

# Revamping the ICT infrastructure of r/v **Laura Bassi**

*Massimiliano Iurcev - OGS*



## The previous situation:

Laura Bassi is a PC5 class A icebreaker, launched in 1995,  
“Ernest Shackleton” of BAS from 1999,  
OGS/PNRA from 2019

Cables: Cat7 + a lot of older stuff

Equipment: QNAP NAS, Dell Servers,  
Firewall PA-820, Cisco switches and AP

Connectivity: VSAT Band C, Band Ku, Iridium

Software: MyWay for navigation,  
info on-board and web dissemination

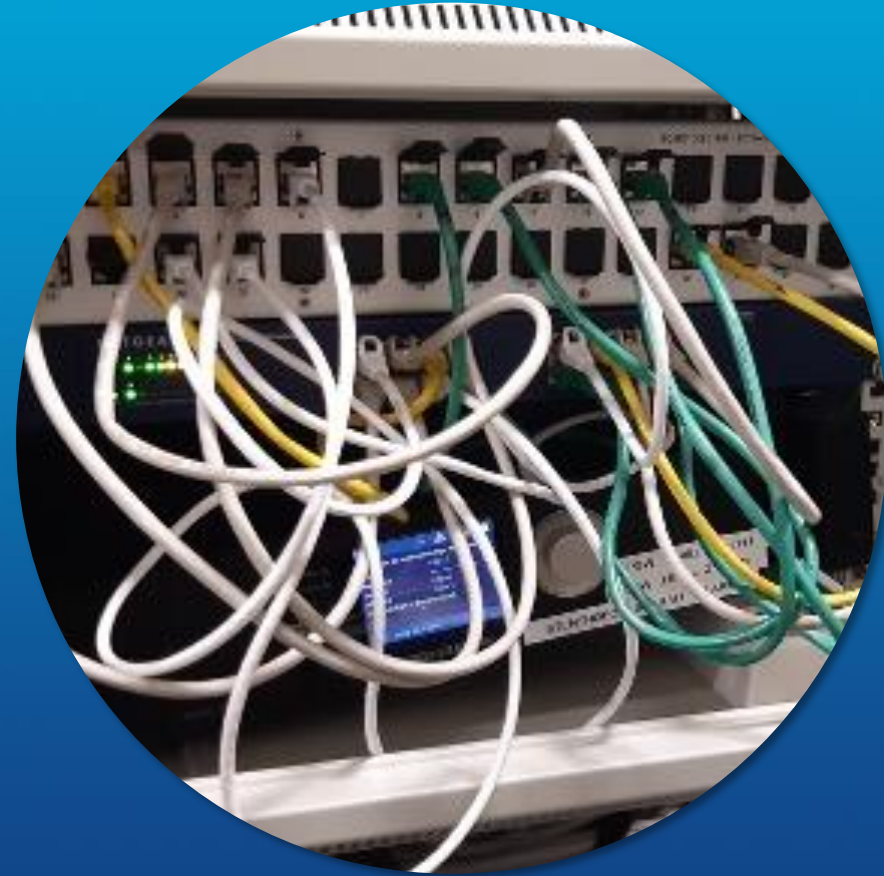


# ISSUES

problems & goals

## ISSUE #1: LABYRINTH

- Partially uncharted network topology.
- Obsolete cables/patches.
- Loops.
- Superposition of two networks  
(ship ~ scientific)





