: * LoRa Mac Layer

LoRaWAN version: 1.0.2

Supported Regional parameter revision: A

Device motion profile: * Random

Base station profile Ufispac macroMacro V2.1 R1

Base Station Installation Configuration

Power Supply Configuration: Power Over Ethernet

Embedded GPS receiver configuration: Present

LoRaWAN RF Hardware Configuration: 1 sector, 2 antennas, 1 board (mono-sector 2*8)

Antennas configuration: *

Name	Base Station Antenna Type	Gain (dBi)
A1	Omnidirectional	
A2	Omnidirectional	

Add Remove

WAN Configuration:

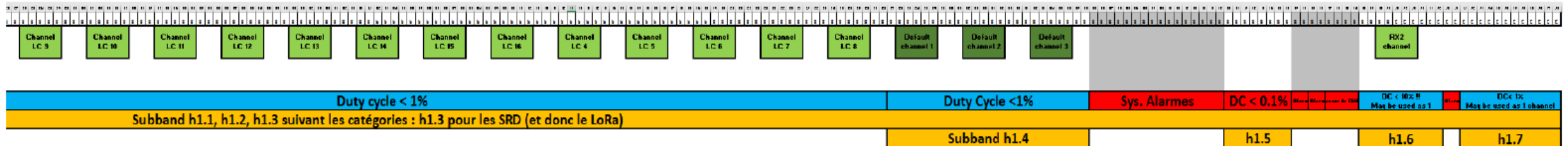
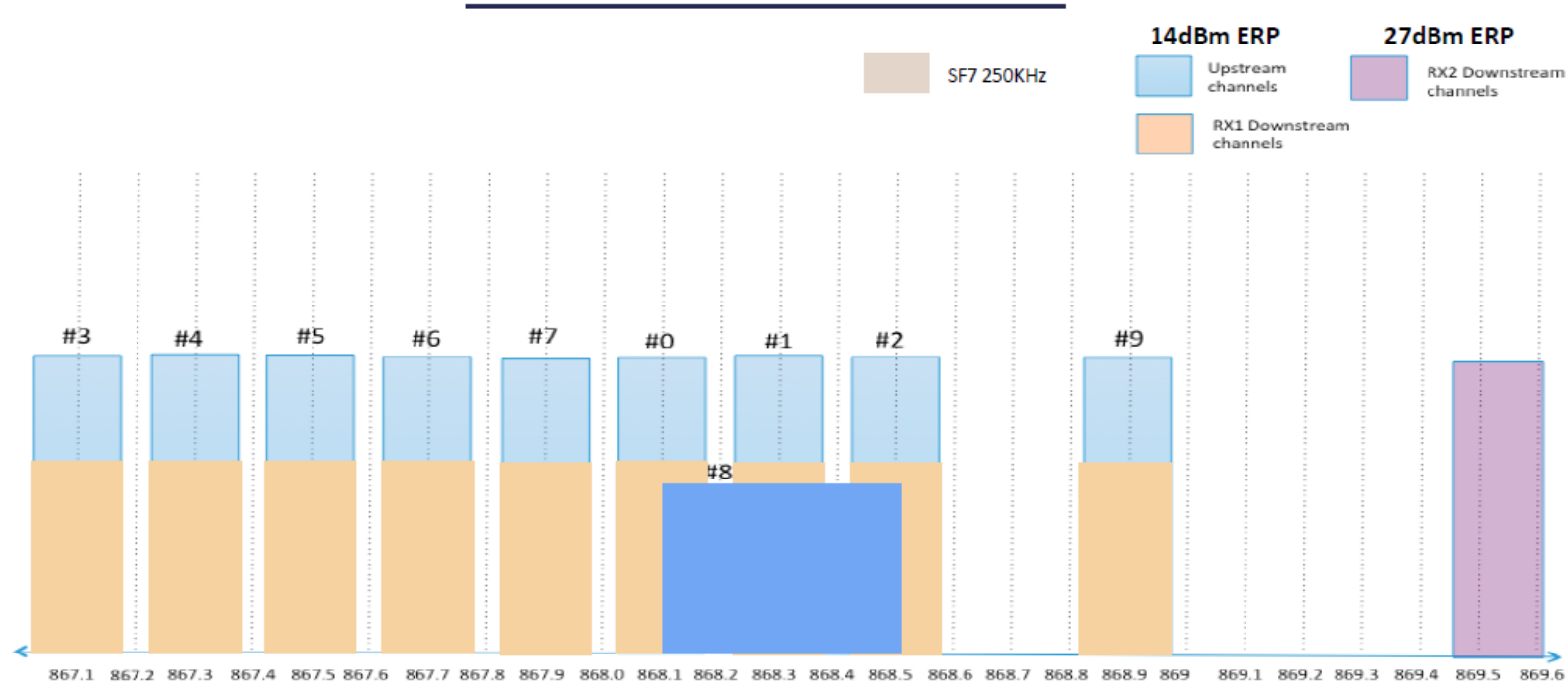
Network Name	Network Connection Type
eth0	Ethernet
ppp0	GPRS

