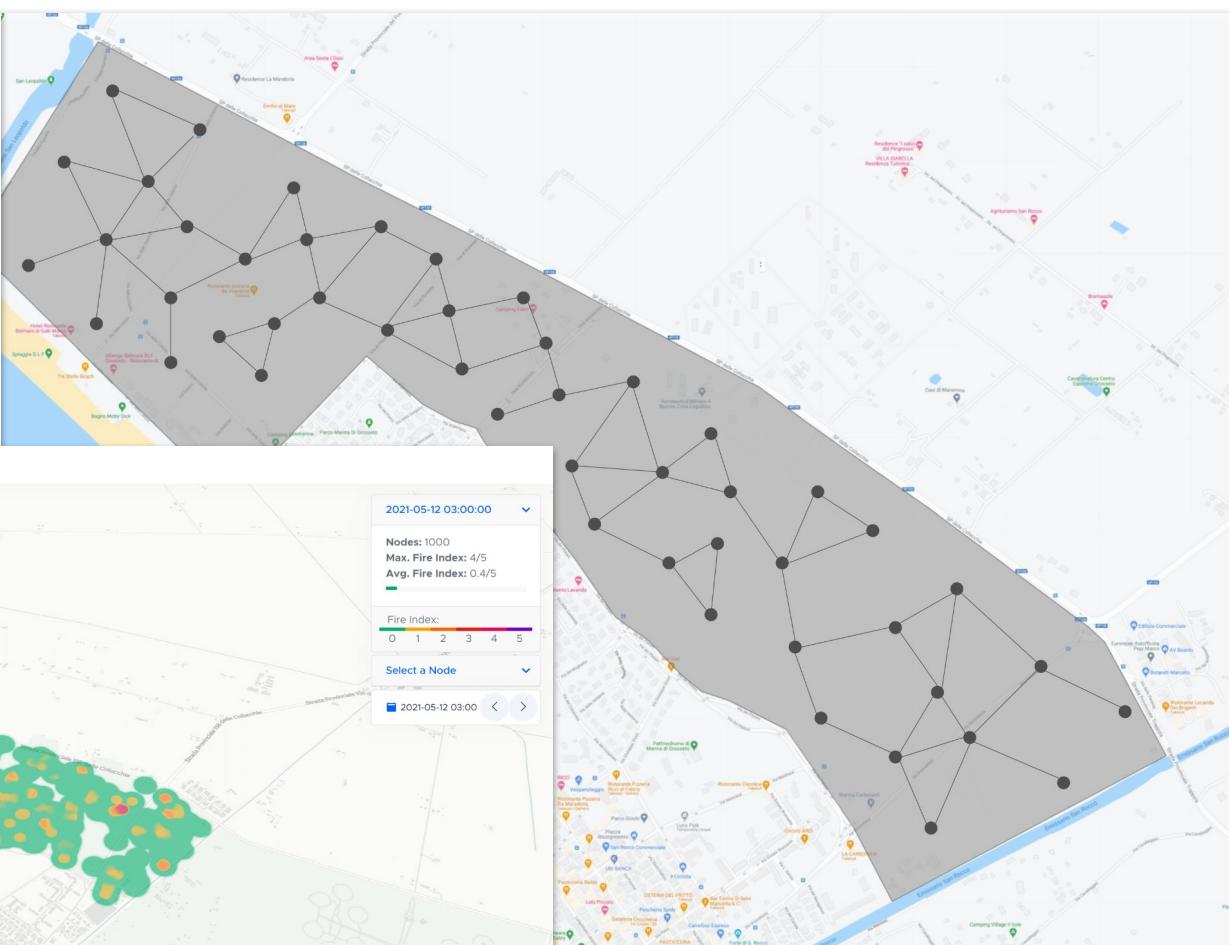
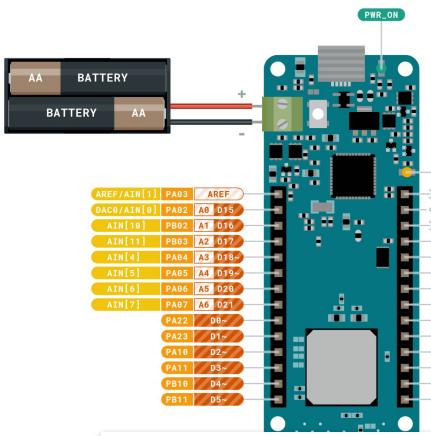