## ISSUE #2: OUT-OF-ORDER

OGS becomes implementation body  
for PNRA mission

networking equipment missing  
not configured  
not updatable

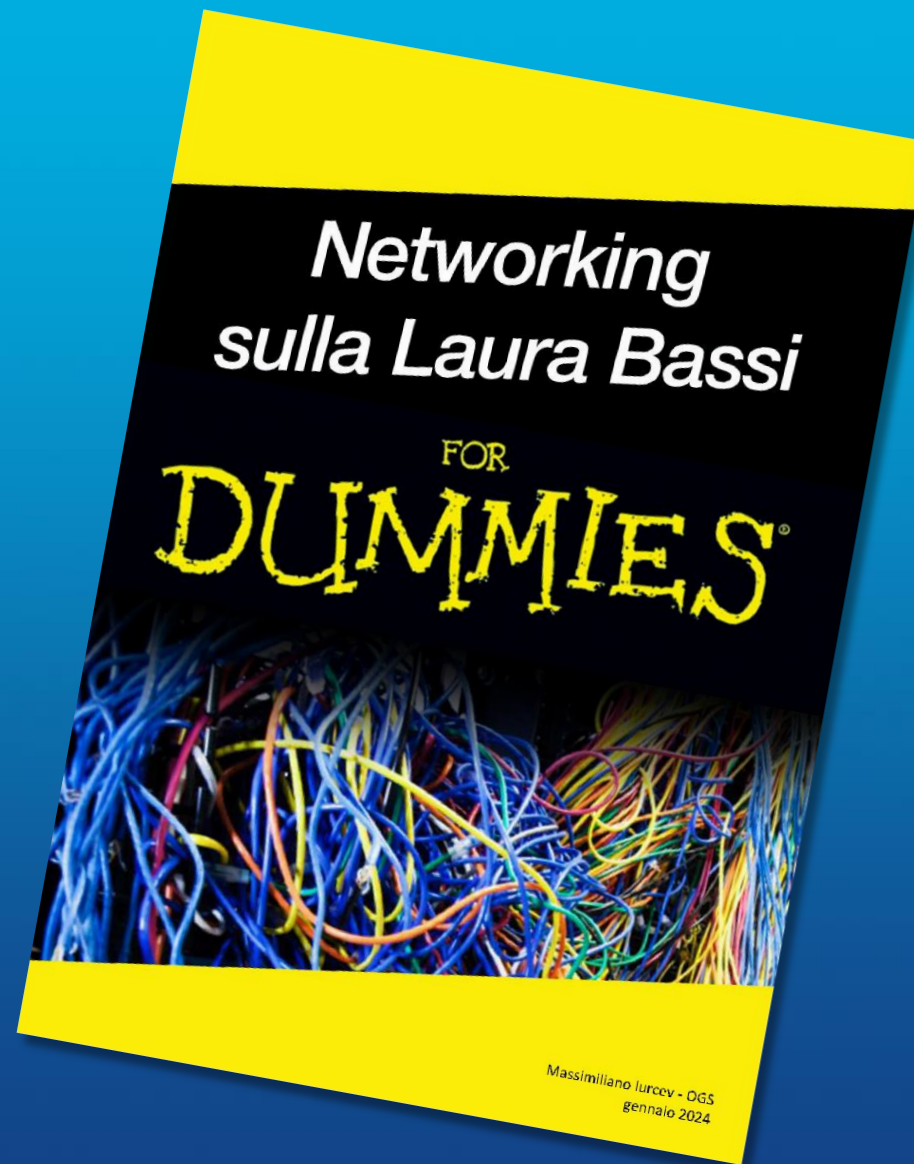
...

missing passwords, licenses, software



## ISSUE #3: SIMPLICITY

- Usability
- Documentation
- System resilience
- Emergency procedures



## ISSUE #4: BETTER INTERNET

New communication provider  
(Telespazio)

