FINAL REVIEW

SIEMENS

École d'ingénieurs
Télécom Physique Strasbourg

TABLE OF CONTENTS

PROJECT PRESENTATION

FIRMWARE

MONITORING APPLICATION

TEST APPLICATION

WIRESHARK PLUGIN

WORK ORGANIZATION

PROJECT CONCLUSION

TABLE OF CONTENTS

PROJECT PRESENTATION

FIRMWARE

MONITORING APPLICATION

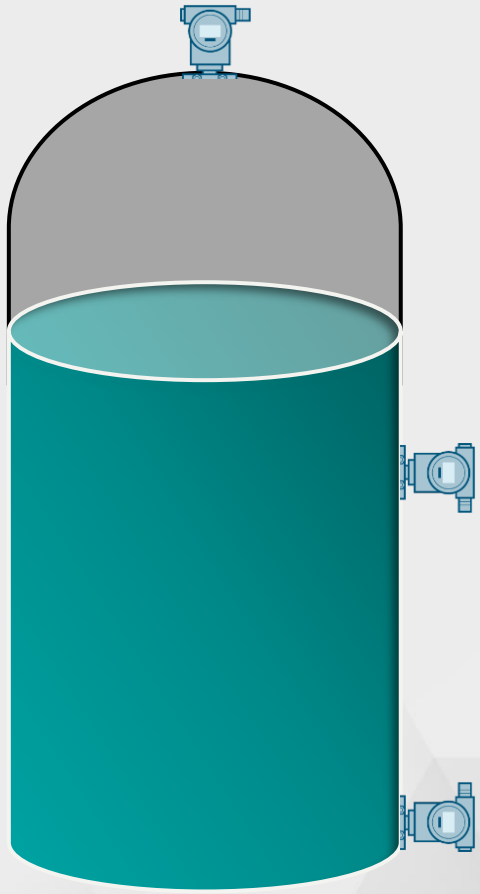
TEST APPLICATION

WIRESHARK PLUGIN

WORK ORGANIZATION

PROJECT CONCLUSION

Use case of the project



Measure the fluid’s level in a tank with pressure sensors which communicate with each other based on ethernet

Pressure measurement sensors

Pressure sensors types

- Relative pressure
- Absolute pressure
- Differential pressure

Sitrans P200/210/220

Sitrans P-Compact

Sitrans P320/420

Fundamental physics basics

l : level
ρ : density
g : gravity
P_H : high pressure
P_O : over pressure
P_L : low pressure
P_D : density pressure
h : height of P_D

One sensor

→ $l = \frac{P_H - P_O}{\rho g}$

with ρ and P_O known

Two sensors

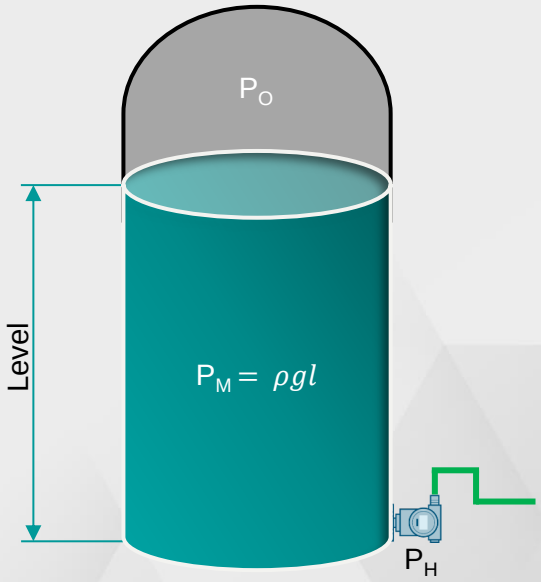
→ $l = \frac{P_H - P_L}{\rho g}$

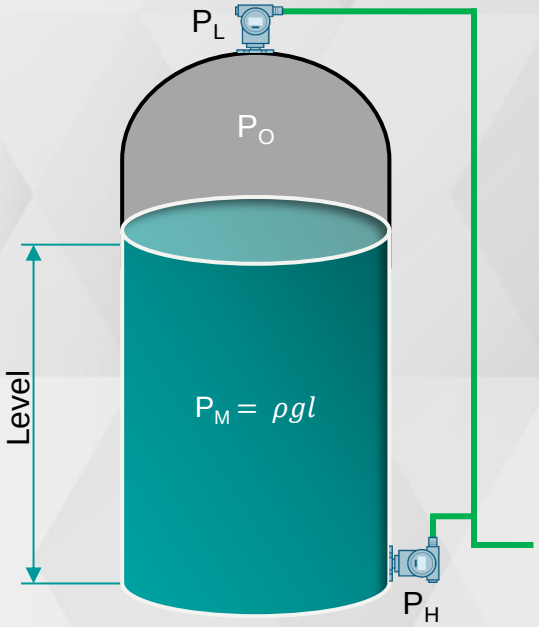
with ρ known

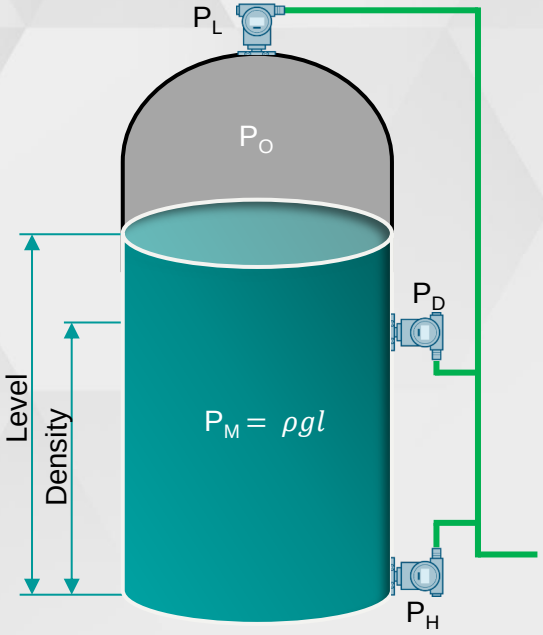
With three sensors

→ $\rho = \frac{P_H - P_D}{gh}$

$l = \frac{P_H - P_L}{\rho g}$







System requirements

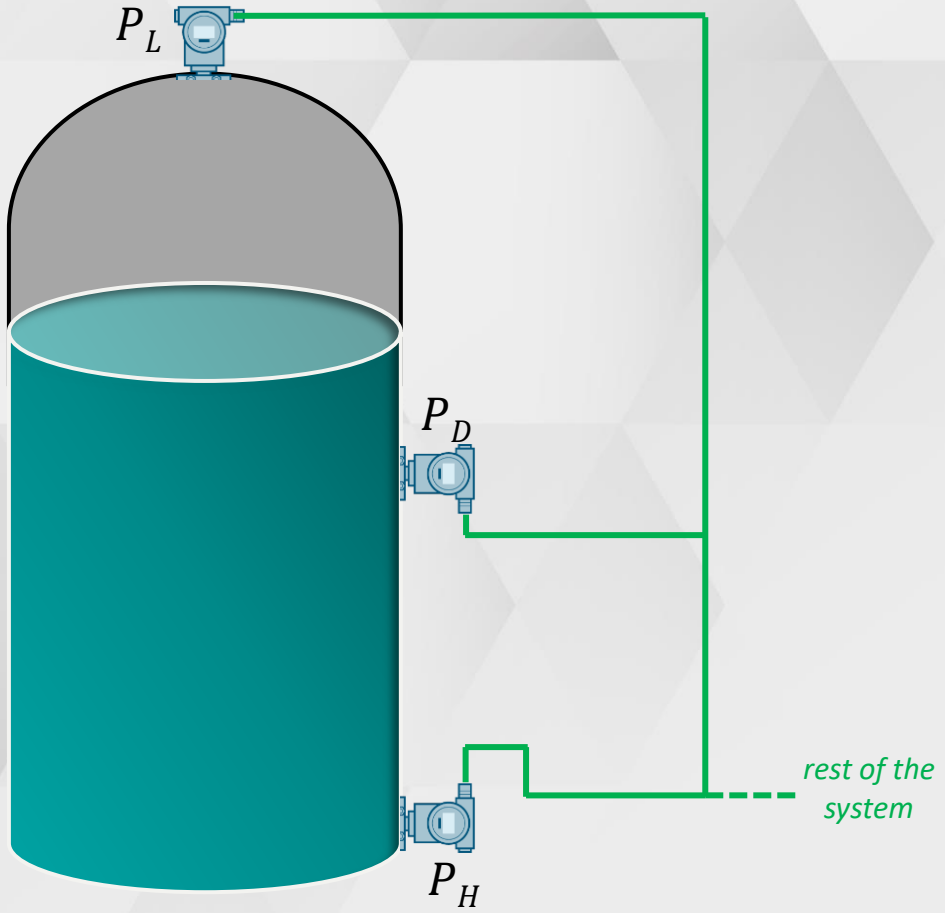
Requirements

- Same firmware for all boards
- System must be configurable in runtime
- Configuration use case
  - 1 sensor ➡ P_H
  - 2 sensor ➡ P_H with P_L
  - 3 sensor ➡ P_H with P_D and P_L
- Measurement cycle should be synchronized

Limitations

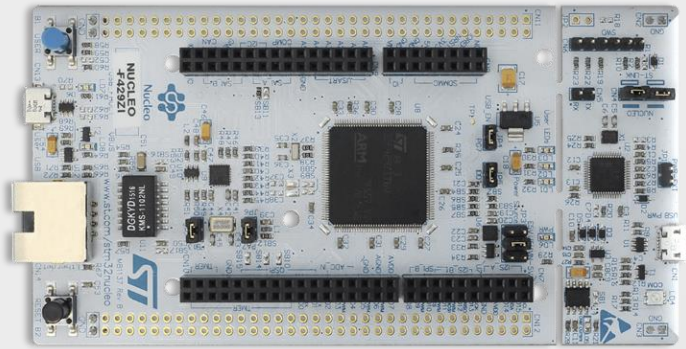
- No physical pressure sensors available