Sistema prevenzione incendi

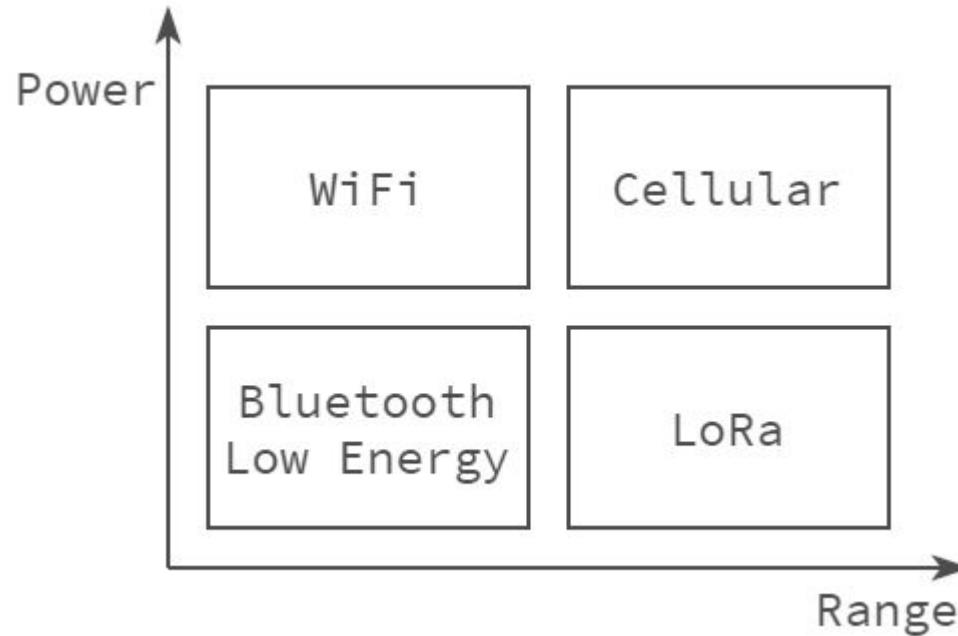
Manfucci Alessandro 5 BIA

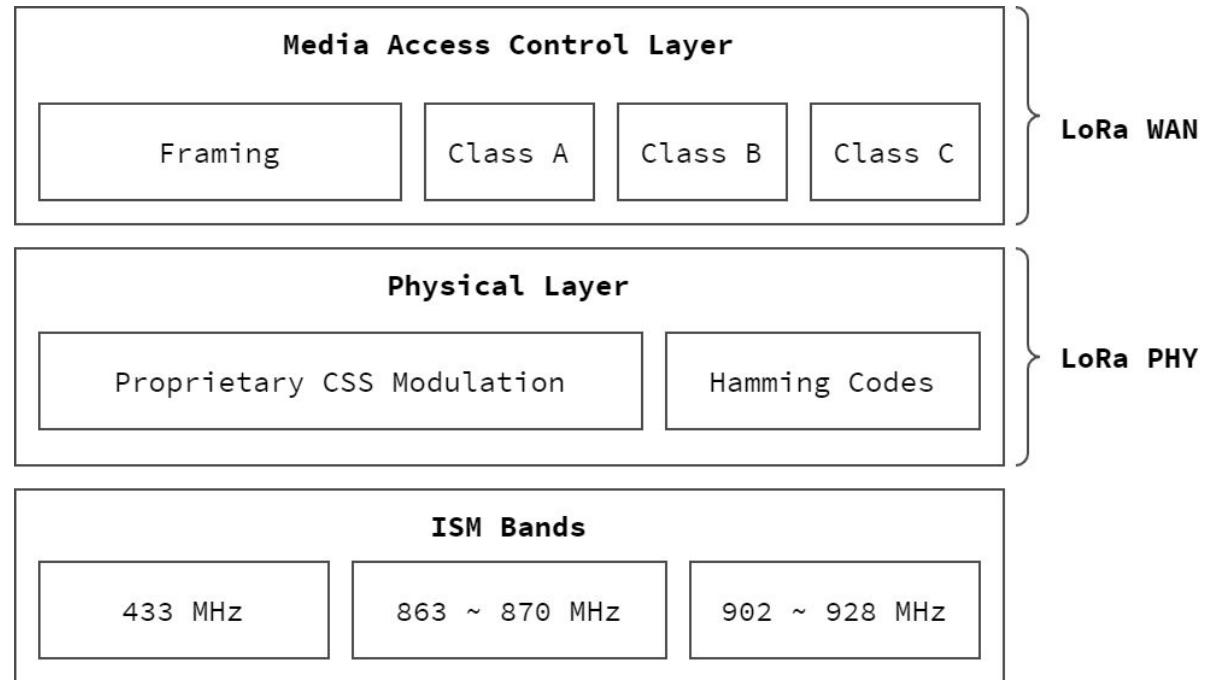
Rete di Sensori





Suite di protocolli per
realizzare **Low Power**
Wide Area Networks

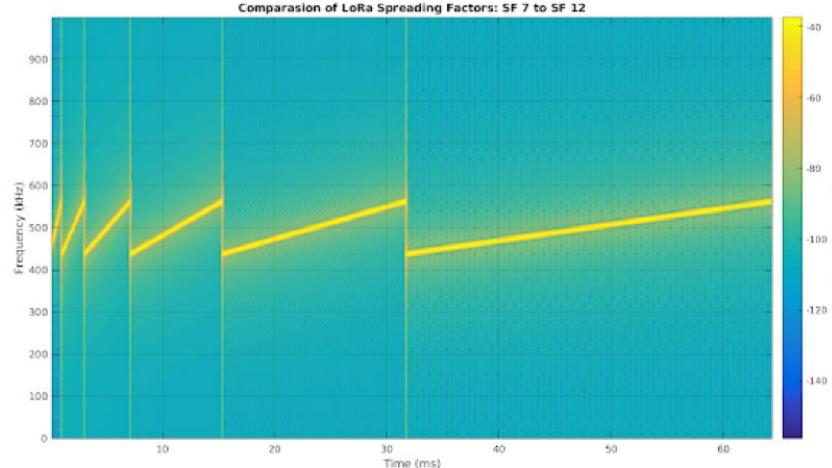
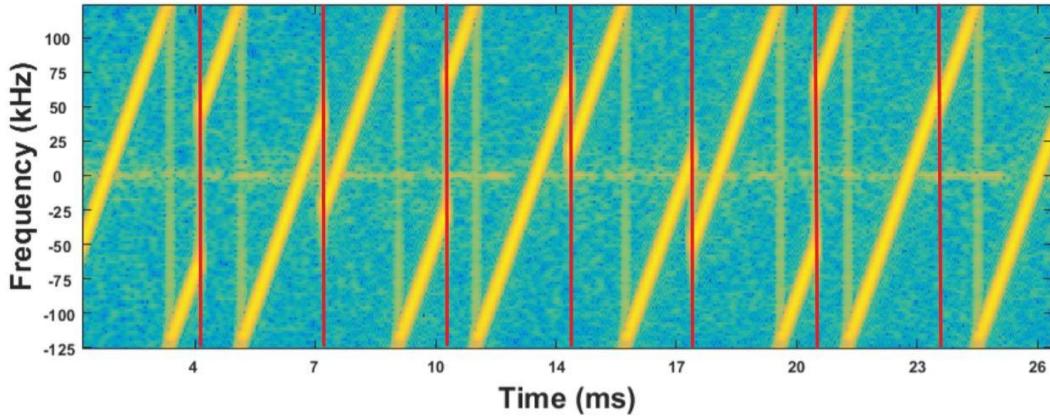




LoRa PHY

Modulazione proprietaria
derivata da Chirp Spread
Spectrum

SF (7~12): n° bit codificati
in un chirp, durata dello
sweep di frequenza





LoRa PHY

Symbol Rate, $R_s = BW/2^SF$

Symbol ToA, $T_{sym} = 2^SF/BW$

Bit rate, $R_b = SF * R_s = SF * BW / 2^SF$

Data Rate	Configurazione SF / BW	Bit Rate [bit/s]	Symbol ToA [ms/symbol]	ToA [ms/byte]
0	SF12 / 125 kHz	370	32.7	21.6
1	SF11 / 125 kHz	670	16.4	12.0
2	SF10 / 125 kHz	1220	8.2	6.5
3	SF9 / 125 kHz	2200	4.1	3.6
4	SF8 / 125 kHz	3900	2.0	2.1
5	SF7 / 125 kHz	6840	1.0	1.2
6	SF7 / 250 kHz	13670	0.5	0.6