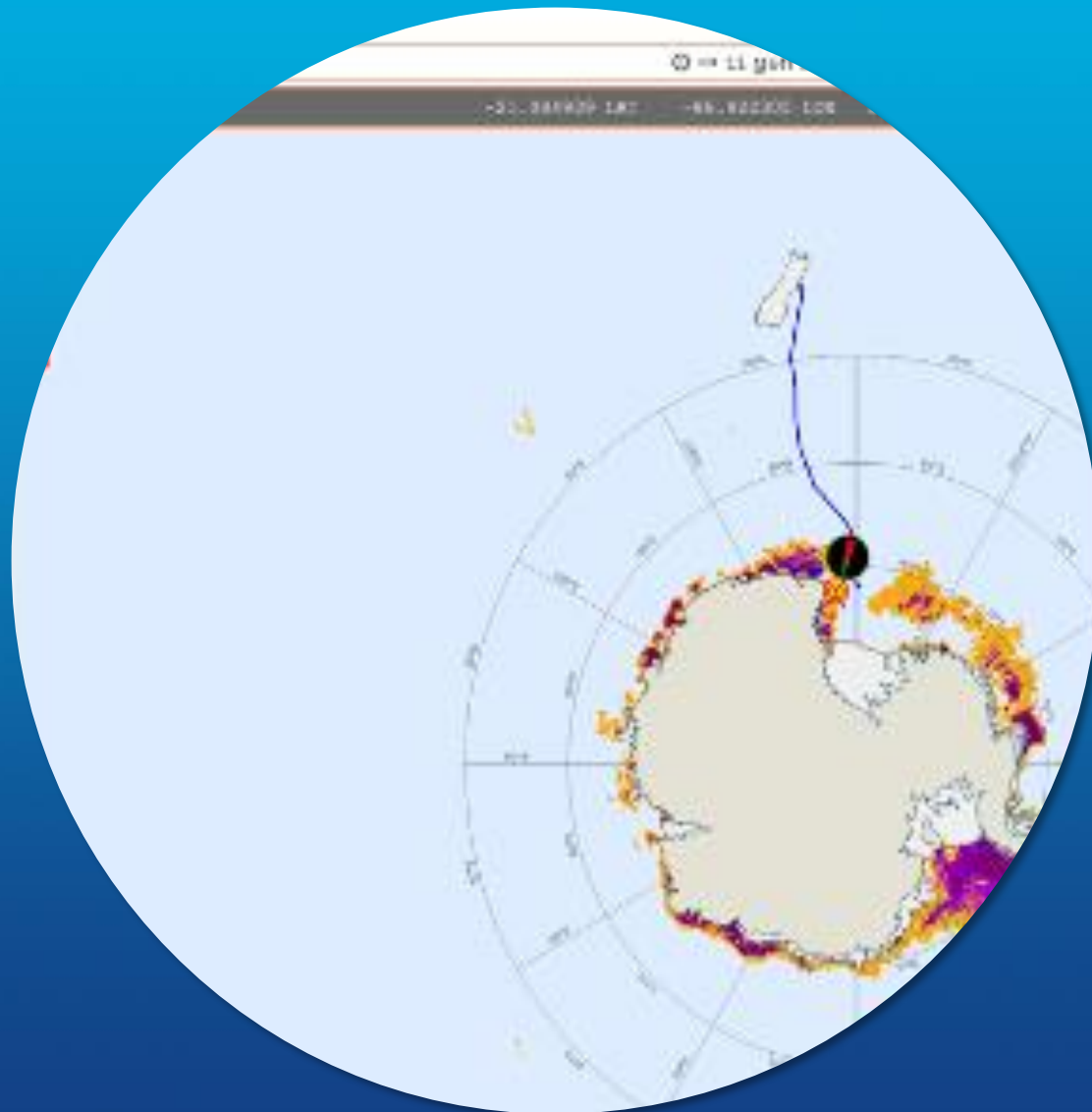
New technologies available  
(Starlink)



## ISSUE #5: REMOTE CONTROL

Remote monitoring/management

Web dissemination





## ISSUE #6: TIME

Limited time for planning,  
purchasing  
and setting up!  
Approximately from July to October