➡ System behaviour must be simulated



Use components

- Pressure sensor represented by STM32 evalboards



- embOS as operating system on the board

- Embedded Studio to build and flash project on the board

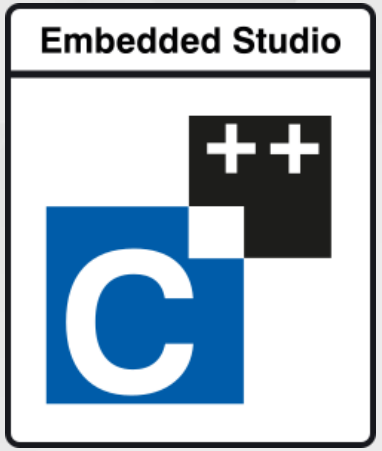


TABLE OF CONTENTS

PROJECT PRESENTATION

FIRMWARE

MONITORING APPLICATION

TEST APPLICATION

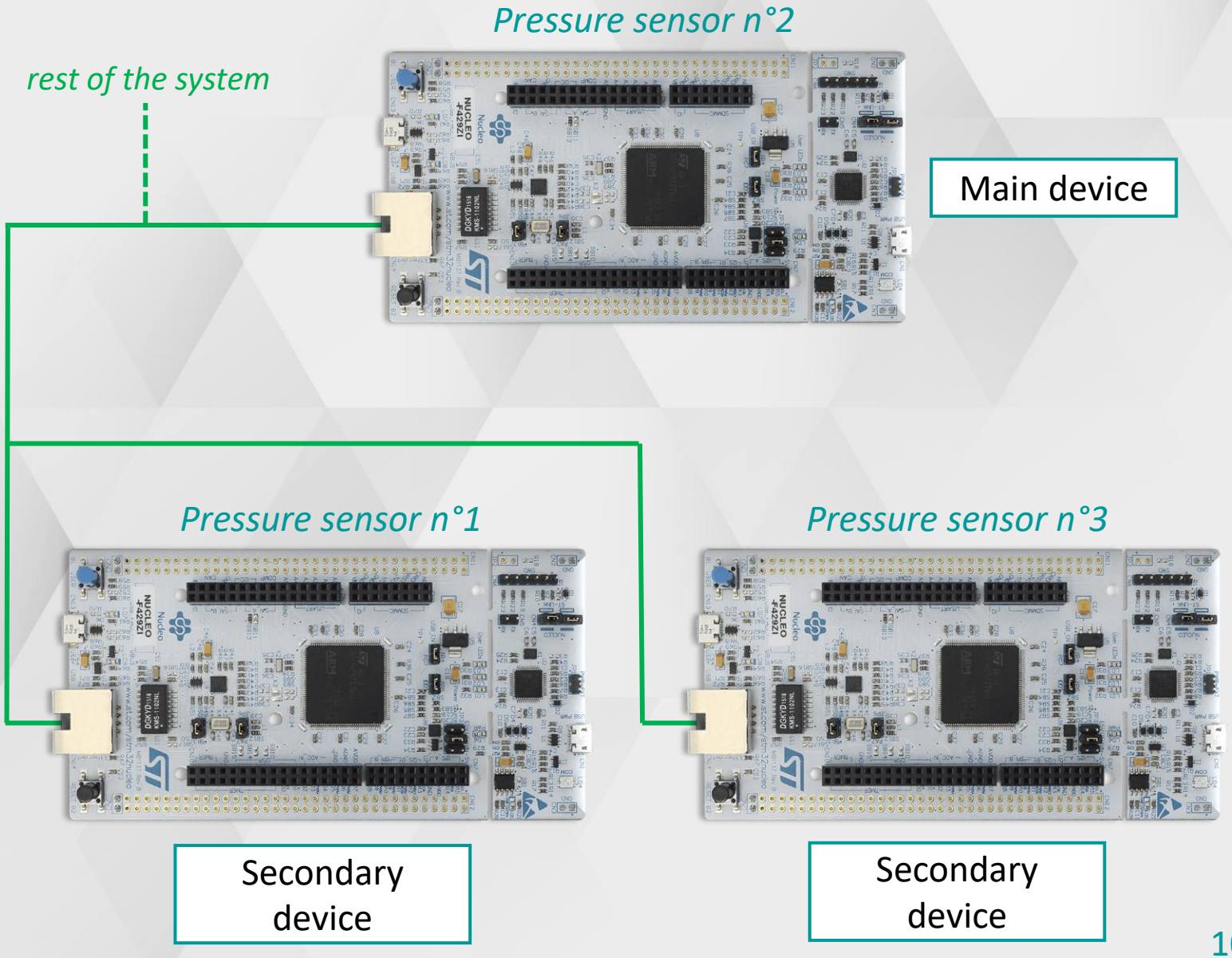
WIRESHARK PLUGIN

WORK ORGANIZATION

PROJECT CONCLUSION

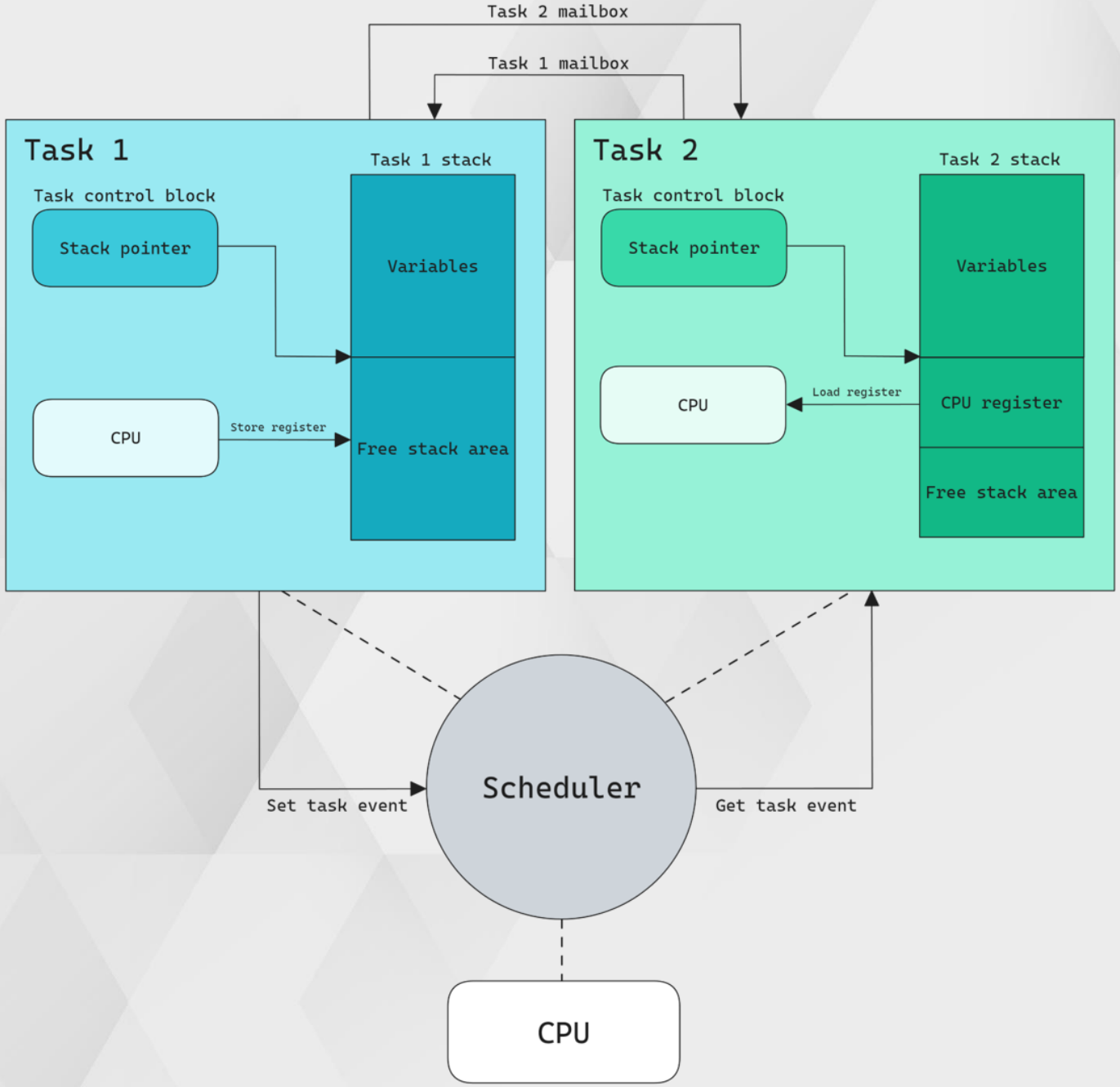
Global system

- Main/Secondary device system

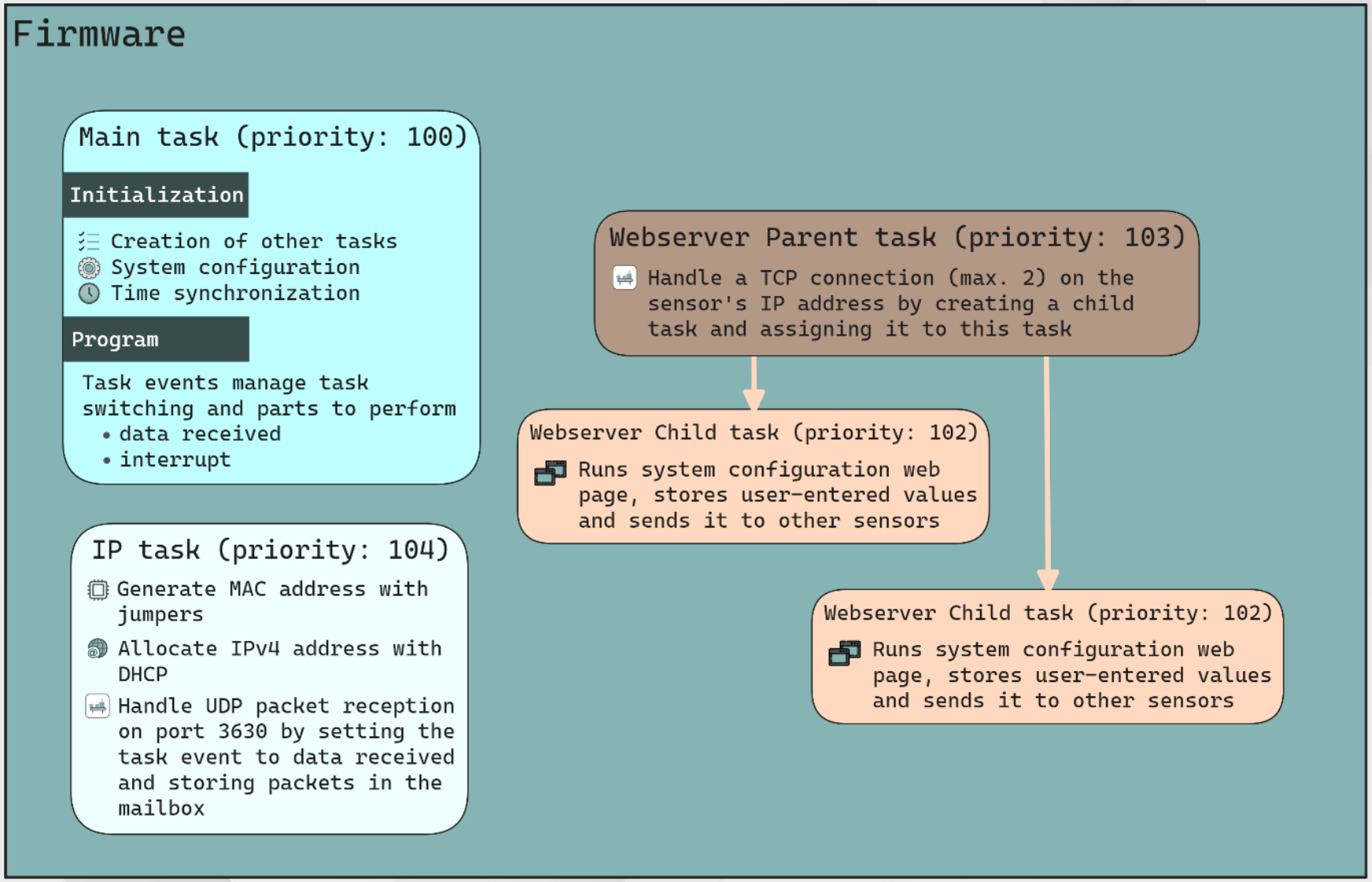


Use EmbOS features

- Task : independent unit of work based on priority
- Task event : digital signal which wake up a sleeping/waiting task
- Mailbox : mechanism for inter-task communication and data exchange
- Software Timer : user-specified routine after a specified delay



System Architecture

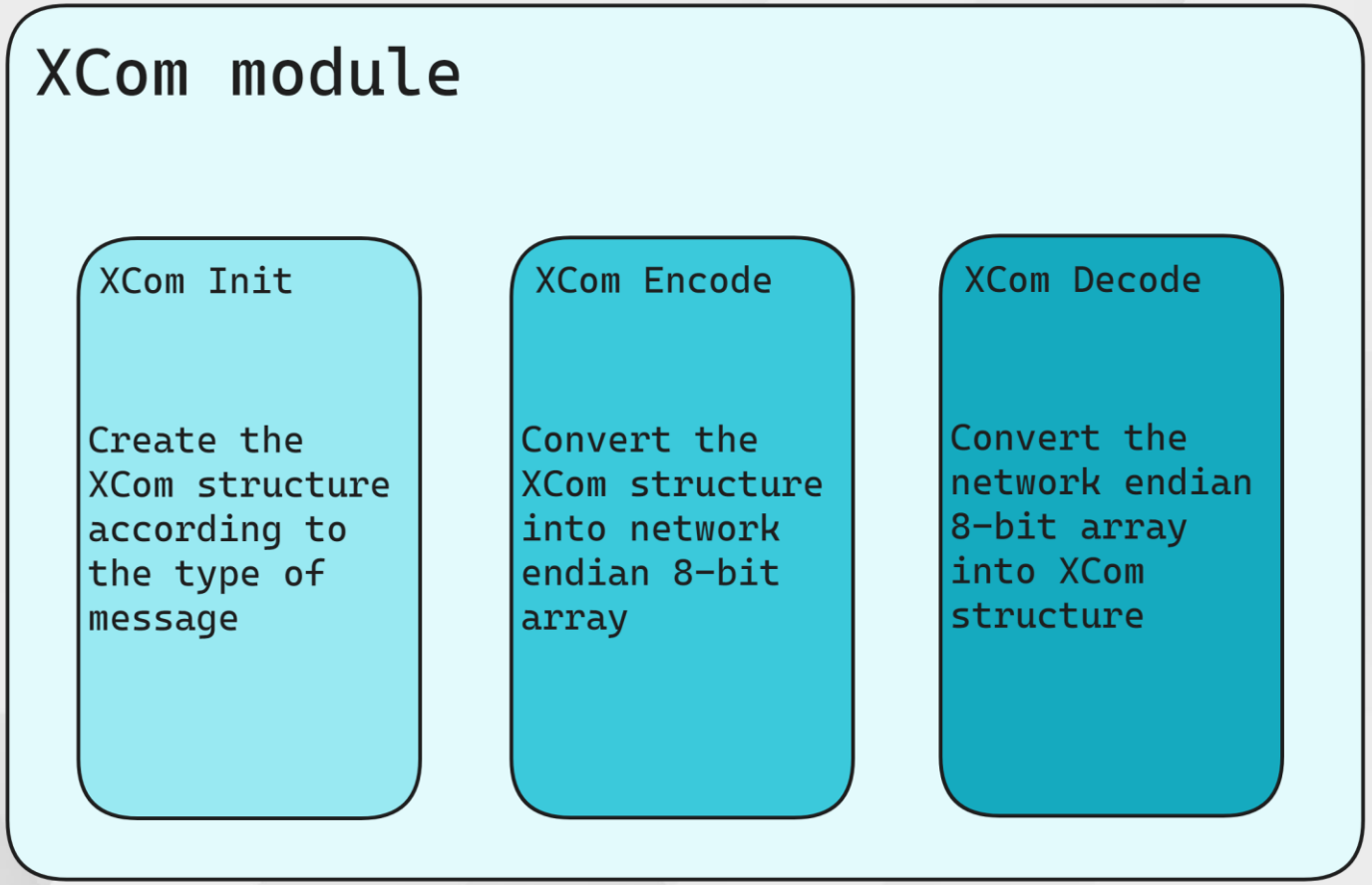


Data Protocol (1)