Add Remove

LRC Configuration:

LRC Name	LRC ID
KAIOTLRC1	
KAIOTLRC2	

LoRa raspored kanala na 868mhz



Korisnički interfejs za upravljanje uređajima

The screenshot displays a web-based interface for managing IoT devices. The top navigation bar includes 'Subscriber', 'Orders & Subscriptions', 'Things', 'Device Manager', and 'Wireless Logger'. The left sidebar shows a tree view for 'Devices' with sub-items like 'environmental_sensing_BU', 'Network', 'Settings', 'Alarms (8)', and 'History'. The main content area is titled 'Device' and shows configuration details for a LoRaWAN Class A device. A map on the right shows the device's location in Belgrade, Serbia, near the Danube river.

Device Configuration:

- Manufacturer: Generic
- Model: LoRaWAN 1.0 - class A - Rx2_SF12 eu868
- Name: environmental_sensing_BU
- Motion indicator: Near static
- Activation mode: Activation By Personalization (ABP)
- DevEUI: 0000000000000007
- DevAddr: 01962565
- Current class: **Class A**

Administrative info:

Performance Metrics:

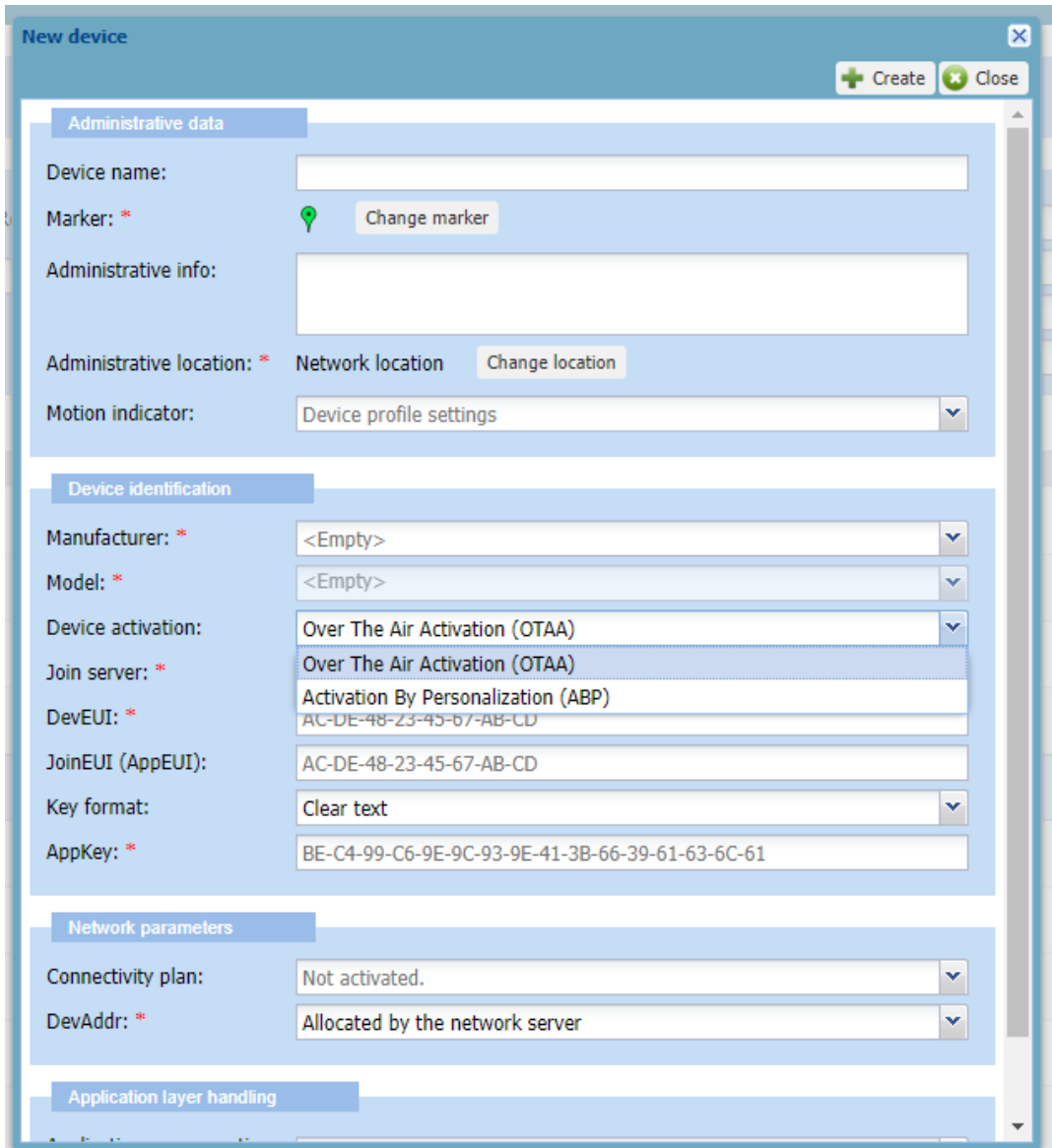
Average packets:	322.0/day	Last spreading factor:	SF7
Average ESP:	-89.3 dBm	Last ESP:	-90.5 dBm
Average SNR:	8.3 dB	Last SNR:	8.8 dB
Average RSSI:	-88.0 dBm	Last RSSI:	-90.0 dBm
Last instantaneous PER:	0.0%	Last uplink frame:	19.10.2021. 14:39:28
Last mean PER:	0.0%	Last downlink frame:	19.10.2021. 13:47:33