LoRa PHY



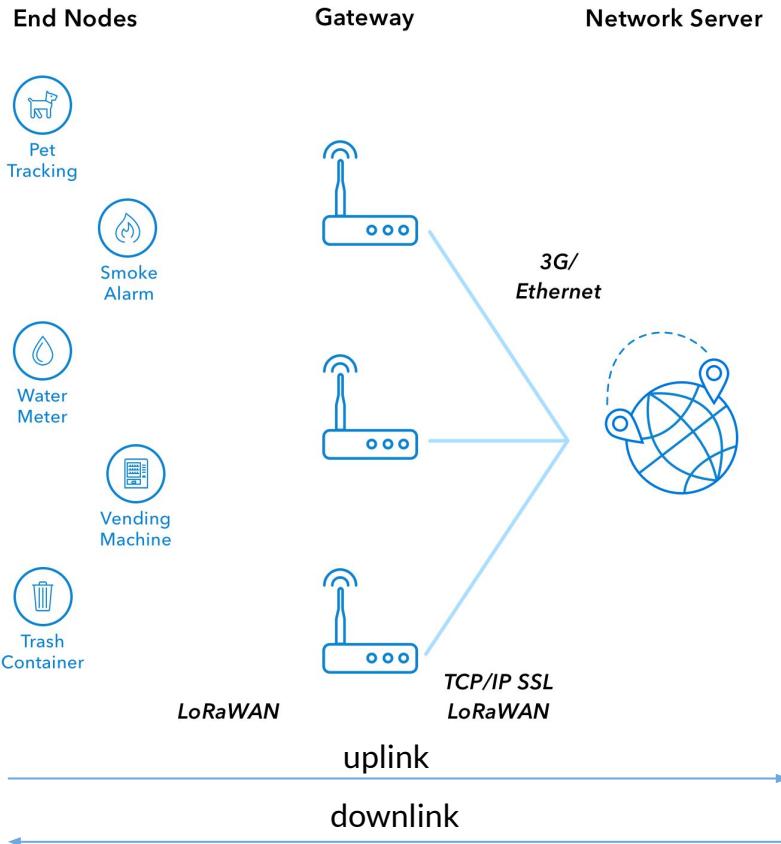
- **Preamble:** rilevamento trasmissione e sincronizzazione
- **Header:** lunghezza Payload (max. 255 B), Error Correcting Code applicato al Payload? Code Rate (4/5 ~ 4/8)?

All'header è sempre applicato un **ECC** con **CR = 4/8**

CR = n/k , **k-n** bit di controllo per ogni **n** bit di informazioni

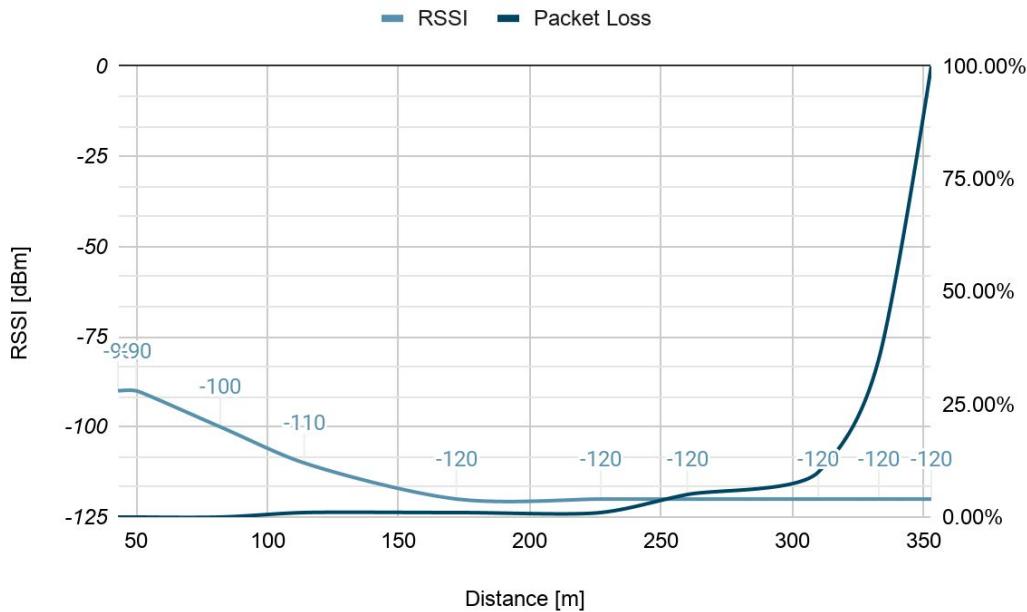
LoRa WAN

- **End Node:** raccolgono le informazioni tramite sensori
- **Gateway:** ricevono i dati trasmessi dai nodi terminali
- **Server:** implementa un servizio/ un' applicazione

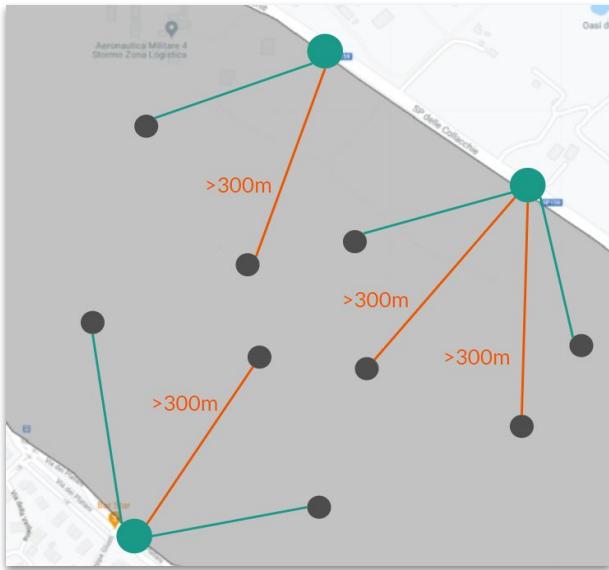




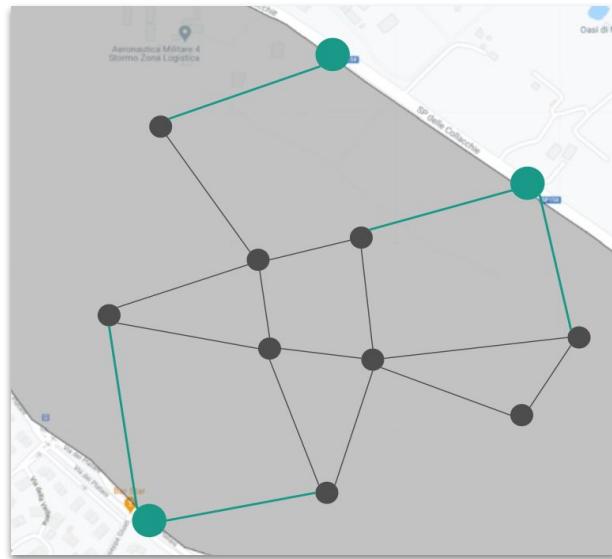
- **RSSI: -120 dBm a 170m**
- **Packet Loss: 100% a 350m**