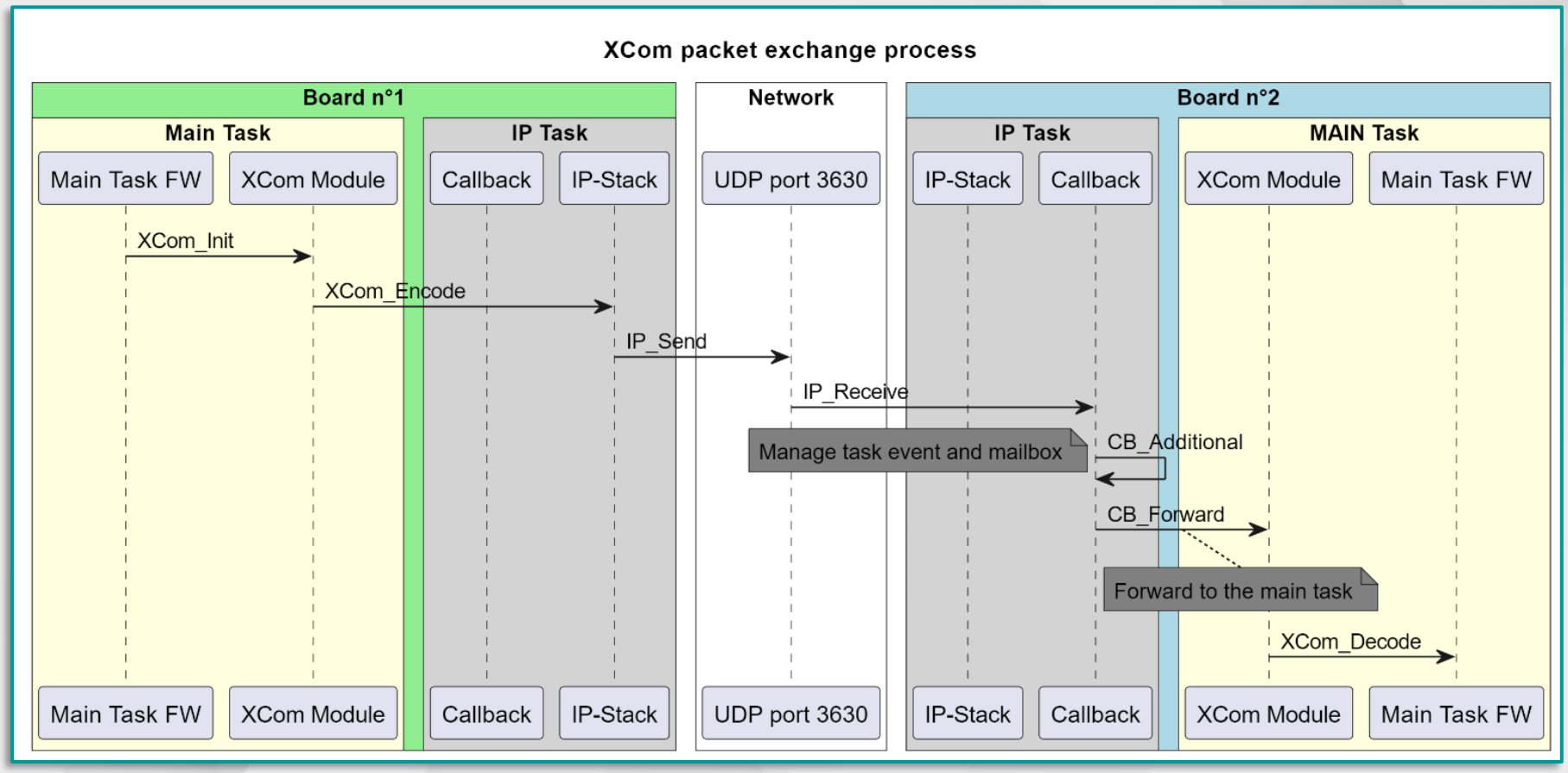
Cross communication protocol

message ID 64 bits	length 32 bits	type 8 bits	payload					
		0x01 *(time synchro)*	type 8 bits	timestamp 64 bits	offset 32 bits			
			0x01 (initialization)					
			0x02 (cycle)					
		0x02 *(configuration)*	type 8 bits	payload				
			0x01 *(send tank info)*	diameter 32 bits	diameter unit 8 bits	volume 32 bits	volume unit 8 bits	heigth 32 bits	heigth unit 8 bits
			0x02 *(get tank info)*						
			0x03 *(sensor info)*	number 8 bits	IP address 32 bits	role 8 bits	type 8 bits	heigth 32 bits	heigth unit 8 bits
			0x04 *(get sensor info)*						
			0x05 *(fluid information)*	density 64 bits	density unit 8 bits	gas pressure 32 bits	pressure unit 8 bits		
			0x06 *(get fluid info)*						
			0x07 *(cycle information)*	cycle time 32 bits	time unit 8 bits	frame loss 8 bits			
		0x03 *(pressure)*	type 8 bits	payload					
			0x01 *(send pressure)*	pressure 64 bits	pressure unit 8 bits	quality code 8 bits			
			0x02 *(get pressure)*						
		0x04 *(level)*	type 8 bits	payload					
			0x01 *(send level)*	level 32 bits	level unit 8 bits				
			0x02 *(get level)*						

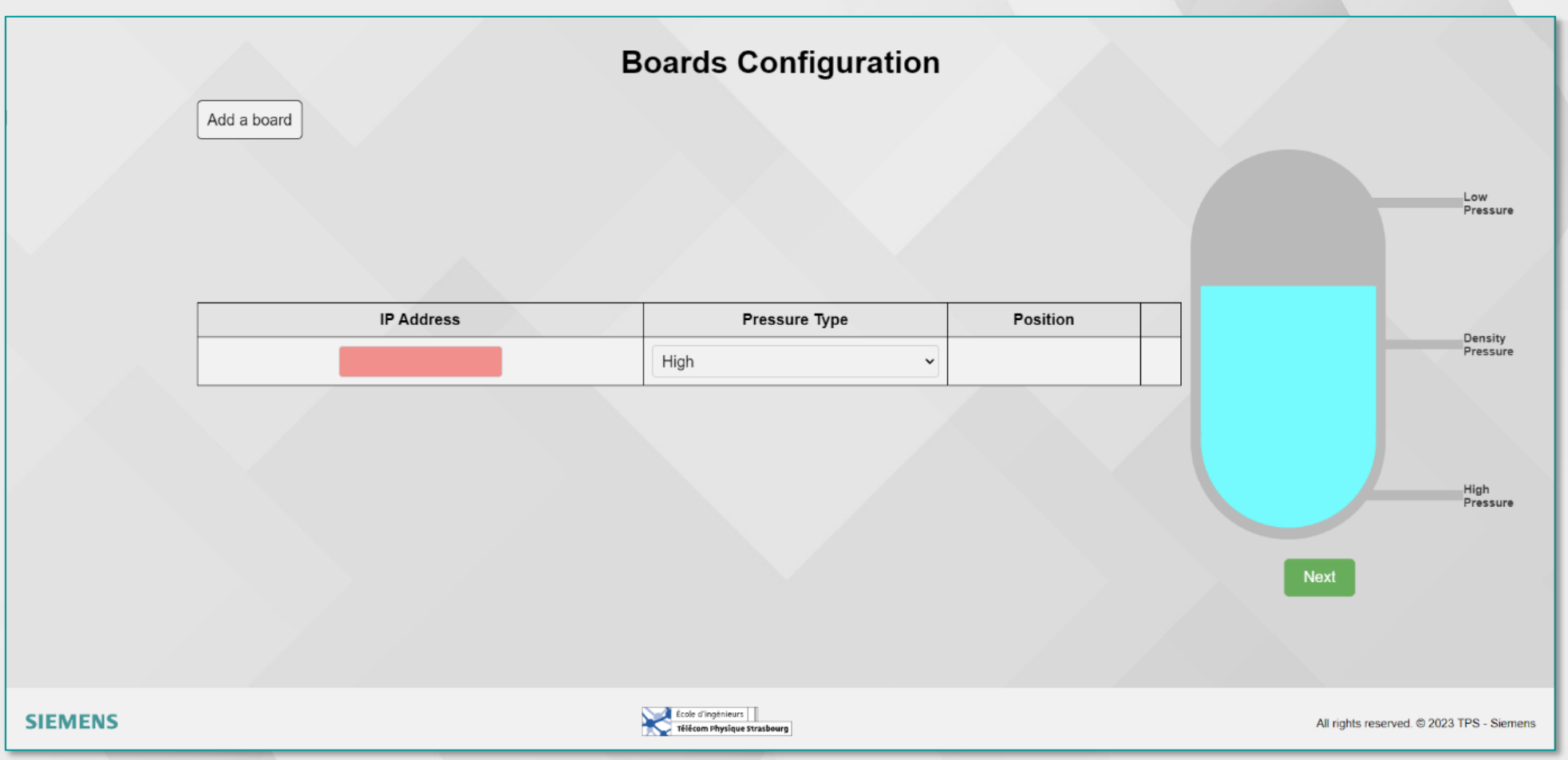
Data Protocol (2)



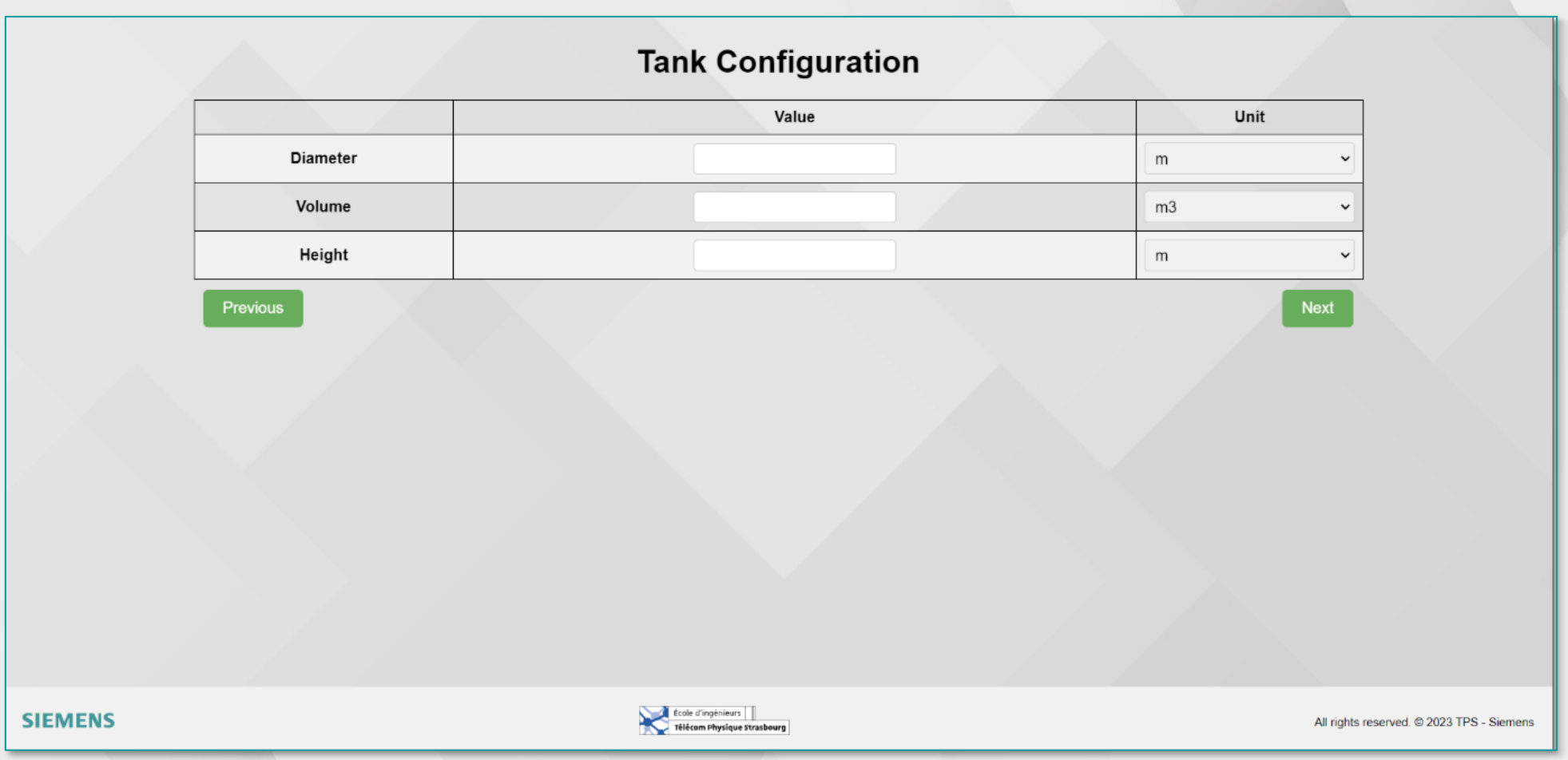
Data Protocol (3)