Battery Status:


- Battery: ?
- Battery replaced: **25.5.2021.**
- Replace battery by: -

Map: Shows the device location in Belgrade, Serbia, near the Danube river. The map includes labels for 'NEW BELGRADE NOVI BEOGRAD', 'Belgrade Београд', and 'Barokna Kapija'. A 'View location history' button is visible below the map.

Provisioning uređaja



The image shows a 'New device' provisioning form with the following sections and fields:

- Administrative data**
 - Device name:
 - Marker: * 
 - Administrative info:
 - Administrative location: * Network location
 - Motion indicator:
- Device identification**
 - Manufacturer: *
 - Model: *
 - Device activation:
 - Join server: *
 - DevEUI: *
 - JoinEUI (AppEUI):
 - Key format:
 - AppKey: *
- Network parameters**
 - Connectivity plan:
 - DevAddr: *
- Application layer handling**

Aplikativna podrška

The screenshot displays a web-based network management interface. At the top, there is a navigation bar with tabs for 'Subscriber', 'Orders & Subscriptions', 'Things', 'Device Manager', and 'Wireless Logger'. The 'Device Manager' tab is active. On the left side, a tree view shows the hierarchy: 'Devices' > 'environmental_sensing_BU' > 'Application servers' > 'Busit'. The main content area is titled 'Application server [Read only]' and contains several sections:

- Application server**:
 - Name: * Busit
 - ID: TWA_1100000048.196.AS
 - Content Type: * JSON
 - Type: HTTP Application Server (LoRaWAN)
 - Status: * Active
- Uplink/downlink security**:
 - Status: Inactive
 - Max timestamp deviation: -
- Route**:
 - Source ports: * *
 - Routing strategy: * Sequential
- Destinations**:
 - Destination: <https://aep.mts.rs/apps/activity/push>
- Status**:
 - Last modification: 8.6.2021. 12:40:03

Logger

Subscriber
 Orders & Subscriptions
 Things
 Device Manager
 Wireless Logger

Dashboard [1100000048]

DevAddr Filtering:
 DevEUI Filtering:
 LRR Id Filtering:
 LRC Id Filtering:
 AS ID Filtering:

From: To:
 Packet Type:

Decoder:

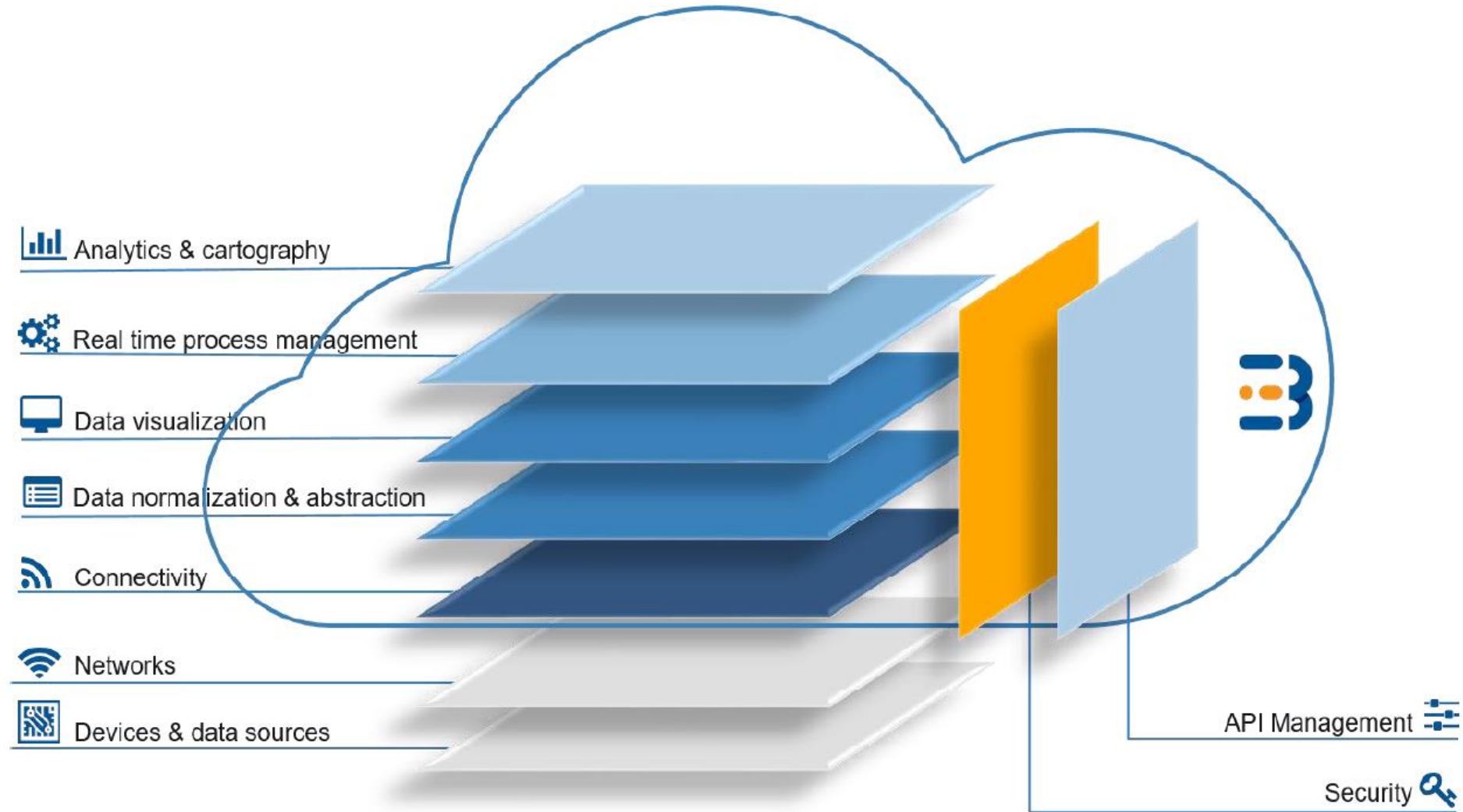
Auto Reload:

 Export size:

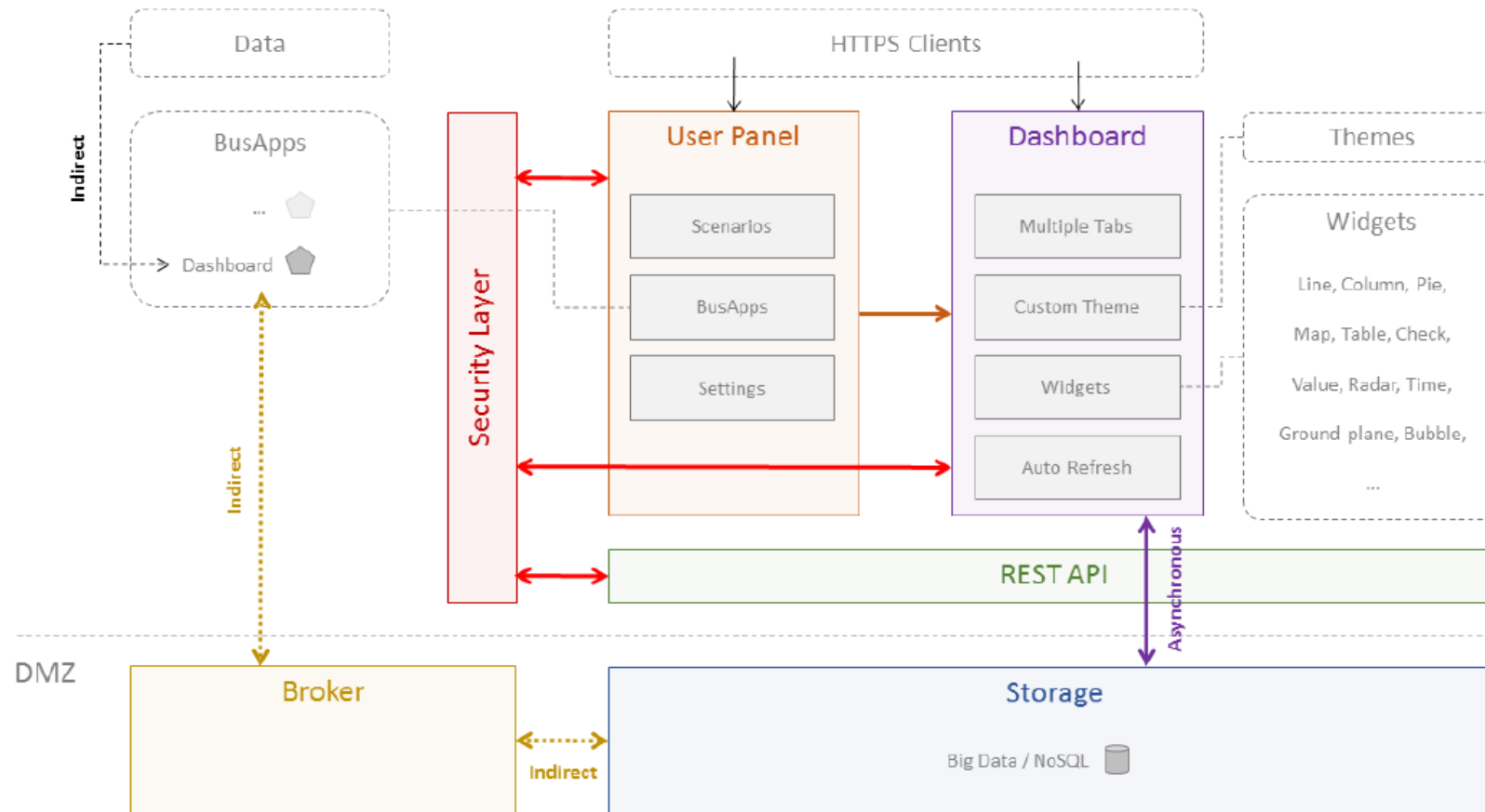
Last packets

		UTC Timestamp	Local Timestamp	DevAddr	DevEUI	FPort	FCnt ↑	FCnt ↓	AFCnt ↓	RSSI	SNR	ESP	SF/DR	SubBand	Channel	LRC Id	LRR Id	LRR Lat	LRR Long	LRR GWCn	Device L																														
	data	2021-10-19 12:34:17.173	2021-10-19 14:34:17.173	01962565	00000000000000007	1	65			-88.0	6.75	-88.832...	SF7	G2	LC6	0000020F	000036B0				1																														
	data	2021-10-19 12:29:05.601	2021-10-19 14:29:05.601	01962565	00000000000000007	1	64			-89.0	8.0	-89.638...	SF7	G2	LC5	0000020F	000036B0				5																														
Mtype: UnconfirmedDataUp Flags: ADR : 1, ADRAckReq : 0, ACK : 0 Mac (hex): - Data (hex): a6623132fa42dc0006136fa42f63c8f6135fa0000000623131fa0000000623130fa00000006231331affffff Driver metadata: model: -, application: - Data size (bytes): 47 AirTime (s): 0.112896																																																			
<table border="1" style="width: 100%; border-collapse: collapse; font-size: 8px;"> <thead> <tr> <th>LRR</th> <th>RSSI</th> <th>SNR</th> <th>ESP</th> <th>CHAINS timestamp {GPS_RADIO:-}</th> </tr> </thead> <tbody> <tr> <td>000036B0</td> <td>-89.0</td> <td>8.0</td> <td>-89.63892</td> <td>CHAIN[0]:2021-10-19T14:29:05.601+02:00 {-}</td> </tr> <tr> <td>00003788</td> <td>-94.0</td> <td>7.0</td> <td>-94.7901</td> <td>CHAIN[0]:2021-10-19T14:29:05.000000000+02:00 {GPS_RADIO}</td> </tr> <tr> <td>00003700</td> <td>-106.0</td> <td>2.5</td> <td>-107.93776</td> <td>CHAIN[0]:2021-10-19T14:29:05.544+02:00 {-}</td> </tr> <tr> <td>000037BF</td> <td>-105.0</td> <td>-1.25</td> <td>-108.680115</td> <td>CHAIN[0]:2021-10-19T14:29:05.547+02:00 {-}</td> </tr> <tr> <td>000005F4</td> <td>-107.0</td> <td>-2.0</td> <td>-111.12443</td> <td>CHAIN[0]:2021-10-19T14:29:05.572+02:00 {-}</td> </tr> </tbody> </table>																						LRR	RSSI	SNR	ESP	CHAINS timestamp {GPS_RADIO:-}	000036B0	-89.0	8.0	-89.63892	CHAIN[0]:2021-10-19T14:29:05.601+02:00 {-}	00003788	-94.0	7.0	-94.7901	CHAIN[0]:2021-10-19T14:29:05.000000000+02:00 {GPS_RADIO}	00003700	-106.0	2.5	-107.93776	CHAIN[0]:2021-10-19T14:29:05.544+02:00 {-}	000037BF	-105.0	-1.25	-108.680115	CHAIN[0]:2021-10-19T14:29:05.547+02:00 {-}	000005F4	-107.0	-2.0	-111.12443	CHAIN[0]:2021-10-19T14:29:05.572+02:00 {-}
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00003788	-94.0	7.0	-94.7901	CHAIN[0]:2021-10-19T14:29:05.000000000+02:00 {GPS_RADIO}																																															
00003700	-106.0	2.5	-107.93776	CHAIN[0]:2021-10-19T14:29:05.544+02:00 {-}																																															
000037BF	-105.0	-1.25	-108.680115	CHAIN[0]:2021-10-19T14:29:05.547+02:00 {-}																																															
000005F4	-107.0	-2.0	-111.12443	CHAIN[0]:2021-10-19T14:29:05.572+02:00 {-}																																															
Device [Lat (solv): - Lat: - Lon (solv): - Lon: - Loc radius: - Loc time: - Alt: - Alt radius: - Acc: - North Velocity: - East Velocity: -] Reporting Status: On time ISM Band: EU 863-870MHz AS ID: TWA_1100000048.196.AS Frequency (MHz): 867.3 Current class: A																																																			
	data	2021-10-19 12:23:53.944	2021-10-19 14:23:53.944	01962565	00000000000000007	1	63			-87.0	8.5	-87.573...	SF7	G1	LC2	0000020F	000036B0				10																														
	data	2021-10-19 12:18:42.361	2021-10-19 14:18:42.361	01962565	00000000000000007	1	62			-86.0	9.75	-86.437...	SF7	G2	LC7	0000020F	000036B0				2																														