DR: 5, CR: 4/5, f: 868MHz



- Gateway all'interno
- DataRate minore
- Rete meshed





Frame

0 1 2 3
0.1.2.3.4.5.6.7.8.9.0.1.2.3.4.5.6.7.8.9.0.1.2.3.4.5.6.7.8.9.0.1

Arduino ID		
Temperature	Humidity	CO2
TVOC		Update ID
TTL	Protocol ID	Reserved

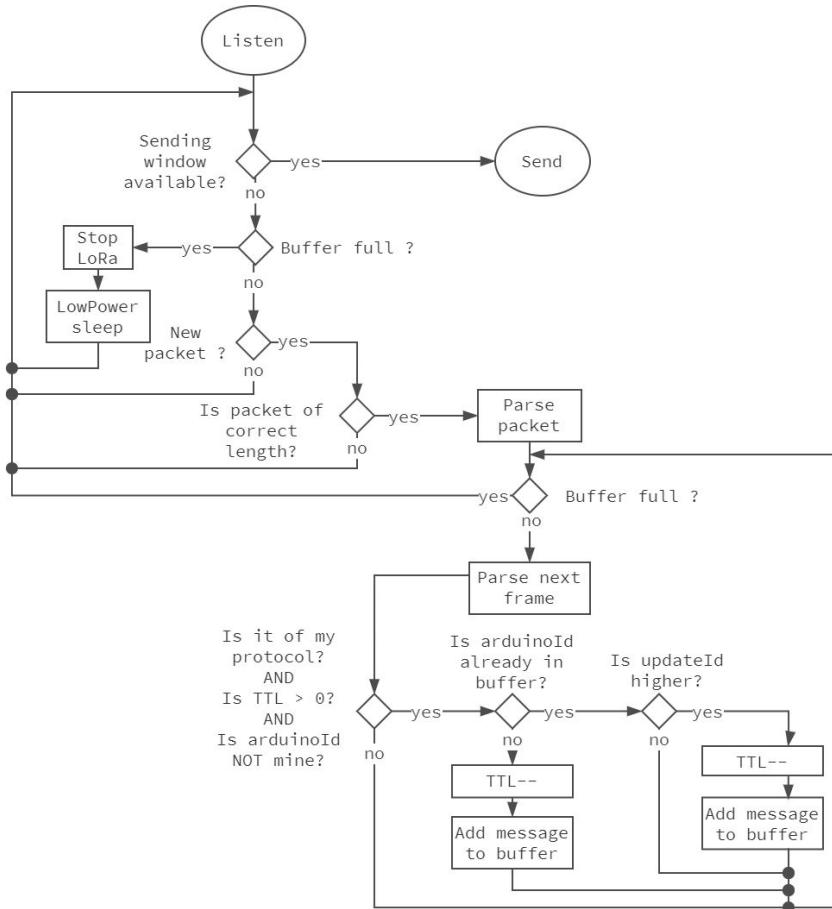
Accesso al mezzo



- Rete **asincrona**
- Finestra di ricezione dinamica
- Finestra di invio dinamica

Ricezione

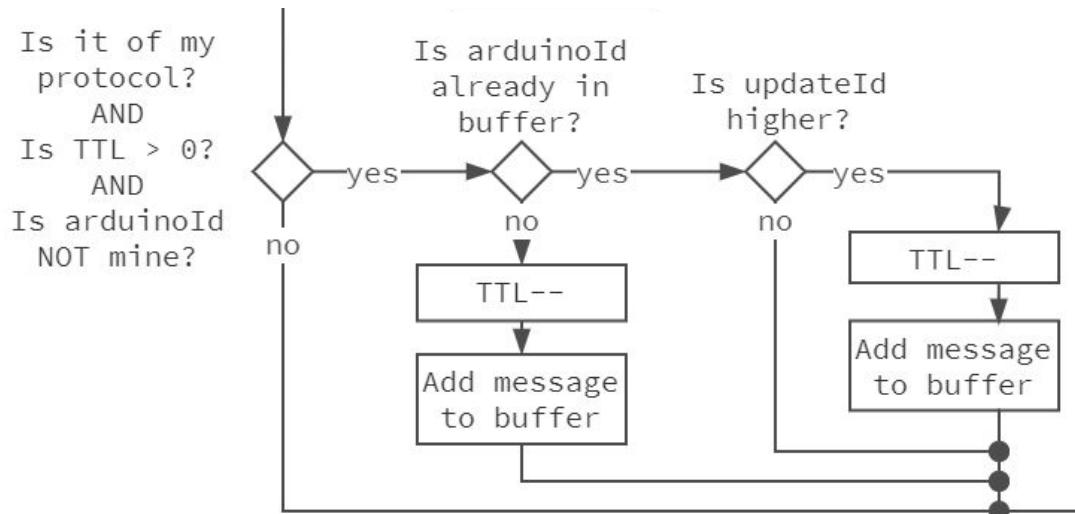
- Si valida il pacchetto
- Si valida il frame
- Si aggiunge il frame al buffer di invio
- Se il buffer è pieno si aspetta l'apertura della finestra di invio



Ricezione

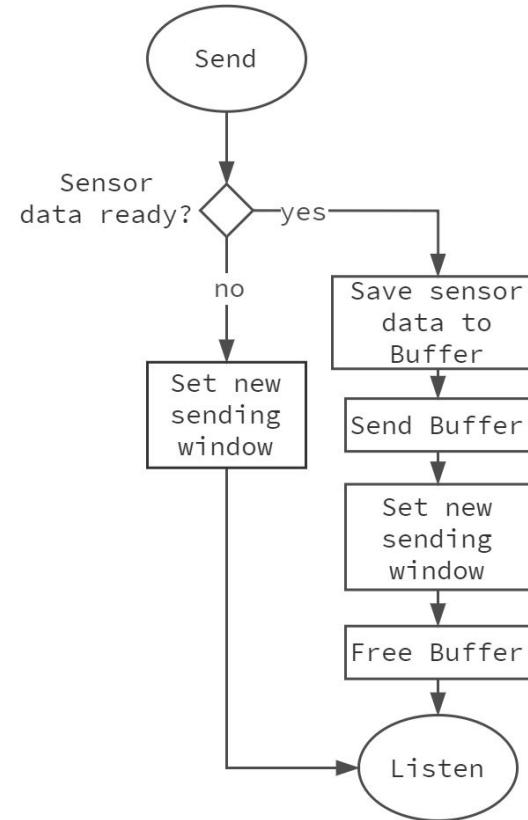
Validazione frame:

- Protocol ID
- TTL
- Arduino ID
- Update ID



Trasmissione

- Si aspettano i dati dai sensori
- Si trasmette il buffer di invio
- Si imposta una nuova finestra d'invio

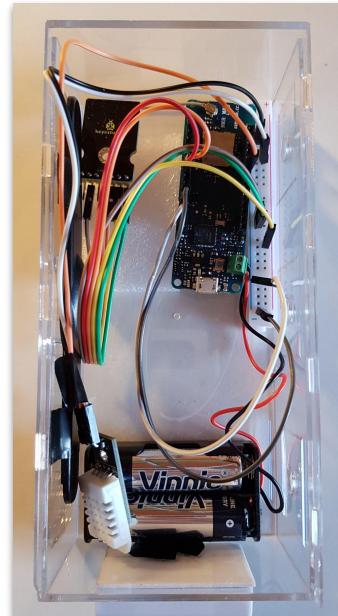
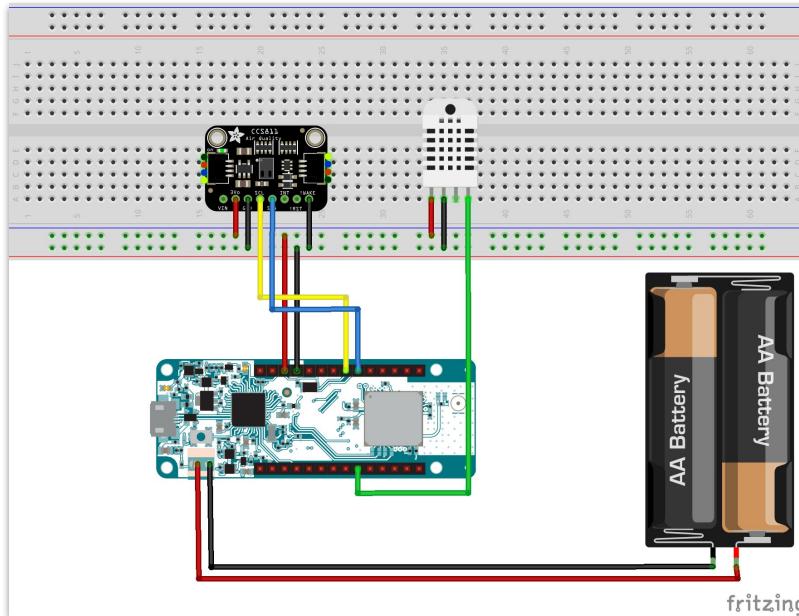


Duty Cycle

Europa:
863.0 ~ 868.6 MHz, 1% (36s max)



Node





Node

35 20 20 20 FF 09 06 2D 18 2D 01 90 00 00 00 03 06 12 00 00

Arduino Id: 35202020FF09062D₁₆

Temp: 18₁₆ = 24₁₀

Hum: 2D₁₆ = 45₁₀

CO2: 0190₁₆ = 400₁₀

tVOC: 0000₁₆ = 0₁₀

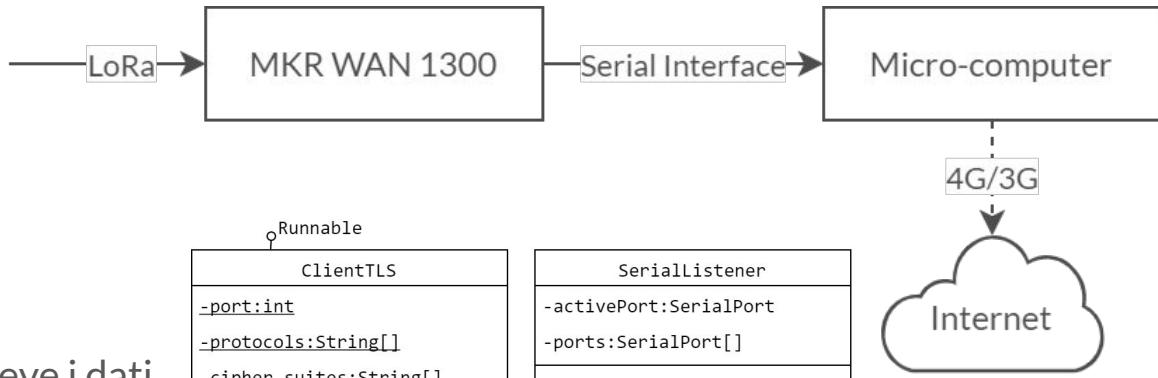
UpdateId: 0003₁₆ = 3₁₀

TTL: 06₁₆ = 6₁₀ (TTL è stato impostato con valore 7)

Protocol Id: 12₁₆

Reserved: 0000₁₆

Gateway



Client Java:

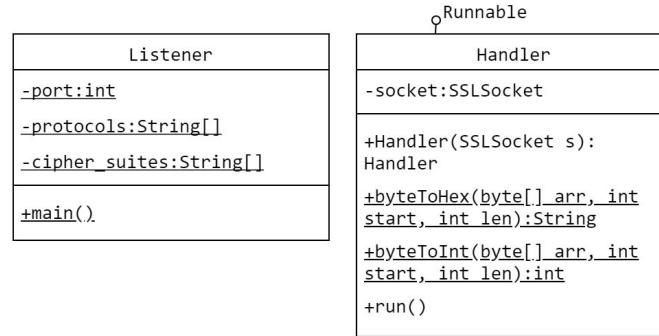
- **SerialListener**: riceve i dati dalla porta seriale; crea un oggetto ClientTLS
- **ClientTLS**: trasmette al server i dati tramite SSL

Runnable	
<pre>ClientTLS +port:int -protocols:String[] -cipher_suites:String[] -SIZE:Int -MESSAGE:Byte[] -SOCKET:SSLocket[] -OS:OutputStream[] +ClientTLS(byte[], int s):ClientTLS +run() +createSocket(String host, int port):SSLocket +main()</pre>	<pre>SerialListener -activePort:SerialPort -ports:SerialPort[] +showAllPort() +isConnected(int port):bool +setPort(int port)</pre>