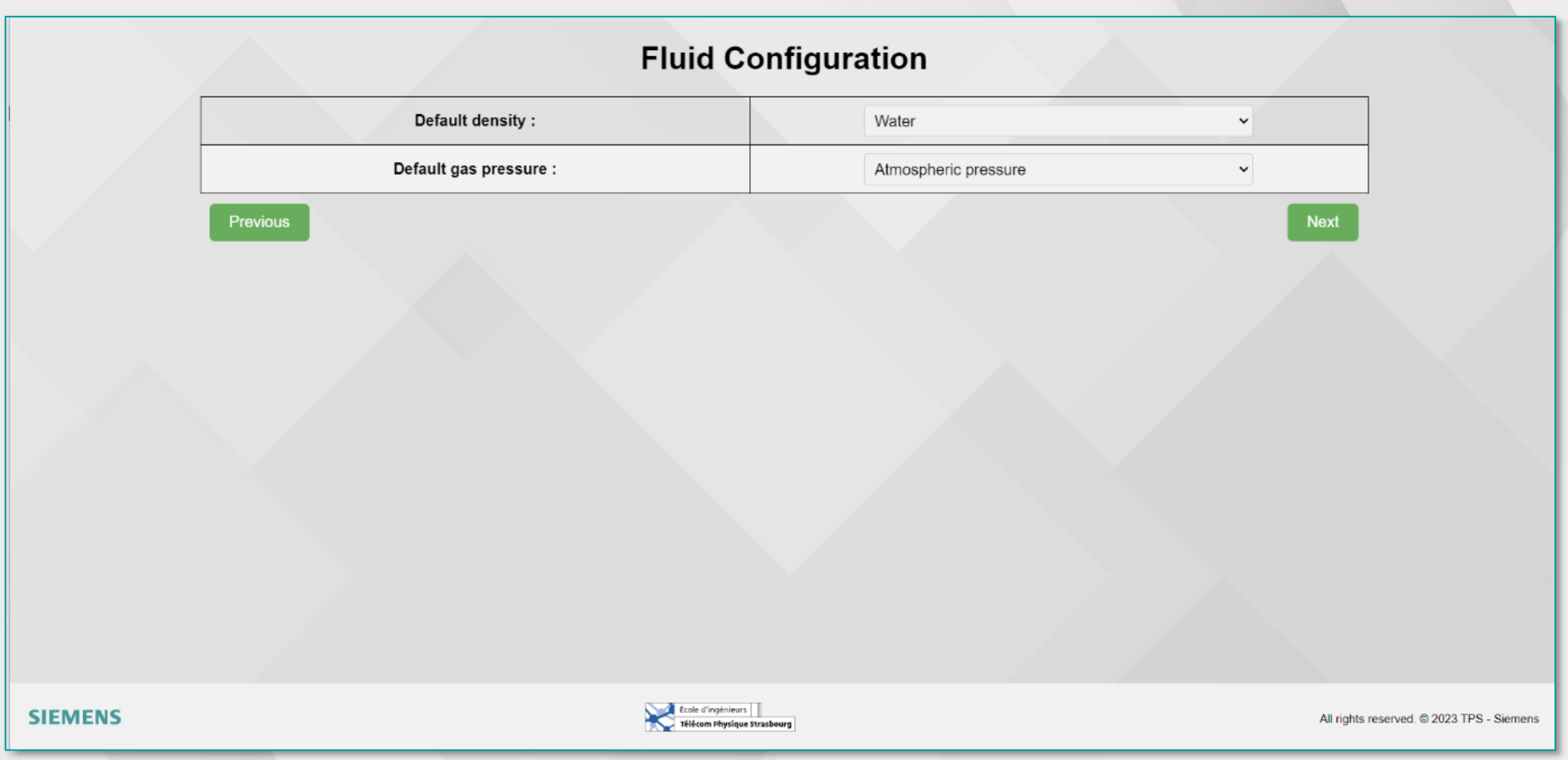
Configuration Webpage (1)



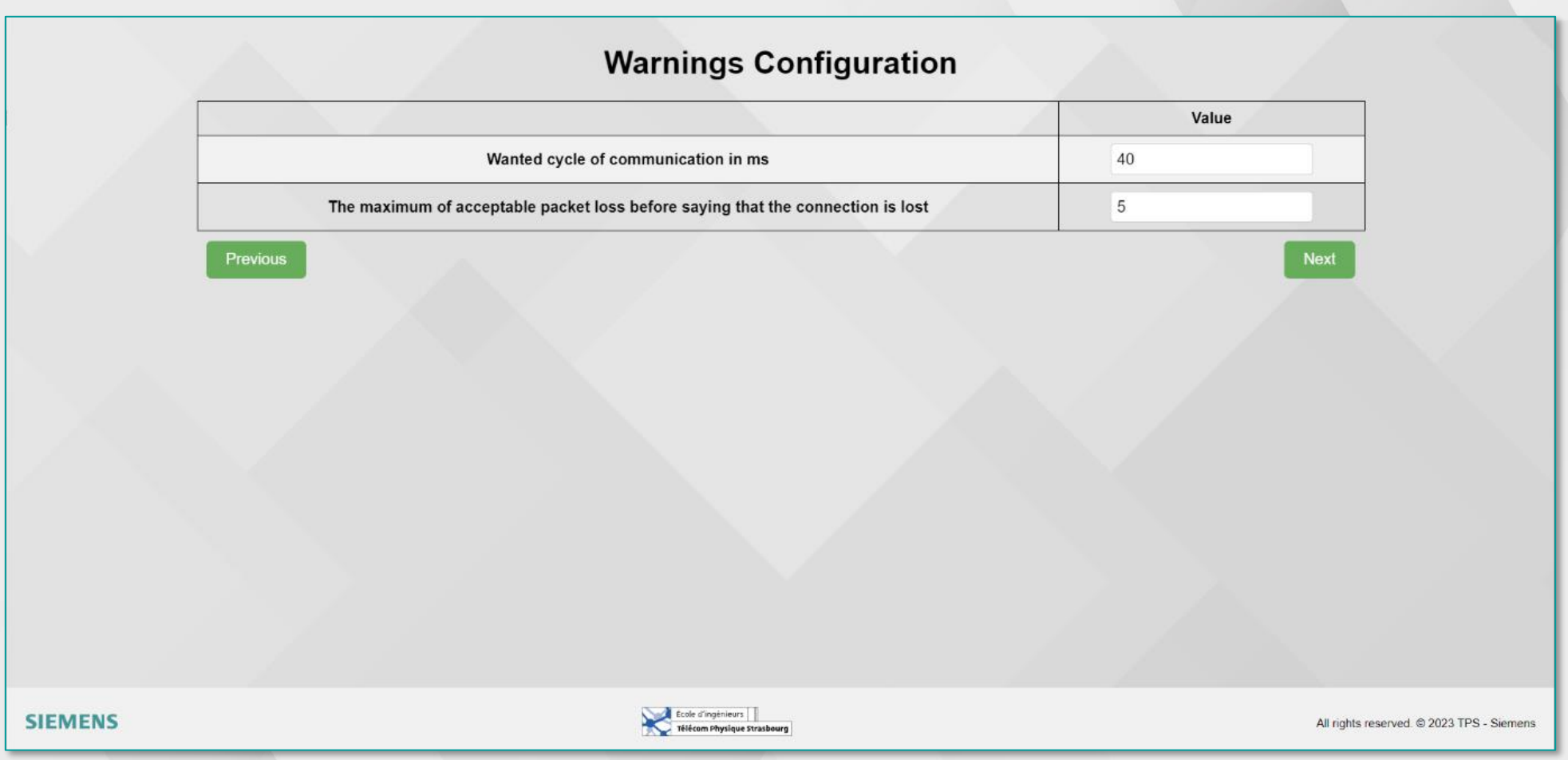
Configuration Webpage (2)



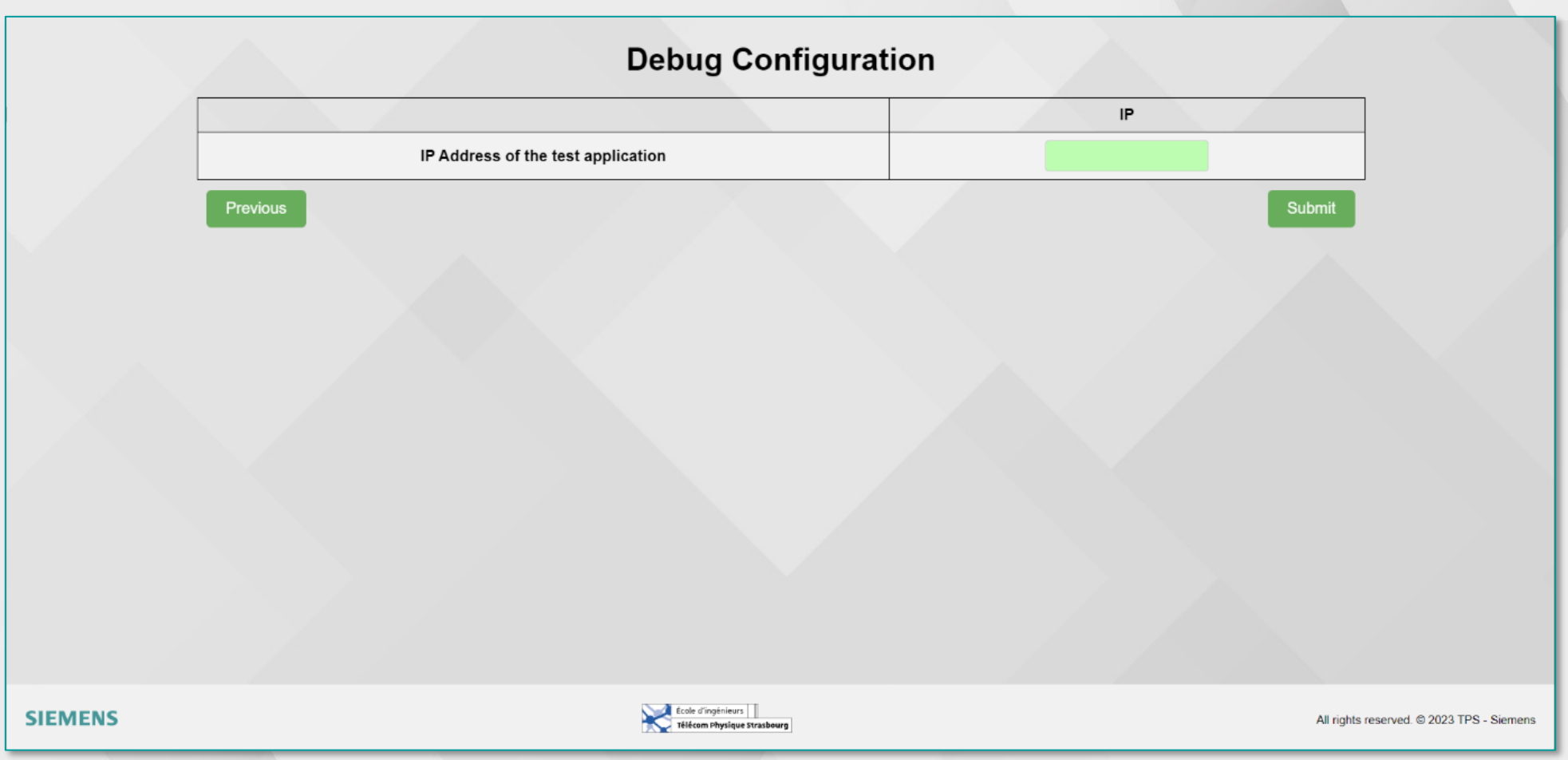
Configuration Webpage (3)



Configuration Webpage (4)



Configuration Webpage (5)