# SOLUTIONS

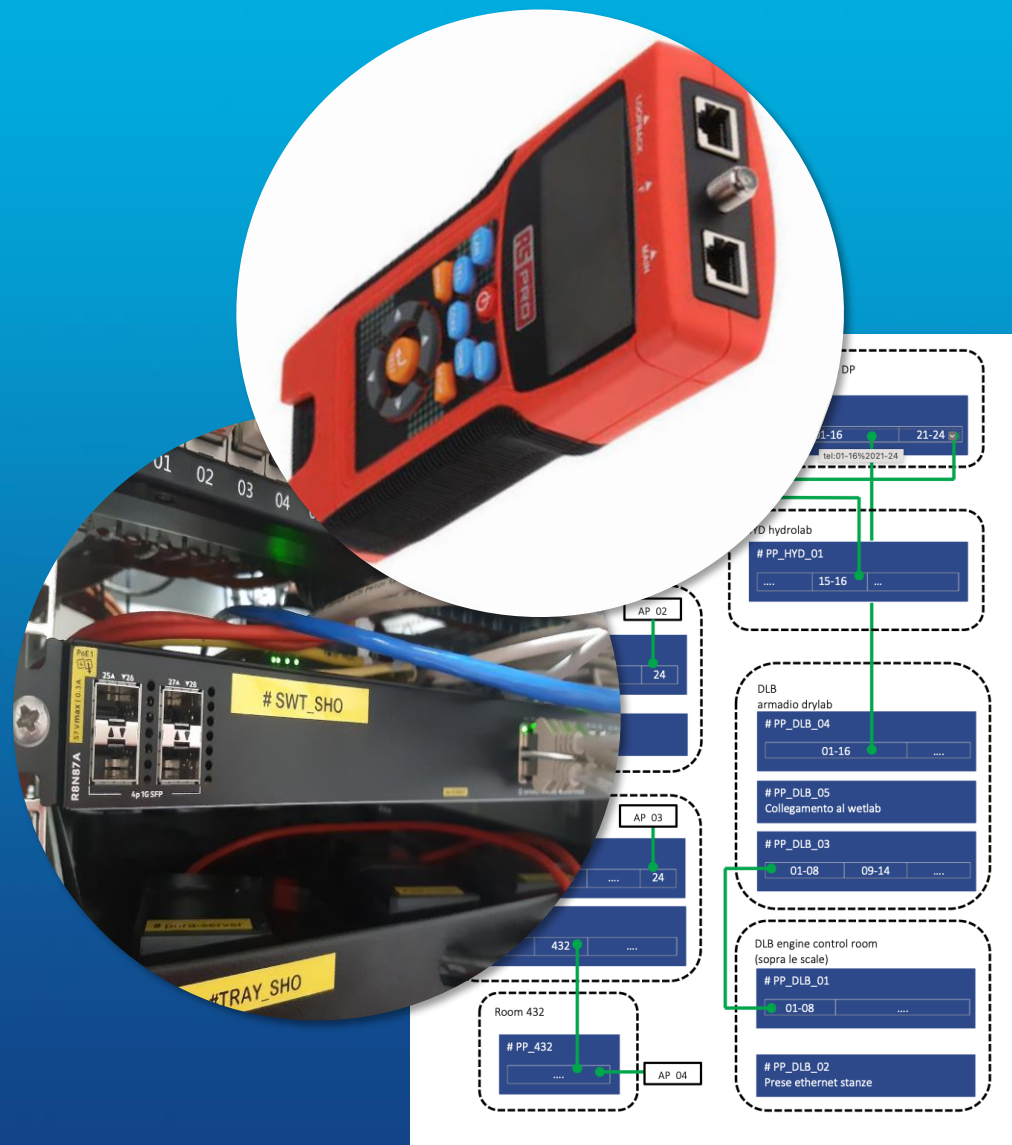
how did we start?  
what have we done?

## #1: SURVEY

- Checking and mapping everything!