Server

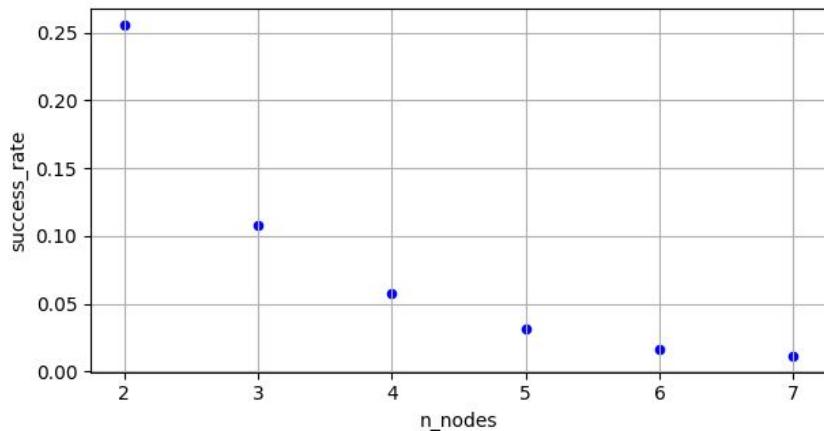
Server Java:

- **Listener:** riceve le richieste di connessione, le accetta e crea un nuovo oggetto Handler
- **Handler:** riceve i dati e li inserisce sul database





Collisioni



Possibili soluzioni:

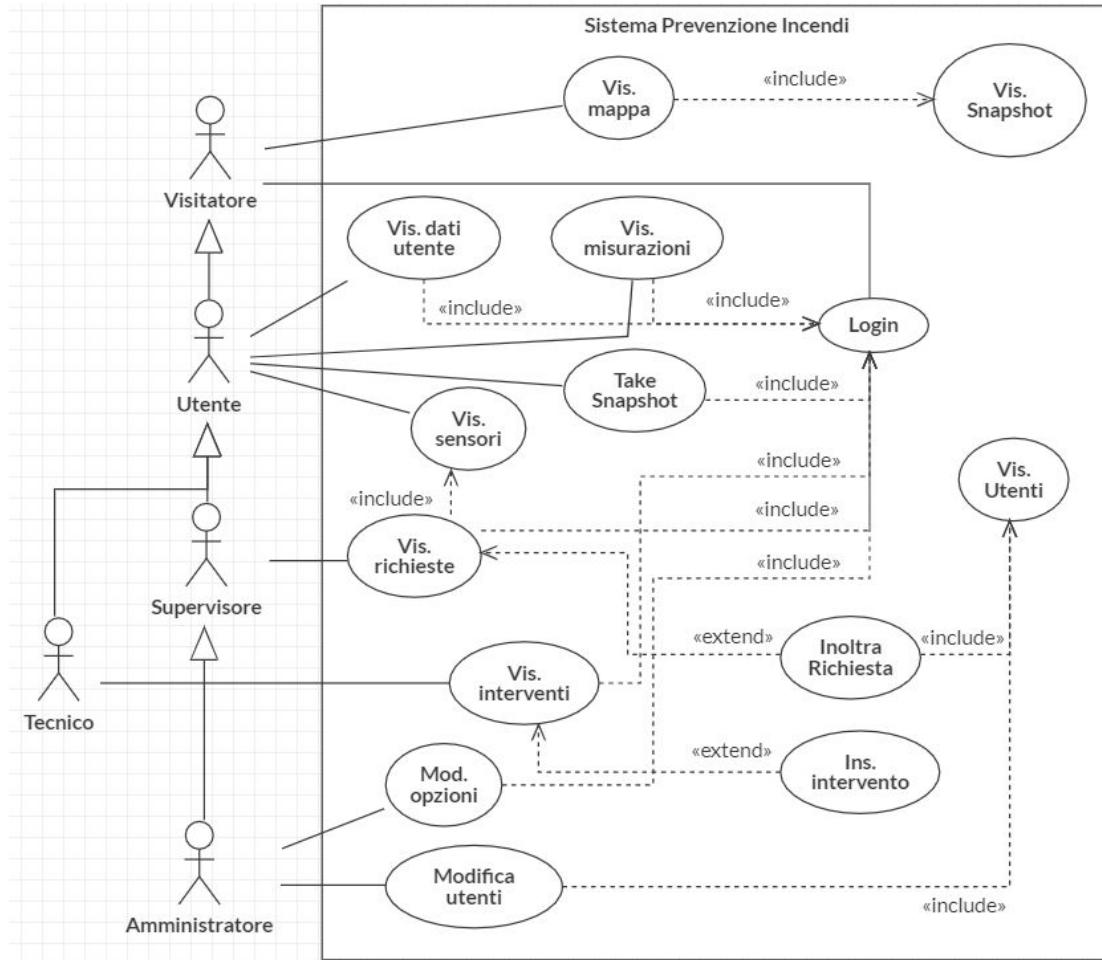
- Diminuire traffico
- CSMA/CA -> Canale Occupato?
- Slotted ALOHA -> NTP/GPS

Base di Dati

Analisi

Attori:

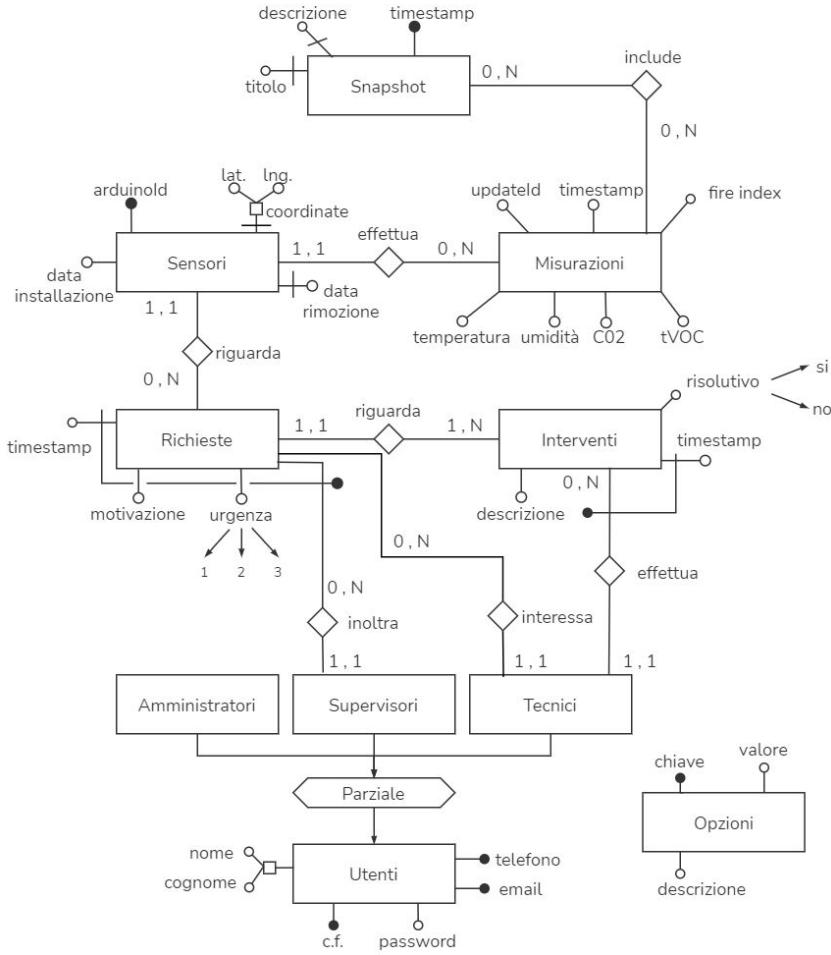
- Visitatore
 - Utente
 - Tecnico
 - Supervisore
 - Amministratore