Time synchronization

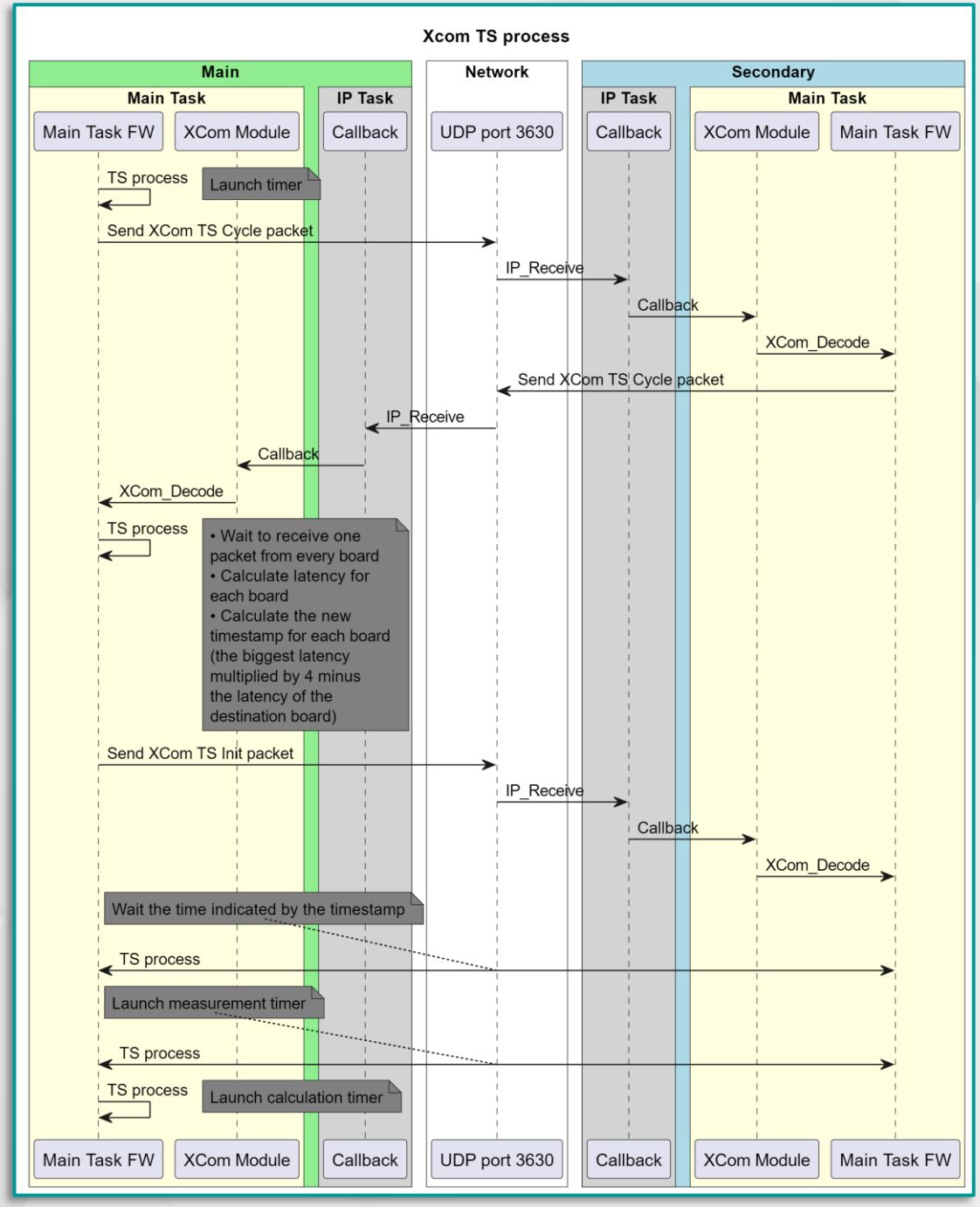


TABLE OF CONTENTS

PROJECT PRESENTATION

FIRMWARE

MONITORING APPLICATION

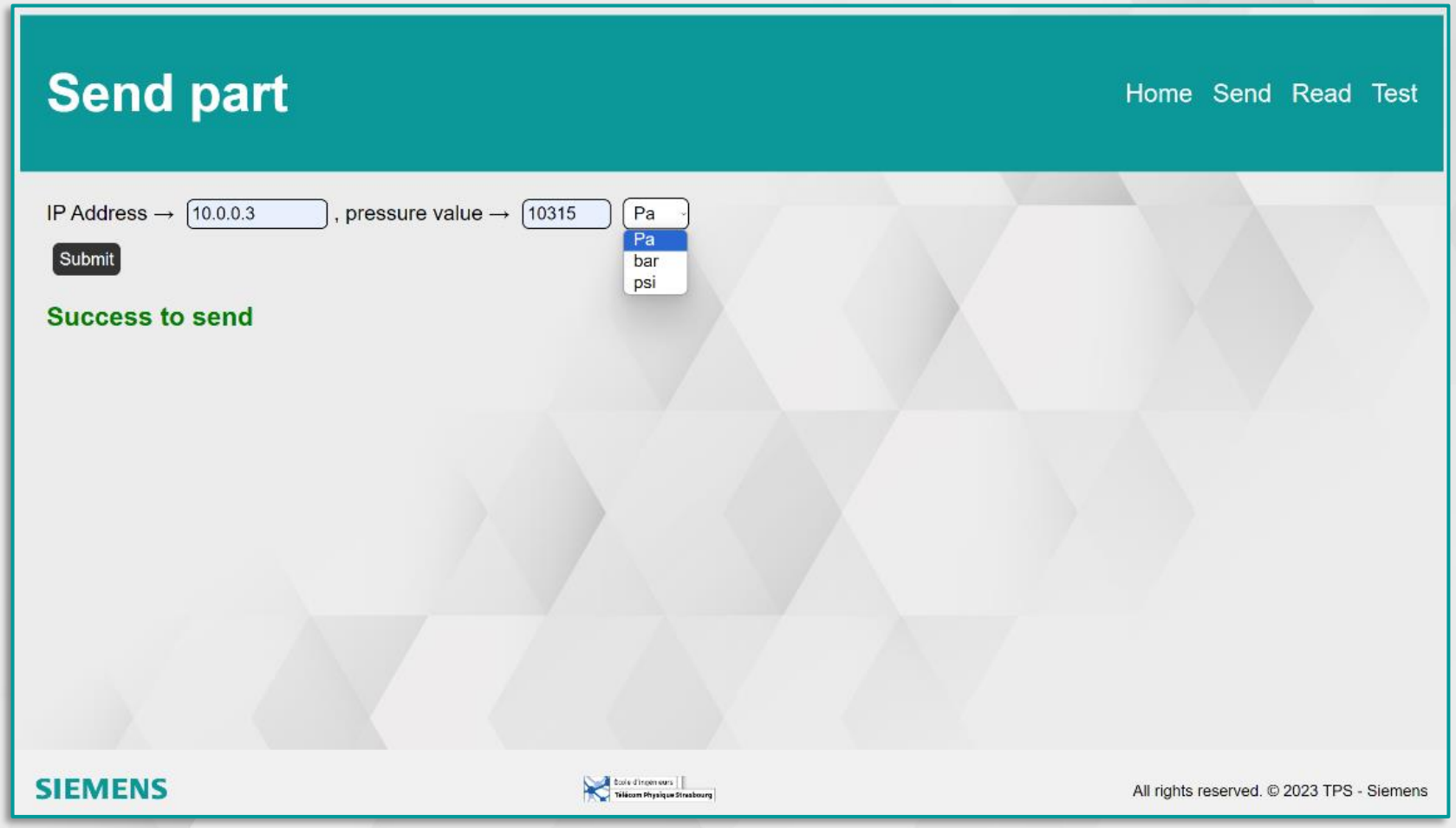
TEST APPLICATION

WIRESHARK PLUGIN

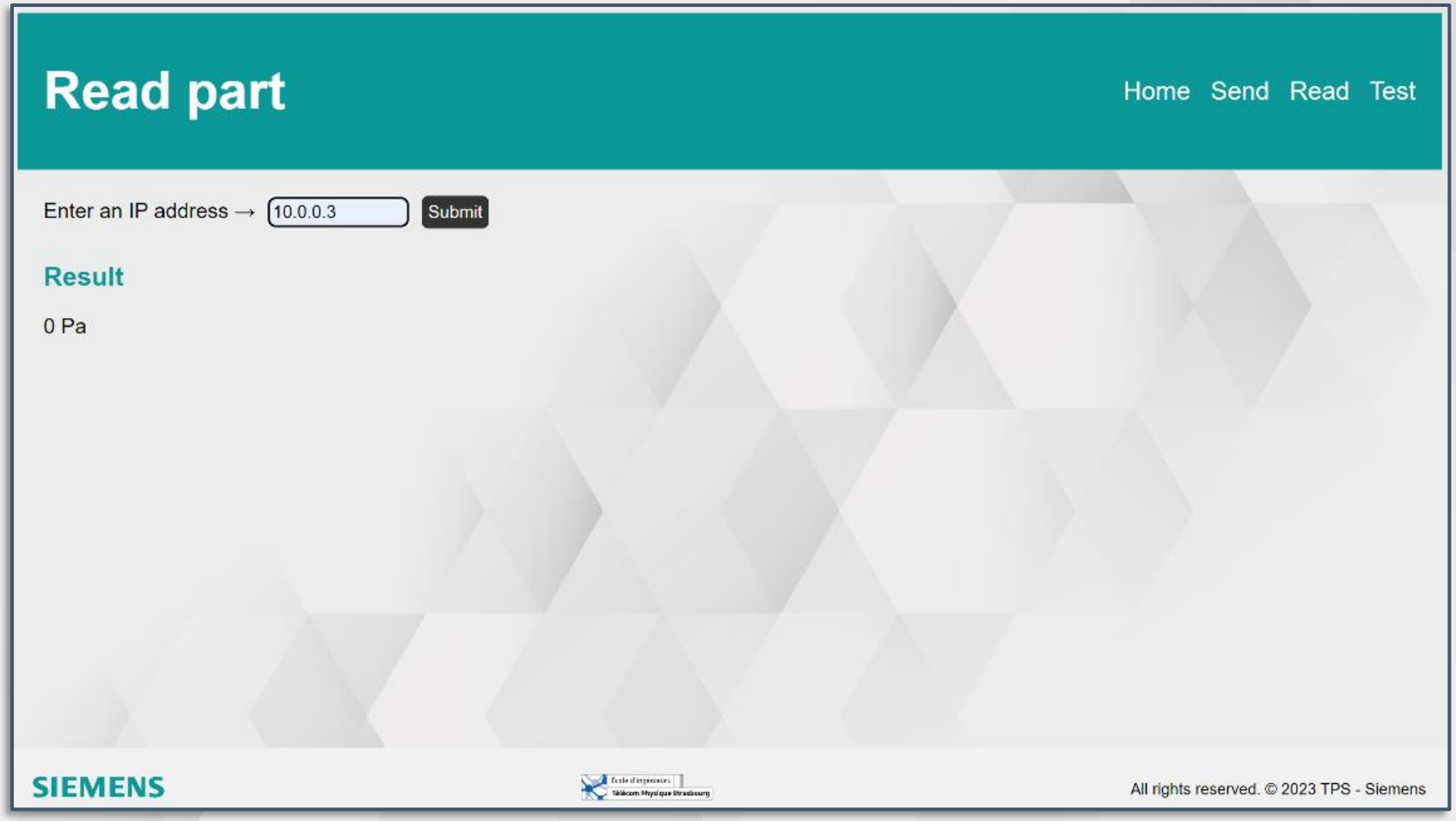
WORK ORGANIZATION

PROJECT CONCLUSION

Send page


Send part
Home Send Read Test
IP Address → 10.0.0.3 , pressure value → 10315 Pa
Pa
bar
psi
Submit
Success to send
SIEMENS
All rights reserved. © 2023 TPS - Siemens

Read page


Read part
Home Send Read Test
Enter an IP address →
10.0.0.3
Submit
Result
0 Pa
SIEMENS
All rights reserved. © 2023 TPS - Siemens