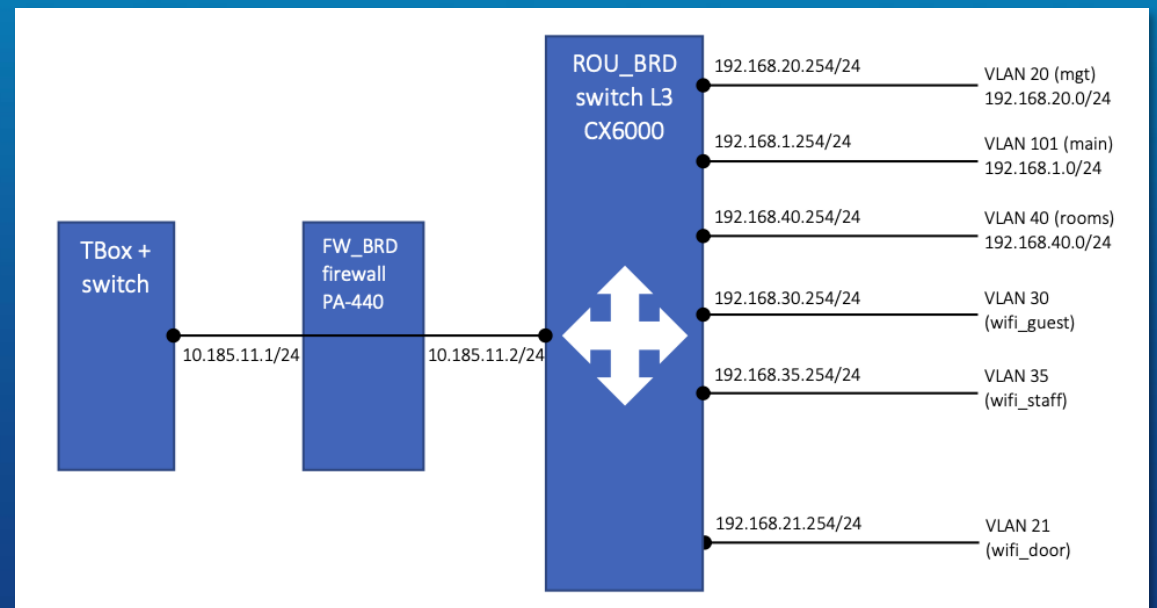
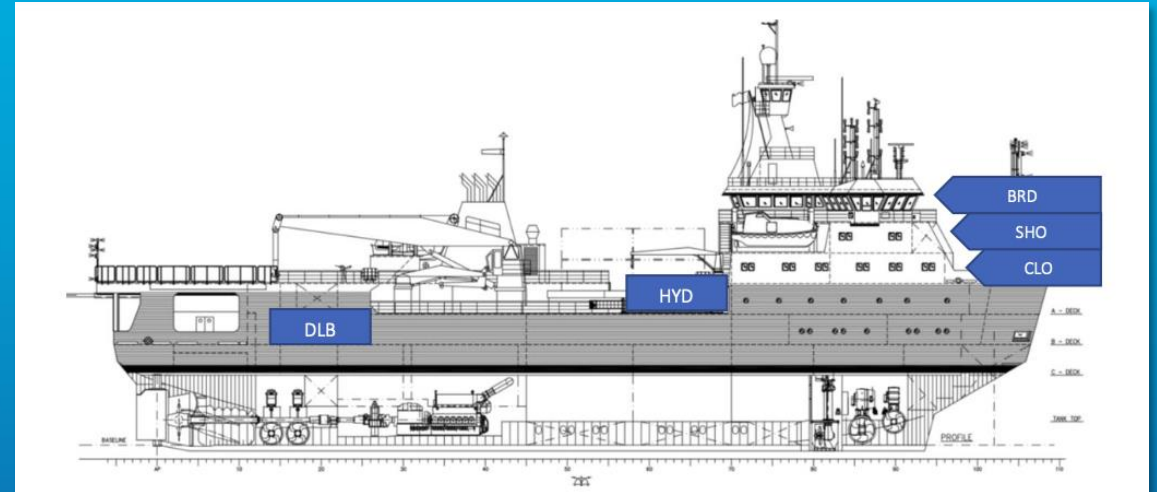
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- We ended up with a full catalog, based on yellow tags



## #2: NETWORK TOPOLOGY

- Physical vs logical architecture
- LAN, WAN, VLANs
- Switches L2 and L3 (routing)
- A perimeter firewall



## #3: WIFI

- Old fashion Cisco Aironet
- Mobility Express
- 2 SSID, 2 policies!
- 1 password to rule them all

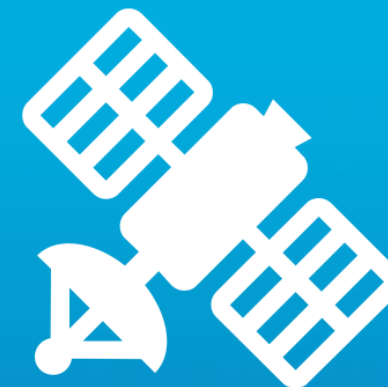




## #4: CONNECTIVITY

- VSAT Band C
- VSAT Band Ku
- Starlink
- LTE
- Iridium

Telespazio: TBox, a double network,  
an algorithm, bandwidth control



## #5: SECURITY

### PaloAlto PA-440 Firewall

Security policies,  
ML-Powered,  
application layer,  
encryption decoding,  
signature matching  
for all threats and content



VirtualWire solution:

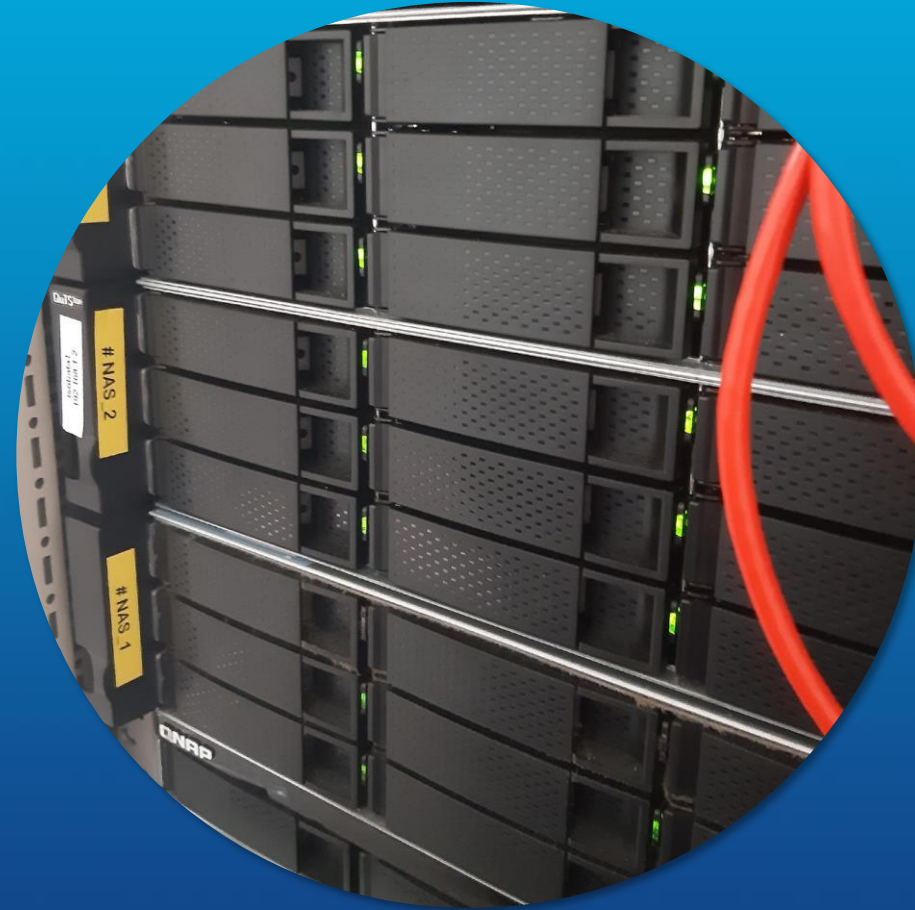


## #6: SERVERS

We needed services,  
a place for software,  
an intranet, automation...

We needed DHCP, Apache, VPN,  
Python, SSH, SFTP, PostgreSQL...

We had only the QNAP NAS...





## #6b: SERVERS

*The FOSS paradigm:  
free and open-source software.*

Raspberry Pi 4 8GB  
+ Linux Ubuntu Server 22.04 (64 bit)  
+ NEO aluminum case for cooling  
+ a lot of standard free software

Small (10cm x 7cm)  
Low cost (< 200EUR)  
Versatile, complete, expendable  
Easy to backup (SD card)  
Quantity vs power



## #7: REMOTE CONNECTION

*Monitoring and controlling everything from ~everywhere~ to Antarctica...*

*No public IP address!?!?*

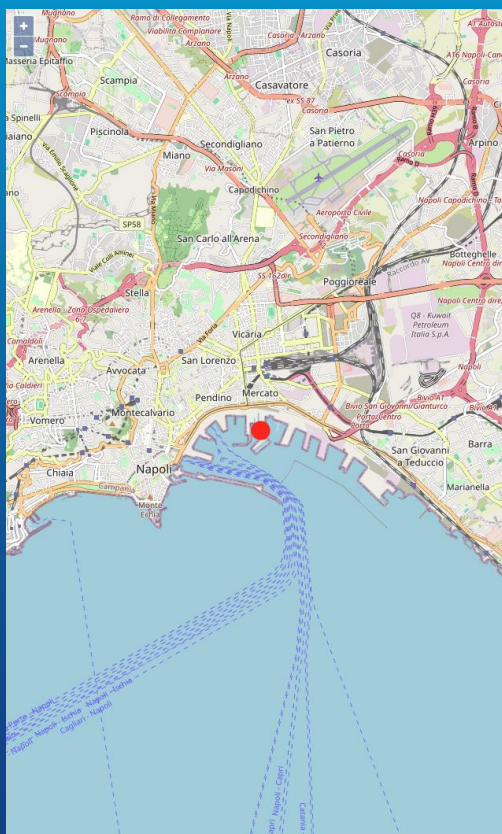
- Basic solution: AnyDesk for Windows (cloud)
- Advanced solution: WireGuard VPN (server in OGS)