Prog. concettuale

Entità:

- Sensori
- Misurazioni
- Snapshot
- Richieste
- Interventi
- Utenti:
 - Amministratori
 - Supervisori
 - Tecnici
- Opzioni





Prog. logica

sensori (arduinold, lat*, lng*, data_inst, data_rim*)

misurazioni (datald, sensore, temperatura, umidità, co2, tvoc, updateld, timestamp, fire_index)

snapshot (timestamp, titolo*, descrizione*)

snapshot_misurazioni (snapshot,misurazione)

utenti (utenteld, cf, nome, cognome, telefono, email, pw, ruolo)

richieste (richiestald, timestamp, motivazione, urgenza, *sensore, supervisore, tecnico*)

interventi (interventold, timestamp, descrizione, risolutivo, *richiesta*)

opzioni (chiave,valore, descrizione)



Prog. fisica

Triggers:

- ❑ update_fire_index

Stored Procedures:

- ❑ take_snapshot(timestamp par1): void
- ❑ add_to_snapshot(timestamp par1): void
- ❑ set_snapshot_interval(int par1): void

Events:

- ❑ auto_snapshot

Applicazione Web

fpspineta.info



Visitatore

User Area

Check your account information

Account Details

First name	Mario	Last name	Rossi
Fiscal Code	KYCNRF89A46B232P	Phone Number	4567893456
Email	mariorossi@gmail.com	User Type	Utente

To change your details please contact an administrator

Fire Prevention System

Readings

View all the Readings

Show: 10 entries

Date	Node	Updated	T [°C]	Hum. [%]	CO2 [ppm]	tVOC [ppb]	F.I.
2021-05-12 03:21:29	382809500935474564	39	27	45	1290	1956	0
2021-05-12 03:21:29	382809500935474563	39	22	64	473	1795	0
	382809500935474583	39	13	88	14119	1118	0
	3828095009354746040	39	24	54	10039	414	0
	3828095009354746096	39	29	62	1247	2300	0
	3828095009354745457	39	36	68	1282	1611	0

Fire Prevention System

Nodes

View all the nodes

Show: 10 entries

ID	Deployed	Retired	Lat.
3828095009354745389	2021-04-05	2021-05-01	42.730058
3828095009354745390	2021-04-05	2021-05-01	42.730704
3828095009354745391	2021-05-12		42.734079260382465
3828095009354745392	2021-05-12		42.727695954062625
3828095009354745393	2021-05-12		42.72692637568411
3828095009354745394	2021-05-12		42.72154978017423
3828095009354745395	2021-05-12		42.72972267722532
3828095009354745396	2021-05-12		42.727008817613694
3828095009354745397	2021-05-12		42.72539192760582
3828095009354745398	2021-05-12		42.723683104602515

Showing 1 to 10 of 1,002 entries

Fire Prevention System

Snapshots

View all the snapshots

Show: 10 entries

Date	Title	Description
2021-05-12 03:20:00	Auto	Auto
2021-05-12 03:15:00	Auto	Auto
2021-05-12 03:10:00	Auto	Auto
2021-05-12 03:05:00	Auto	Auto
2021-05-12 03:00:00	Auto	Auto
2021-05-12 02:55:00	Auto	Auto
2021-05-12 02:50:00	Auto	Auto
2021-05-12 02:45:00	Auto	Auto
2021-05-12 02:40:00	Auto	Auto
2021-05-12 02:35:00	Auto	Auto

Showing 1 to 10 of 40 entries

First | Previous | Next | Last

Utente

- Home
- User Area
- Data
- Supervisor Area
 - Follow your requests
 - Forward new requests

Requests

Follow your requests

2021-05-16 12:59:48 (Id: 5), Medium Priority

No on-site service yet

Assigned to Giacomo Rossi (Id: 7) for the reason: 'Controllo Periodico'

Node: 38280950093547

Fire Prevention System

2021-05-16 07:52:3

Show 10 entries

ID	Timestamp
1	2021-0

Showing 1 to 1 of 1 entries

PDF

Requests

Forward new requests for on-site services

Reason of the request

Priority

Node

Low

3828095009354745389

Submit

Supervisore

Requests

Follow your requests

2021-05-16 15:39:12 (Id: 6), Low Priority

Show [10] entries

ID	Timestamp	Description	Solved
6	2021-05-16 20:00:18	Prova	

Search:

Fire Prevention System

Requests

Follow your requests

2021-05-16 15:39:12 (Id: 6), Low Priority

Assigned by Alessandro Manfucci (Id: 4) for the reason: 'Controllo Periodico'

Show [10] entries

ID	Timestamp
6	2021-05-16 20:00:18

Showing 1 to 1 of 1 entries

[First](#) [Previous](#) [Next](#) [Last](#)

[PDF](#)

No active Request

Currently, you have no active request. Sit back and relax :)

[Return to Home](#)

Description of the on-site service

Request

Solved

Submit

Tecnico

Amministratore

Fire Prevention System

- Home
- User Area
- Data
- Supervisor Area
- Administrator Area
 - Follow all requests
 - Manage Users
 - Manage App Options

Requests

Follow all requests

2021-05-16 15:39:12 (Id: 6), Low Priority

Show 10 entries

ID	Timestamp
2	2021-05-16 20:00:18

Showing 1 to 1 of 1 entries

PDF

Assigned to Giovanni Rossi (Id: 4) By Alessandro
Node: 3828095009354745392

2021-05-16 12:59:48 (Id: 5), Medium Priority

No on-site service yet

Fire Prevention System

- Home
- User Area
- Data
- Supervisor Area
- Administrator Area
 - Follow all requests
 - Manage Users
 - Manage App Options