Test page

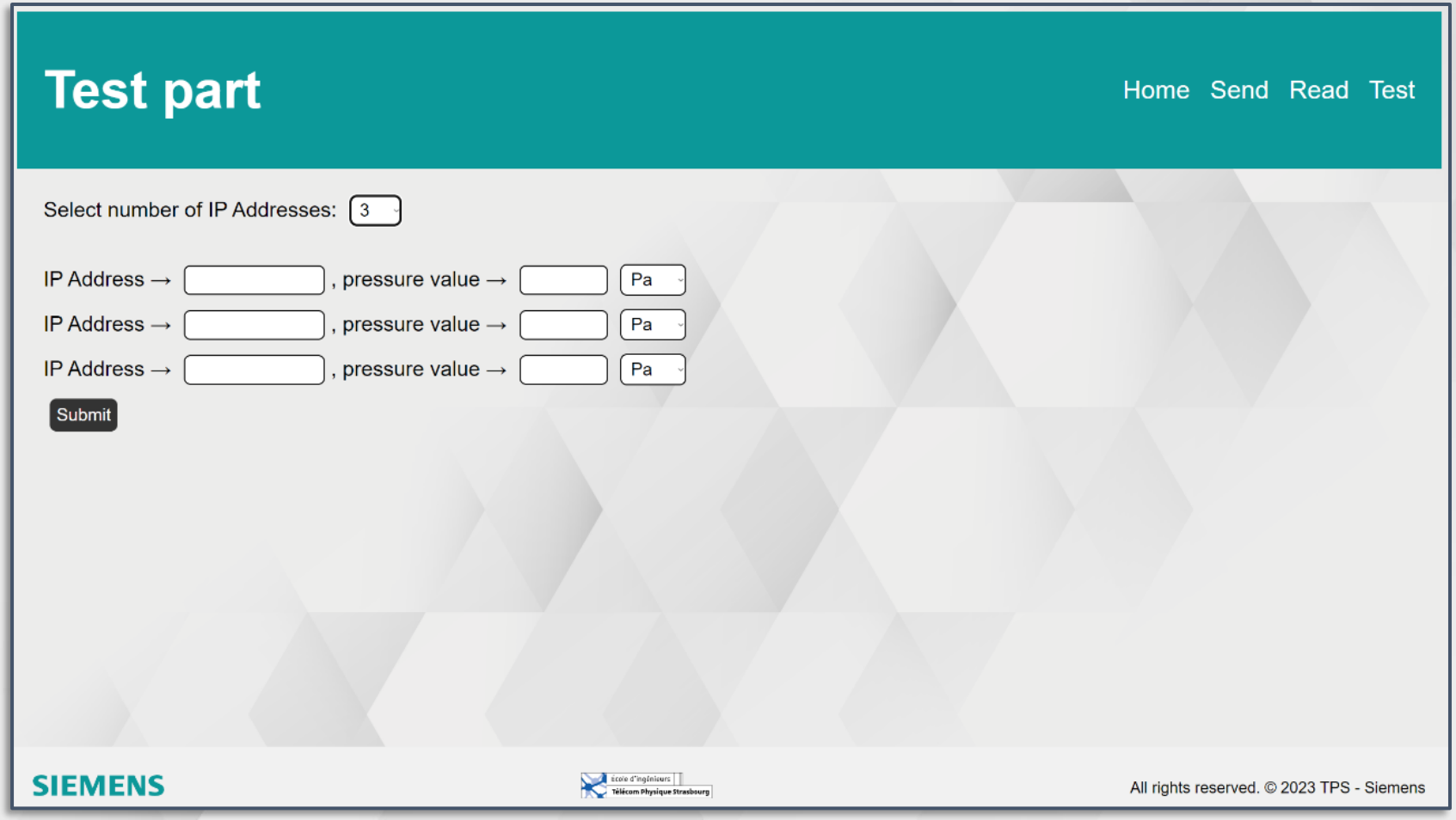

Test part
Home Send Read Test
Select number of IP Addresses: 3
IP Address → , pressure value → Pa
IP Address → , pressure value → Pa
IP Address → , pressure value → Pa
Submit
SIEMENS
Télécom Physique Strasbourg
All rights reserved. © 2023 TPS - Siemens