Busit AEP *Low code - no code*











Busit funkcionalni blokovi



BusApps

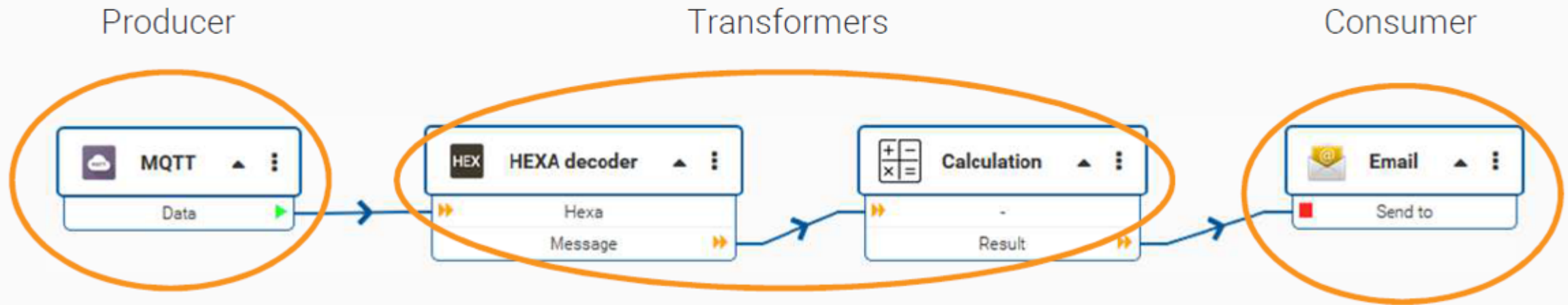
- 1 Osnovni blok/modul u okviru platforme
- 2 BusApp-ovi služe za prikupljanje, obradu i prikaz podataka
- 3 Većina modula može da se iskoristi i za prikupljanje i za prikaz podataka
- 4 Na raspolaganju je 180 različitih BusApp-ova. Neki su posebno dizajnirani za prikupljanje ili obradu podataka sa konkretnih IoT uređaja

All types Data sources Modifiers Endpoints

 Debug	 Activity Activity Thingpark Generic	 Data table	 Generic producer
 WebSocket	 Dashboard action	 Alarm	 Inter-scenario



Scenario



1

Definisanje protokola i uređaja sa kojih se podaci prikupljaju

2

Obrada i normalizacija podataka sa definisanih uređaja

3

Uvid u obrađene podatke

Prikaz podataka/dashboard

Ambient 424 / Empty page



Date and time

23.5.2021. 22:33

Temperature

25,75

Humidity

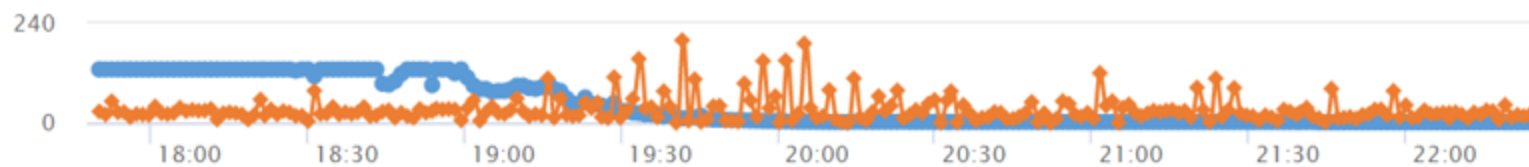


Preasure

1.011,02

Temporal curve

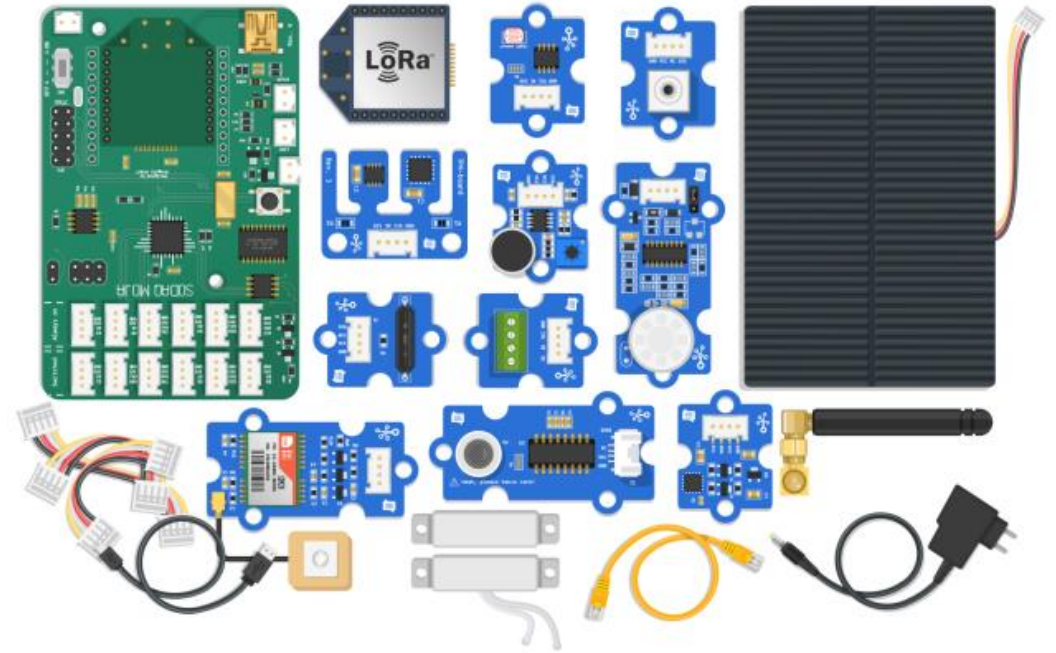
—●— Light —◆— Sound



Sadržaj AllThingsTalk rapid development paketa

Contents of the Kit:

- 1* SODAQ Mbili, low power Arduino (ATmega 1284P) with 16kB, and 128kB flash memory.
- 1* LoRa Microchip RN2483 module with U.FL connector
- 1* Antenna (1/4 Wavelength) and U.FL to SMA pigtail
- 1* Power adaptor (Euro 220V/5V)
- 1* Mini USB cable
- 1* 1.5W Solar panel
- 1* Lithium Polymer Battery 1200mAh
- 1* Grove – Button
- 1* Grove – Light sensor
- 1* Grove – PIR motion sensor
- 1* Grove – Temperature – pressure – humidity sensor
- 1* Grove – 3-Axis Digital Accelerometer
- 1* Grove – Sound/Loudness Sensor
- 1* Grove – GPS module
- 1* Grove – Air quality sensor
- 1* Grove – Tilt switch
- 1* Grove – Magnetic door switch & screw connector
- 10* 5cm 4 Pin Grove Cables
- 5* 20cm 4 Pin Grove Cables



<https://docs.allthingstalk.com/examples/hardware/get-started-sodaq-mbili/>

Rešenje za zaštitu kablovske infrastrukture

- Masovna primena LoRa senzorskih uređaja ispod čeličnih poklopaca
- Odabir senzora za specifične potrebe
- Zadovoljavajuće fizičke karakteristike otpornosti
- Web aplikacija za praćenje statusa u oknu na osnovu pristiglih poruka, autorizaciju ulazaka i generisanje alarma
- Mobilna aplikacija za autorizaciju na terenu



Telekom Srbija Pregled okna u tabeli

St. L.	Isobri	ID okna	Uređaj / Vred	Izvršna jedinica	Opština / Mesto	Ulica	Ulazak trenutno dozvoljen	Alarmirajući događaj	Vreme događaja	Broj narednih alarma
		XXXX_1301	1/2	Služba za mrežne operacije Krovni Vezac	Beograd / BEOGRAD	VERBA 1	Ne	Detektovano otvaranje poklopca	2018.09.15.07:18:00	4
		XXXX_1302	1/1	Služba za mrežne operacije Krovni Vezac	Beograd / BEOGRAD	GOSPODARA VUČIĆA 100A	Ne	Detektovano prisustvo u oknu (prijelaz okna)	2018.09.15.06:27:13	15
		XXXX_1303	1/1	Služba za mrežne operacije Krovni Vezac	Beograd / BEOGRAD	VAN DERBKA 17	Ne	Detektovano prisustvo u oknu (prijelaz zatvarača)	2018.09.15.06:43:05	4
		XXXX_30	1/1	Služba za mrežne operacije Centar -kablovi	Beograd / BEOGRAD	ŠERBANOVIĆA 15A	Da	Detektovano otvaranje poklopca	2018.09.15.06:12:23	7
		XXXX_36	1/1	Služba za mrežne operacije Centar -kablovi	Beograd / BEOGRAD	MIRKOVAČIĆA 11	Ne	/	2018.09.15.06:09:12	1
		XXXX_X	1/1	Služba za mrežne operacije Centar -kablovi	Beograd / BEOGRAD	BULEVAR ALEKSANDRA KAMBOREVIĆA 60	Ne	Detektovano otvaranje poklopca	2018.09.15.06:06:43	11
		XXXX_1309	1/1	Služba za mrežne operacije Krovni Vezac	Beograd / BEOGRAD	SIMATOVAČKA 11	Ne	Detektovano otvaranje poklopca	2018.09.15.05:01:54	3
		XXXX_1310	1/1	Služba za mrežne operacije Krovni Vezac	Beograd / BEOGRAD	VERBA 1	Ne	Detektovano otvaranje poklopca	2018.09.15.05:01:54	3

Previdi 1 od 119 20 redova Stranica

Hvala na pažnji.