The collage illustrates the remote connection setup. The top window shows the OGS N/R Laura Bassi web interface, indicating the GPS is offline. The middle window shows a terminal output of system processes, including tasks like 'ide\_inject', 'migration', 'ksoftirqd', 'kdevtmpfs', 'inet\_frag\_wq', 'kudld', 'khungtaskd', 'oom\_reaper', 'writeback', 'kcompactd', 'ksmd', and 'khugepaged'. The bottom window shows a detailed system monitoring dashboard with various widgets for Log, Firmware, Config, Management Modules, Thermals, CPU, Memory, Power Supplies, Fans, and System Info.

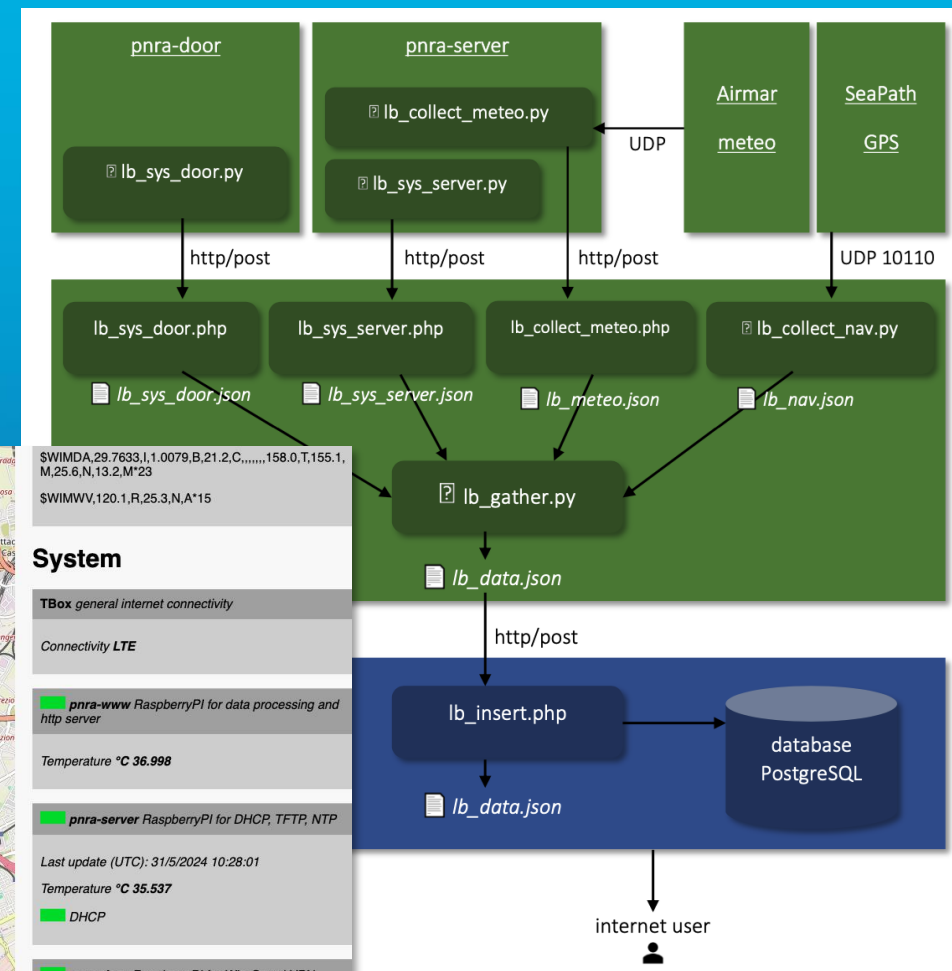


## #8: ACQUISITION/MONITORING

- ICT infrastructure status
- Kongsberg SeaPath GPS
- AirMar meteo station
- Web page for local and remote monitoring