TABLE OF CONTENTS

PROJECT PRESENTATION

FIRMWARE

MONITORING APPLICATION

TEST APPLICATION

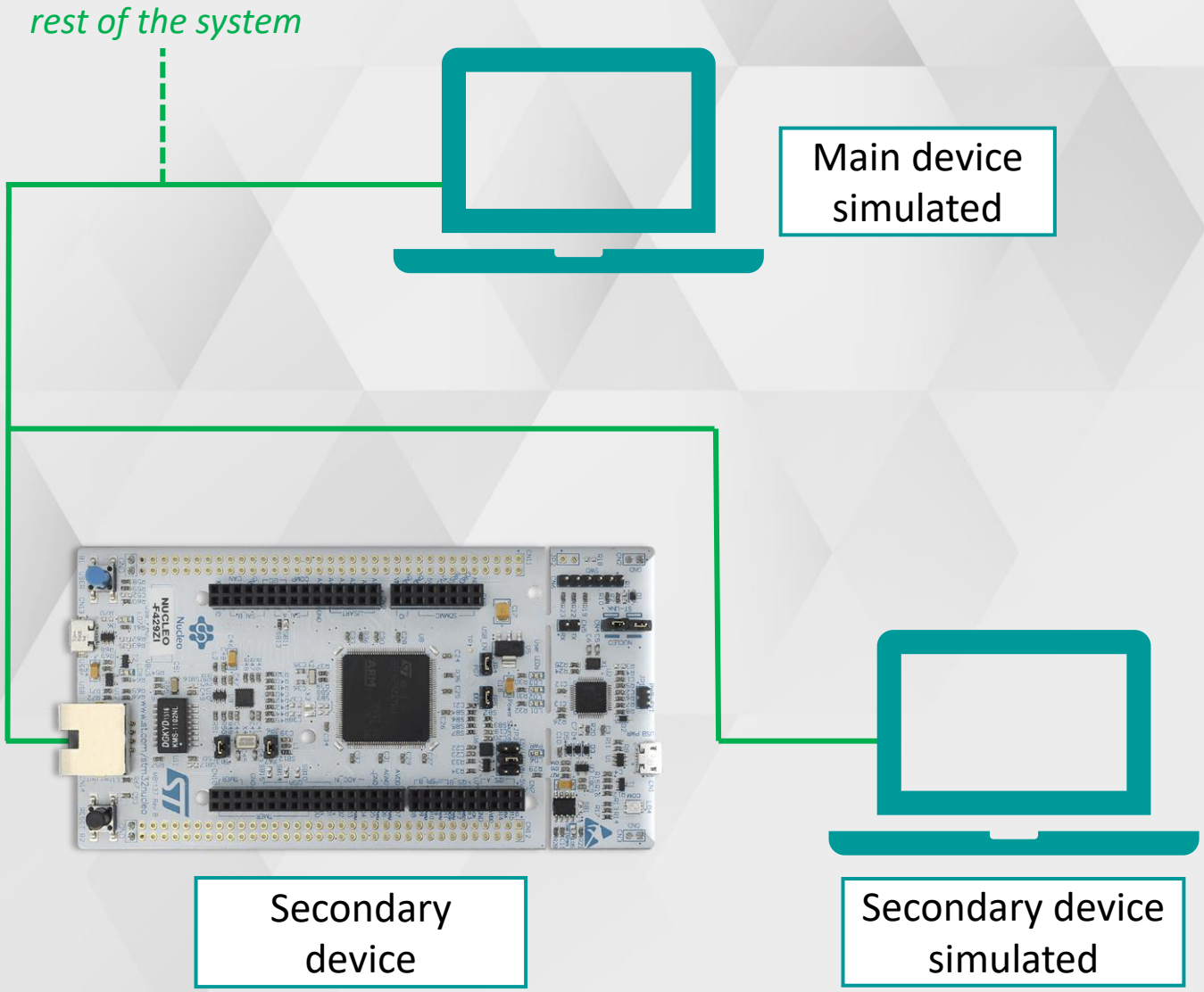
WIRESHARK PLUGIN

WORK ORGANIZATION

PROJECT CONCLUSION

Simulate Boards Behaviour

- Limited number of boards



Simulation Applications

- 2 Applications: client and server

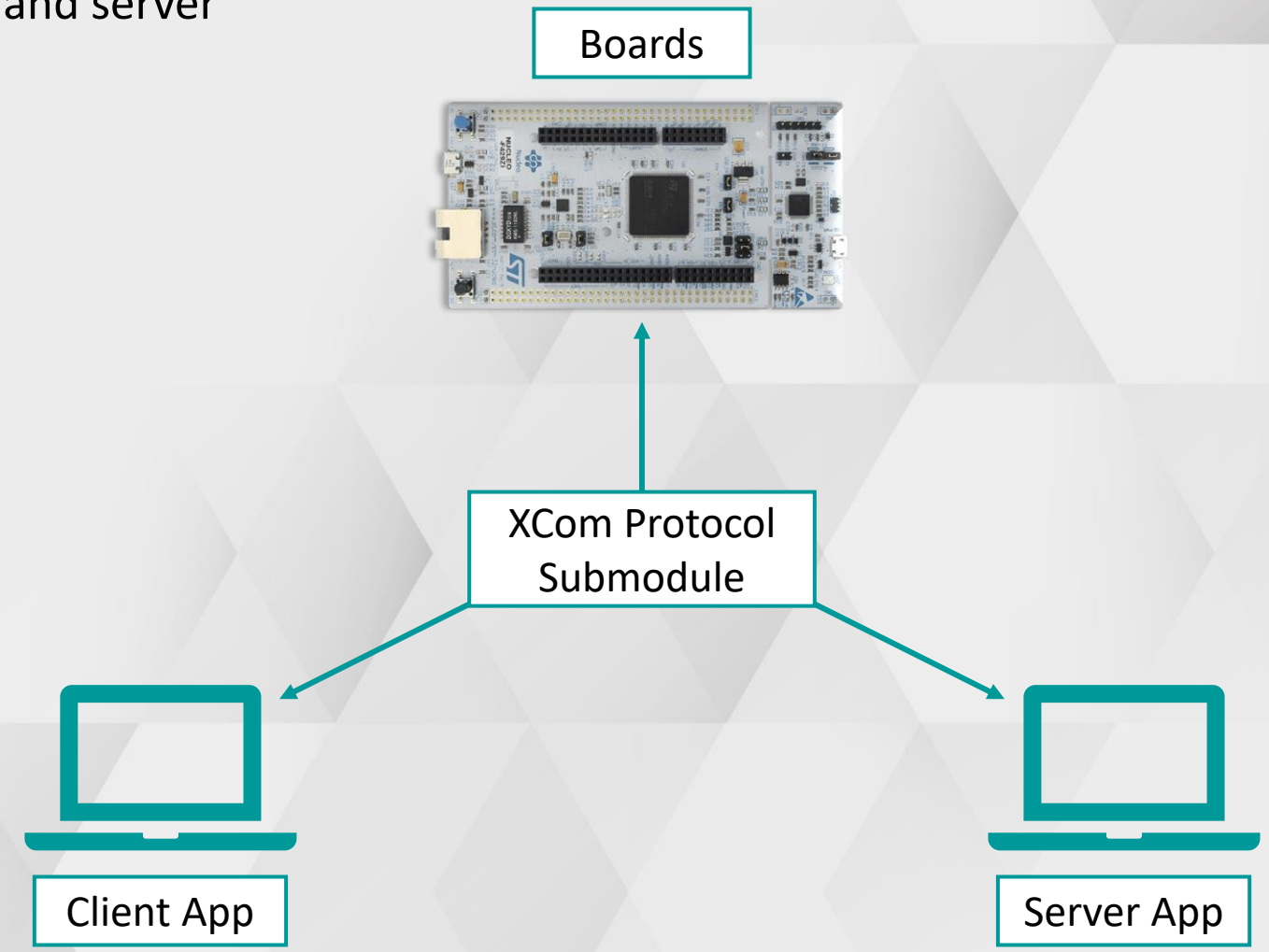


TABLE OF CONTENTS

PROJECT PRESENTATION

FIRMWARE

MONITORING APPLICATION

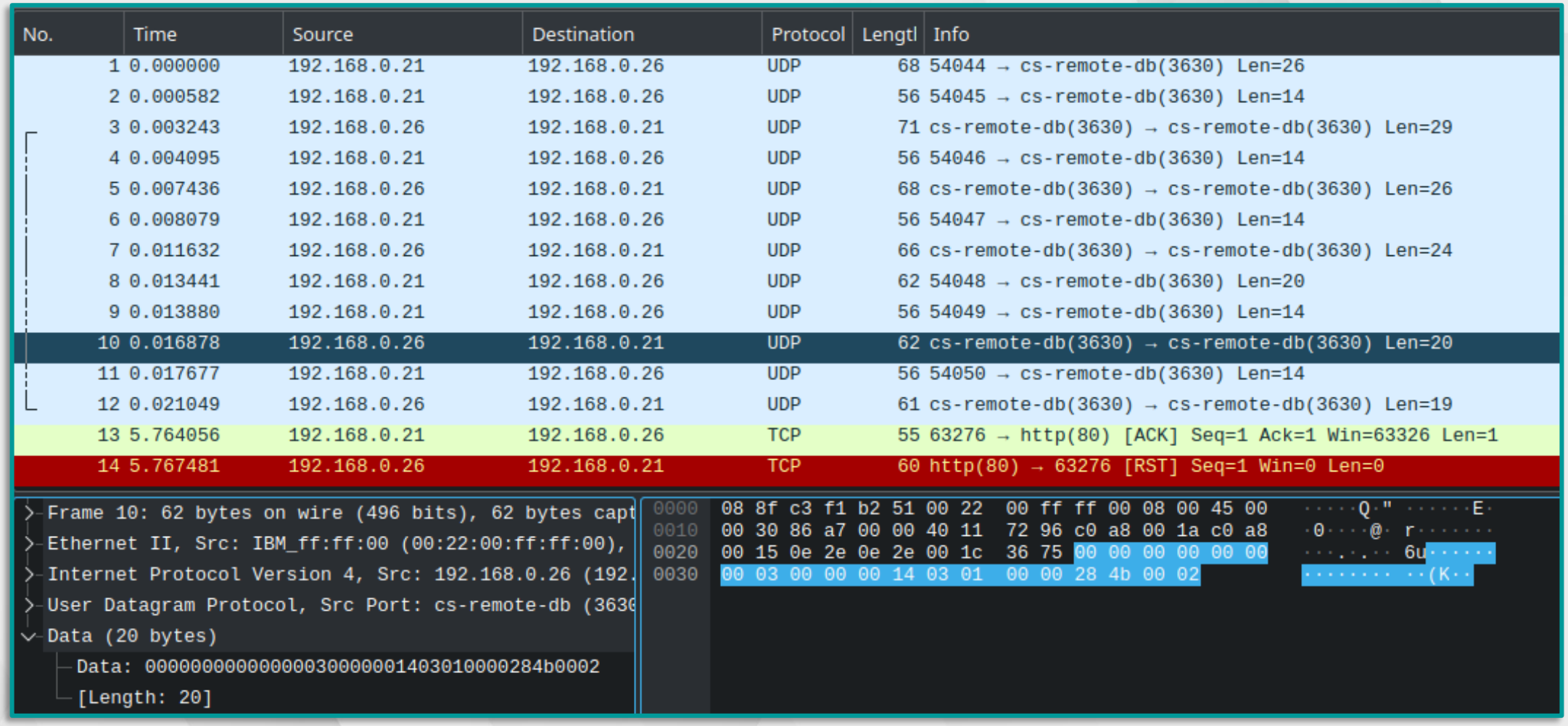
TEST APPLICATION

WIRESHARK PLUGIN

WORK ORGANIZATION

PROJECT CONCLUSION

Before The Plugin



No.	Time	Source	Destination	Protocol	Lengtl	Info
1	0.000000	192.168.0.21	192.168.0.26	UDP	68	54044 → cs-remote-db(3630) Len=26
2	0.000582	192.168.0.21	192.168.0.26	UDP	56	54045 → cs-remote-db(3630) Len=14
3	0.003243	192.168.0.26	192.168.0.21	UDP	71	cs-remote-db(3630) → cs-remote-db(3630) Len=29
4	0.004095	192.168.0.21	192.168.0.26	UDP	56	54046 → cs-remote-db(3630) Len=14
5	0.007436	192.168.0.26	192.168.0.21	UDP	68	cs-remote-db(3630) → cs-remote-db(3630) Len=26
6	0.008079	192.168.0.21	192.168.0.26	UDP	56	54047 → cs-remote-db(3630) Len=14
7	0.011632	192.168.0.26	192.168.0.21	UDP	66	cs-remote-db(3630) → cs-remote-db(3630) Len=24
8	0.013441	192.168.0.21	192.168.0.26	UDP	62	54048 → cs-remote-db(3630) Len=20
9	0.013880	192.168.0.21	192.168.0.26	UDP	56	54049 → cs-remote-db(3630) Len=14
10	0.016878	192.168.0.26	192.168.0.21	UDP	62	cs-remote-db(3630) → cs-remote-db(3630) Len=20
11	0.017677	192.168.0.21	192.168.0.26	UDP	56	54050 → cs-remote-db(3630) Len=14
12	0.021049	192.168.0.26	192.168.0.21	UDP	61	cs-remote-db(3630) → cs-remote-db(3630) Len=19
13	5.764056	192.168.0.21	192.168.0.26	TCP	55	63276 → http(80) [ACK] Seq=1 Ack=1 Win=63326 Len=1
14	5.767481	192.168.0.26	192.168.0.21	TCP	60	http(80) → 63276 [RST] Seq=1 Win=0 Len=0

```
> Frame 10: 62 bytes on wire (496 bits), 62 bytes capt
> Ethernet II, Src: IBM_ff:ff:00 (00:22:00:ff:ff:00),
> Internet Protocol Version 4, Src: 192.168.0.26 (192.
> User Datagram Protocol, Src Port: cs-remote-db (3630
v Data (20 bytes)
    Data: 00000000000000030000001403010000284b0002
    [Length: 20]
```

```
0000  08 8f c3 f1 b2 51 00 22  00 ff ff 00 08 00 45 00   .....Q." ......E.
0010  00 30 86 a7 00 00 40 11  72 96 c0 a8 00 1a c0 a8   .0....@. r.......
0020  00 15 0e 2e 0e 2e 00 1c  36 75 00 00 00 00 00 00   ........ 6u......
0030  00 03 00 00 00 14 03 01  00 00 28 4b 00 02         ........ ..(K..
```