Users

Manage and add users

Manage user

User

Aldo Rossi, (Id: 5)

First name

Aldo

Last name

Rossi

Fiscal Code

SCGQRR95C23B722F

Phone Number

1234567890

Email

aladorossi@gmail.com

User Type

Supervisore

Password

Fire Prevention System

- Home
- User Area
- Data
- Supervisor Area
- Administrator Area
 - Follow all requests
 - Manage Users
 - Manage App Options

Options

Manage App Options

Snapshot Interval

L'intervallo di tempo per la creazione automatica di un nuovo snapshot (espresso in minuti)

5

Auto Snapshot

Submit

Rete del dipartimento



Analisi

Sede principale:

- Piano 0
 - Ufficio 1 -> 31
 - Ufficio 2 -> 31
 - Ufficio 3 -> 31
- Piano 1
 - Ufficio 4 -> 31
 - Ufficio 5 -> 31
 - Ufficio 6 -> 31
- WLAN
 - 180

Sede ausiliaria:

- Piano 0
 - Ufficio 1 -> 11
 - Ufficio 2 -> 11
 - Ufficio 3 -> 11
 - Ufficio 4 -> 11
 - Ufficio 5 -> 11
 - Ufficio 6 -> 11
- WLAN
 - 60



Progettazione

- Subnetting statico
- DMZ
 - External FW
 - Internal FW
- PAT
- Housing: 3-Tier Architecture
 - Presentation
 - Business
 - Data
- Server DHCP
- Server RADIUS
- VPN S2S
 - IPSec

7 Subnet -> 3 Bit

180 Host -> 8 Bit

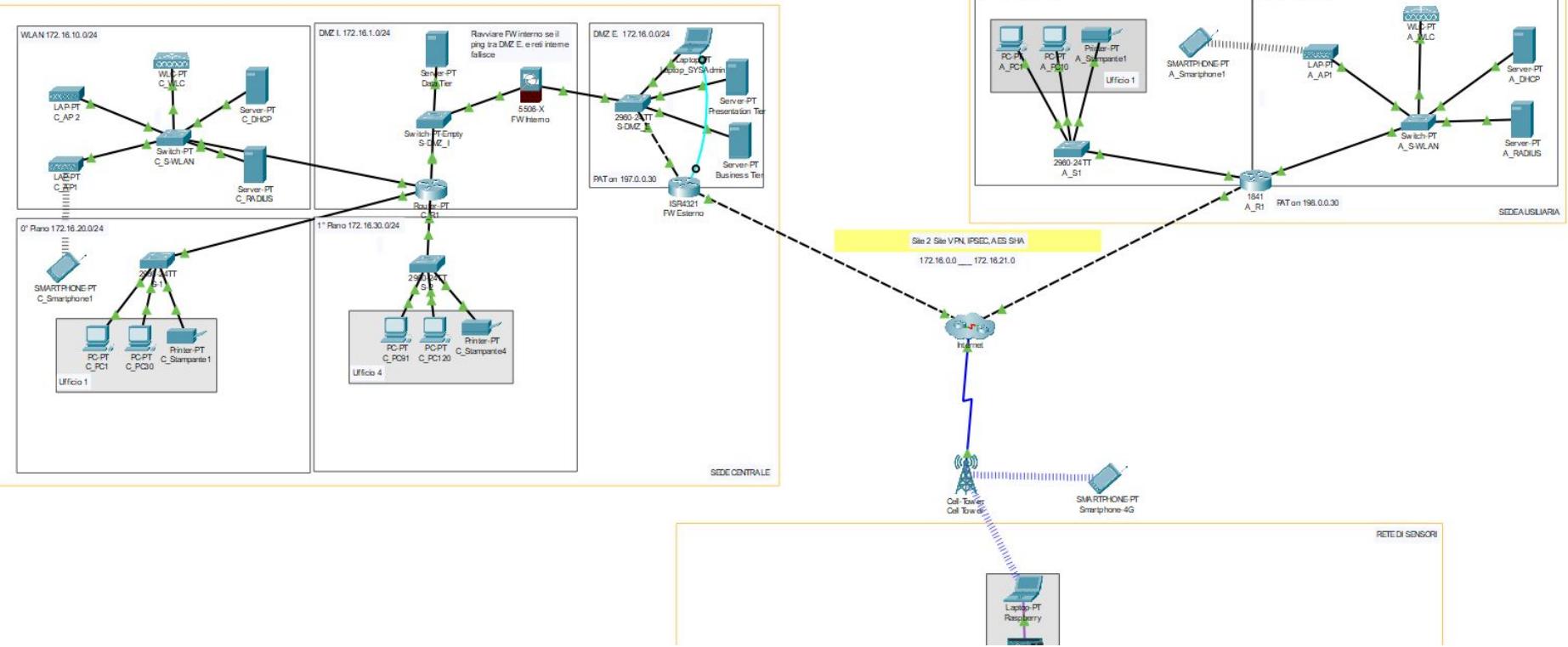
Classe B, Privato -> **172.16.0.0**

Sede principale:

Rete	IP Rete	Broadcast	Range	Subnet Mask
WLAN	172.16.10.0	172.16.10.255	172.16.10.1~254	255.255.255.0
0°Piano	172.16.20.0	172.16.20.255	172.16.20.1~254	255.255.255.0
1°Piano	172.16.30.0	172.16.30.255	172.16.30.1~254	255.255.255.0
DMZ E.	172.16.0.0	172.16.0.255	172.16.0.1~254	255.255.255.0
DMZ I.	172.16.1.0	172.16.1.255	172.16.1.1~254	255.255.255.0

Sede ausiliaria:

Rete	IP Rete	Broadcast	Range	Subnet Mask
WLAN	172.16.11.0	172.16.11.255	172.16.11.1~254	255.255.255.0
0°Piano	172.16.21.0	172.16.21.255	172.16.21.1~254	255.255.255.0



Topologia Logica

Cablaggio strutturato

Sede centrale

- Building Distributor
 - Router FW
 - Server Pres./Bus./Data
 - Server DHCP/RADIUS
 - WLC
 - UPS
- Floor Distributor
 - Switch
 - AP

Sede ausiliaria

- Building Distributor
 - Router FW
 - Server DHCP/RADIUS
 - WLC
- Floor Distributor
 - Switch
 - AP



Grazie per l'attenzione

Sistema prevenzione incendi

Manfucci Alessandro 5 BIA