With the pluggin

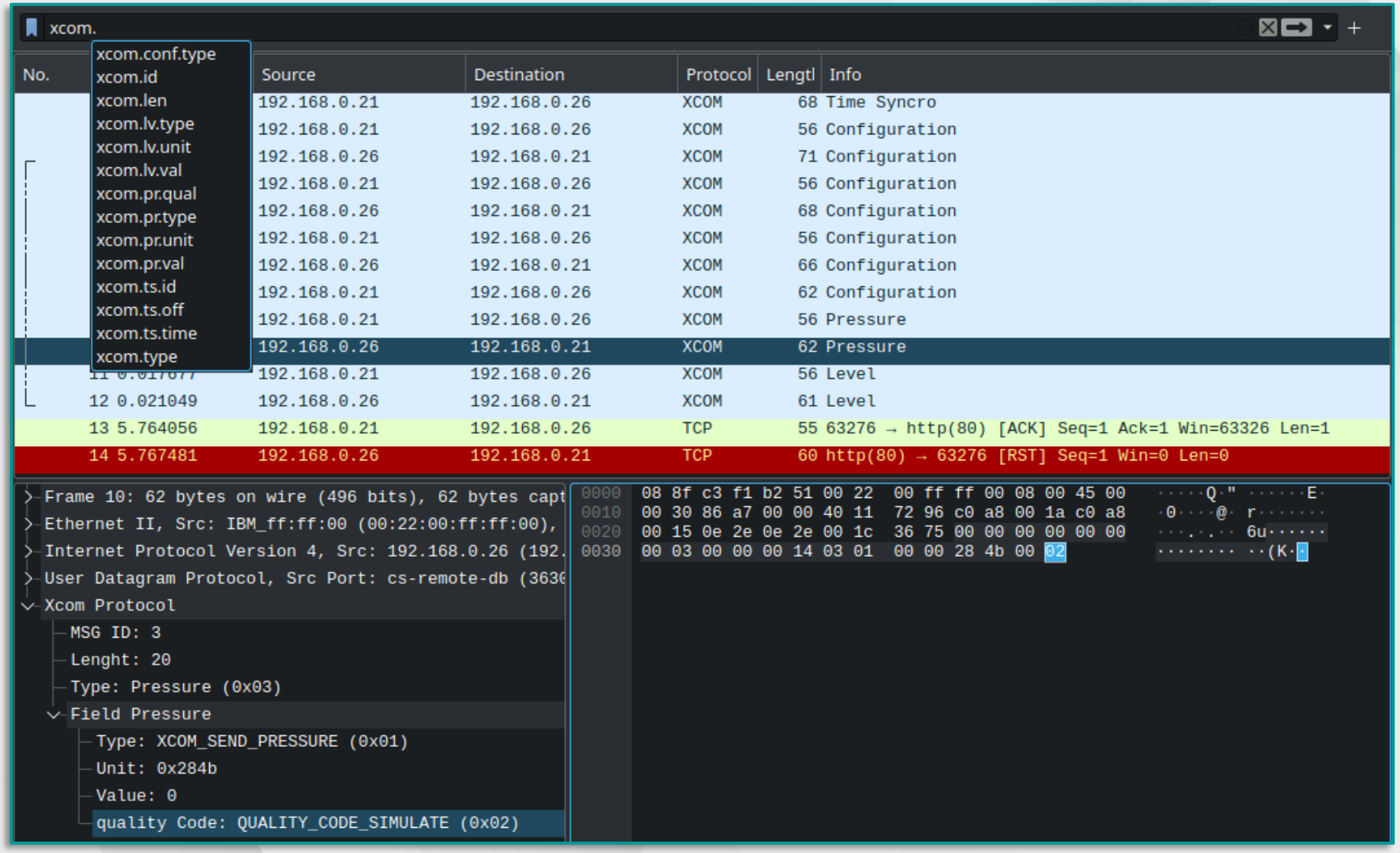


TABLE OF CONTENTS

PROJECT PRESENTATION

FIRMWARE

MONITORING APPLICATION

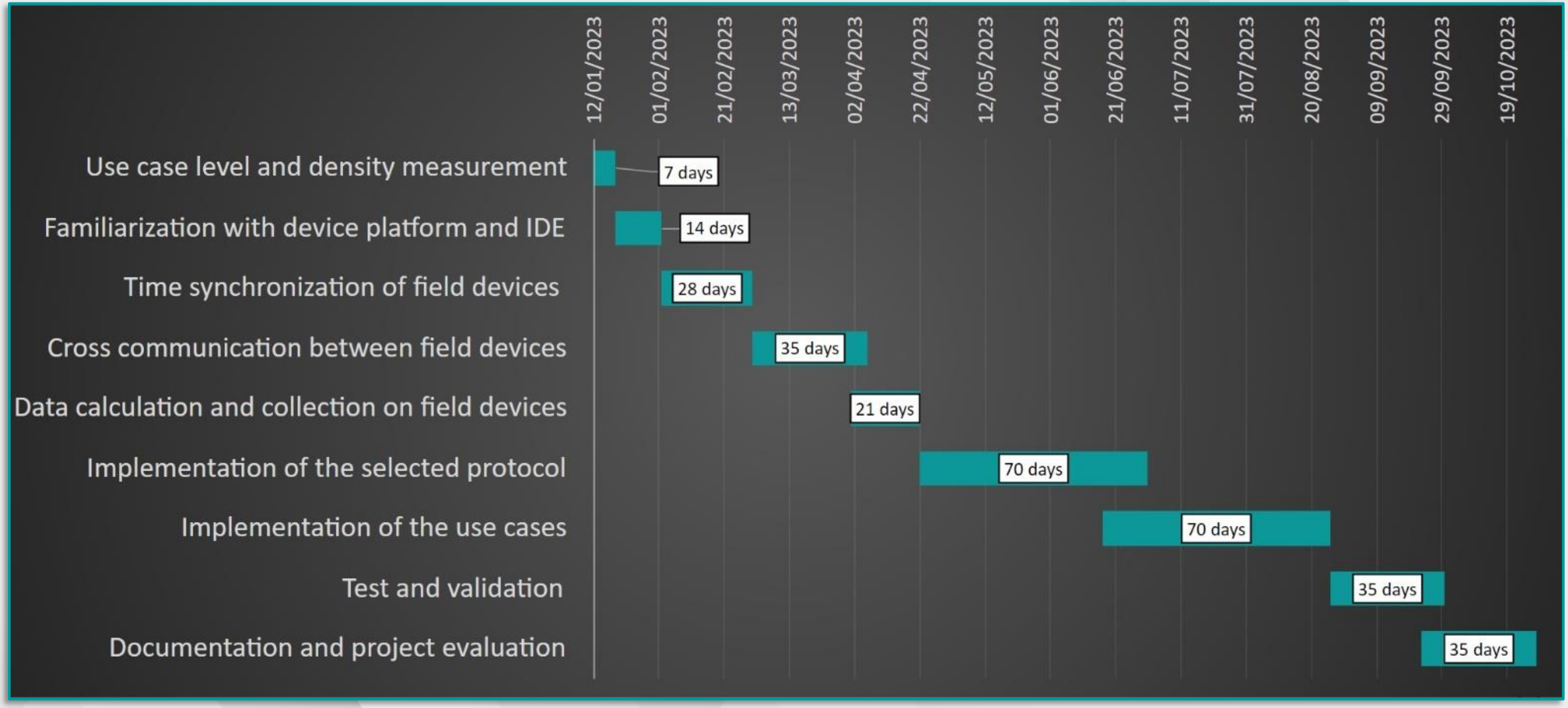
TEST APPLICATION

WIRESHARK PLUGIN

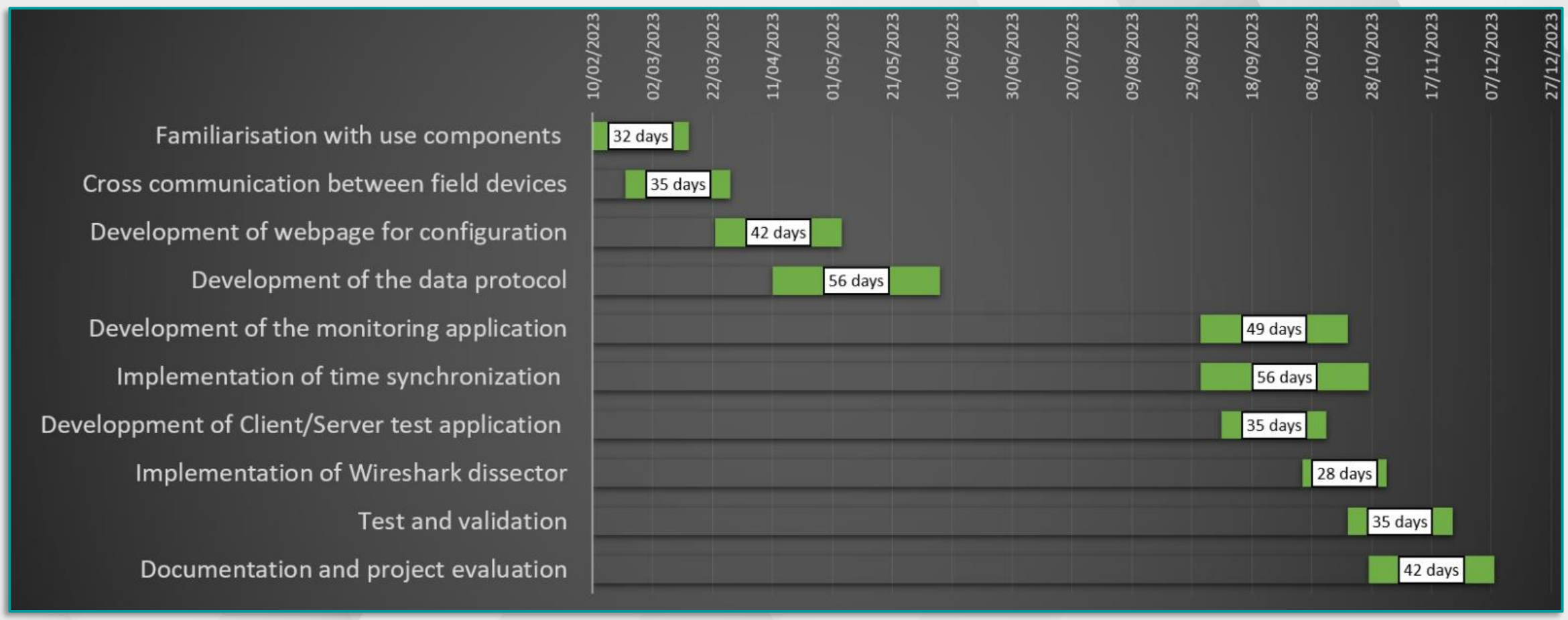
WORK ORGANIZATION

PROJECT CONCLUSION

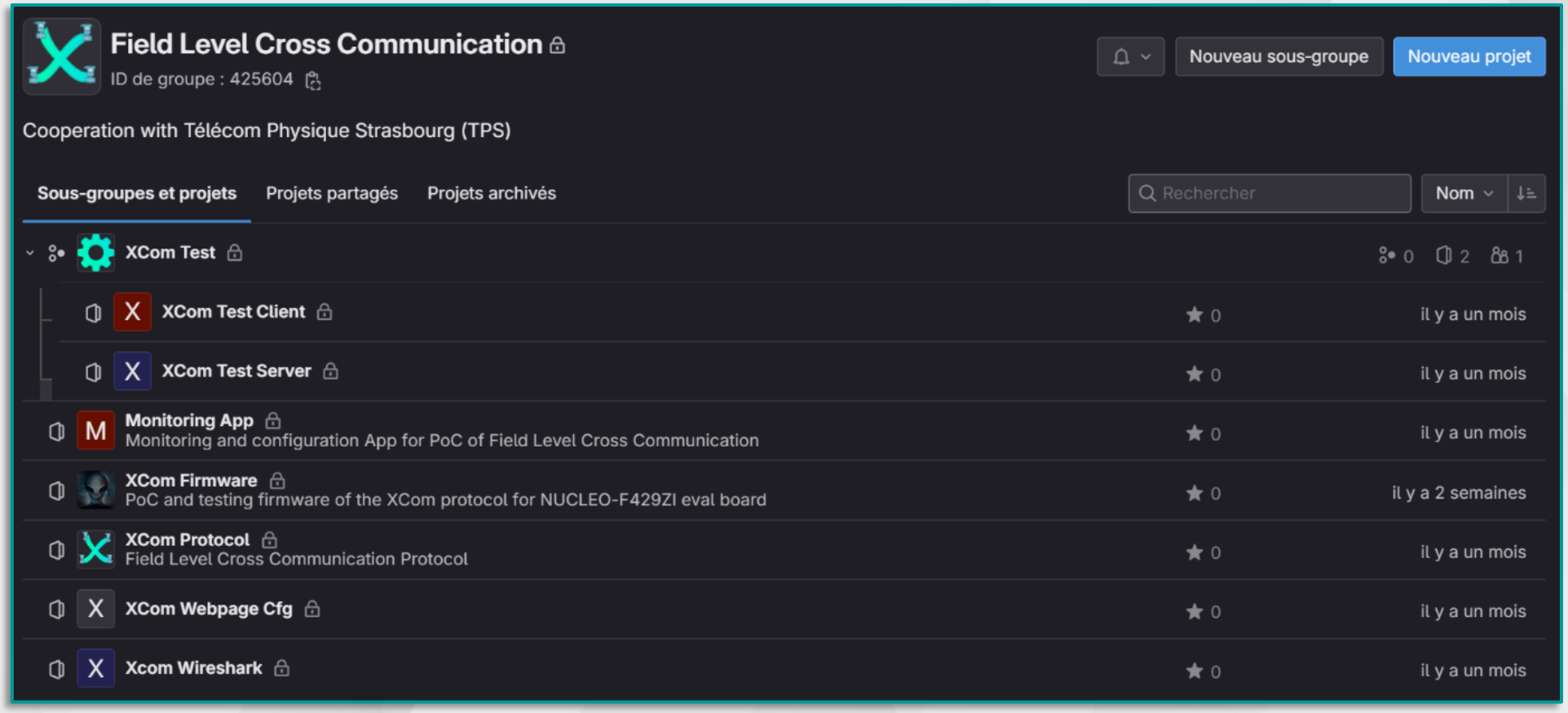
Initial Gantt chart



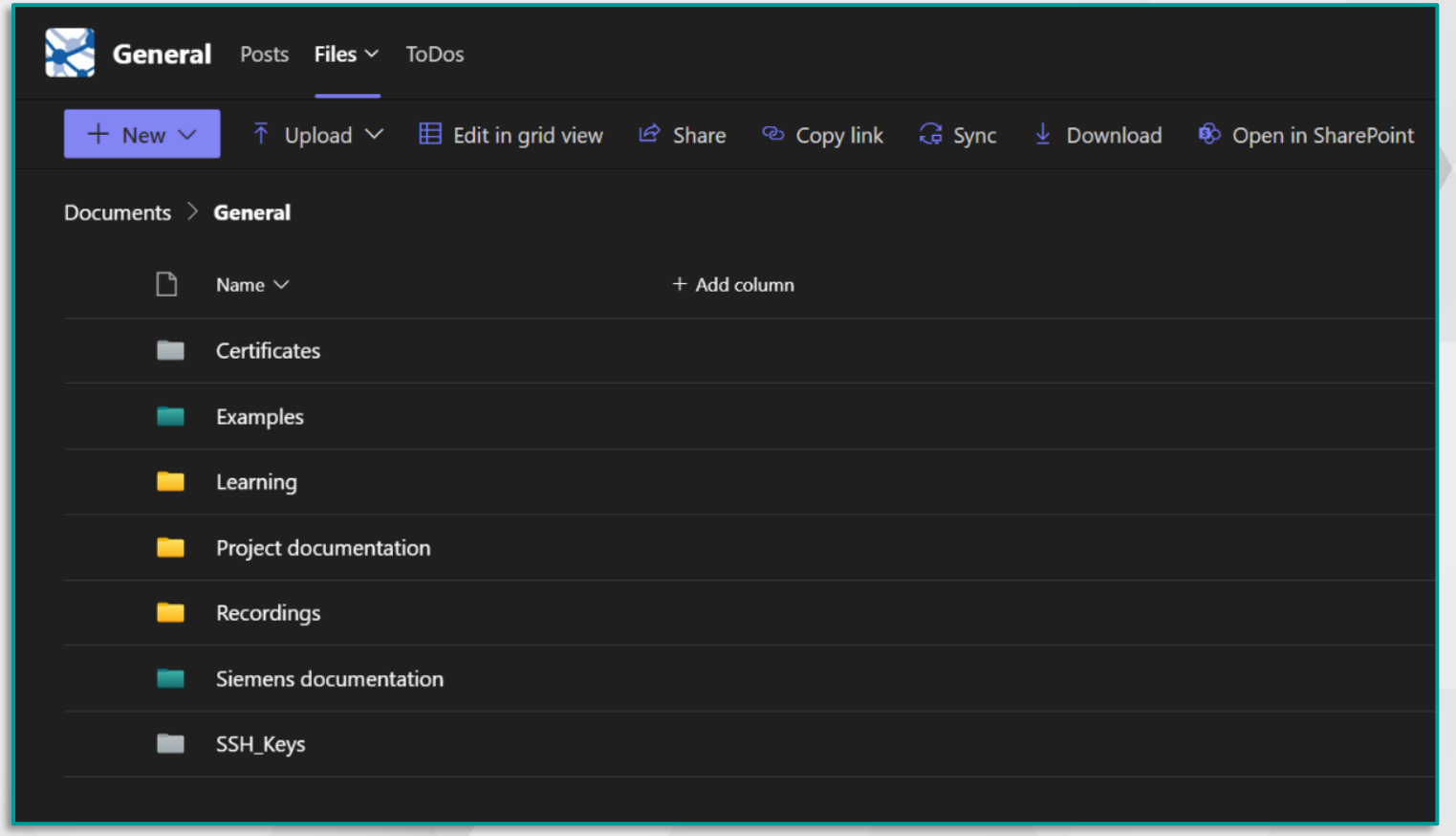
Final Gantt chart



Tools used (1)


Field Level Cross Communication
ID de groupe : 425604
Nouveau sous-groupe
Nouveau projet
Cooperation with Télécom Physique Strasbourg (TPS)
Sous-groupes et projets
Projets partagés
Projets archivés
Rechercher
Nom
XCom Test
XCom Test Client
XCom Test Server
Monitoring App
Monitoring and configuration App for PoC of Field Level Cross Communication
XCom Firmware
PoC and testing firmware of the XCom protocol for NUCLEO-F429ZI eval board
XCom Protocol
Field Level Cross Communication Protocol
XCom Webpage Cfg
Xcom Wireshark
il y a un mois
il y a 2 semaines

Tools used (2)


General
Posts
Files
ToDos
New
Upload
Edit in grid view
Share
Copy link
Sync
Download
Open in SharePoint
Documents
General
Name
Add column
Certificates
Examples
Learning
Project documentation
Recordings
Siemens documentation
SSH_Keys

Assigment and day-to-day work

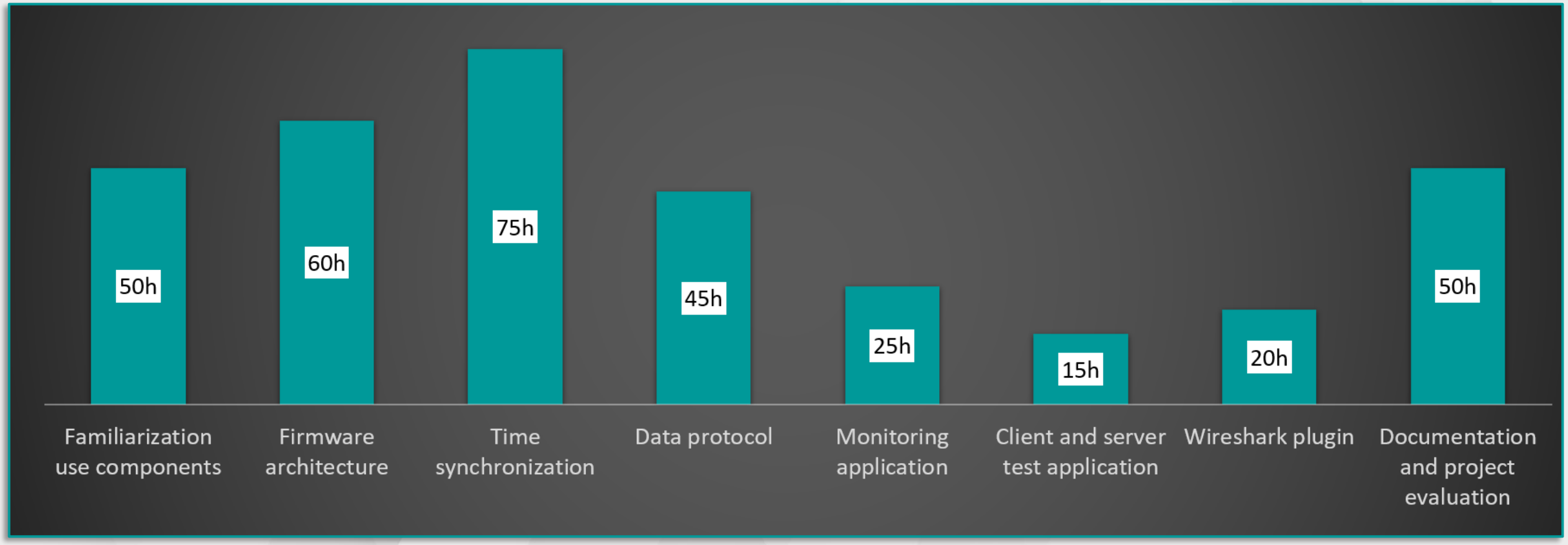


TABLE OF CONTENTS

PROJECT PRESENTATION

FIRMWARE

MONITORING APPLICATION

TEST APPLICATION

WIRESHARK PLUGIN

WORK ORGANIZATION

PROJECT CONCLUSION