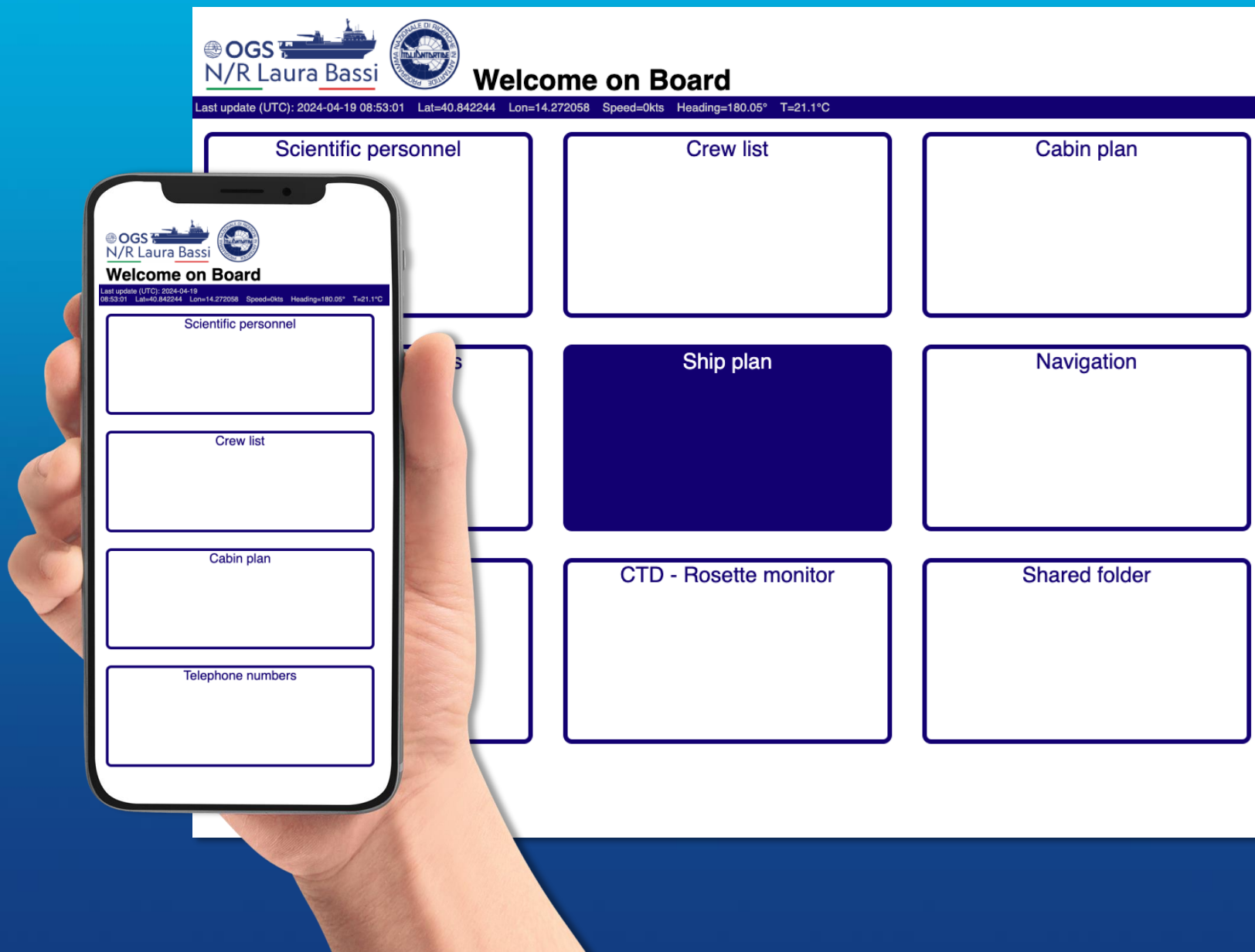


SWIMDA,29.7633,I,1.0079,B,21.2,C,,,,,158.0,T,155.1,M,25.6,N,13.2,M*23
SWIMWV,120.1,R,25.3,N,A*15
<b>System</b>
TBox general internet connectivity
Connectivity LTE
pnra-www RaspberryPI for data processing and http server
Temperature °C 36.998
pnra-server RaspberryPI for DHCP, TFTP, NTP
Last update (UTC): 31/5/2024 10:28:01
Temperature °C 35.537
DHCP
pnra-door RaspberryPI for WireGuard VPN
Last update (UTC): 31/5/2024 10:27:02
Temperature °C 35.05
WireGuard
<b>network infrastructure</b>
firewall PA-440
switch/router L3
switch L2 - ship office
switch L2 - client office



## #9: WELCOME ON BOARD

Intranet for everybody  
based on Apache server  
with documents,  
links, real-time info,  
shared screens...



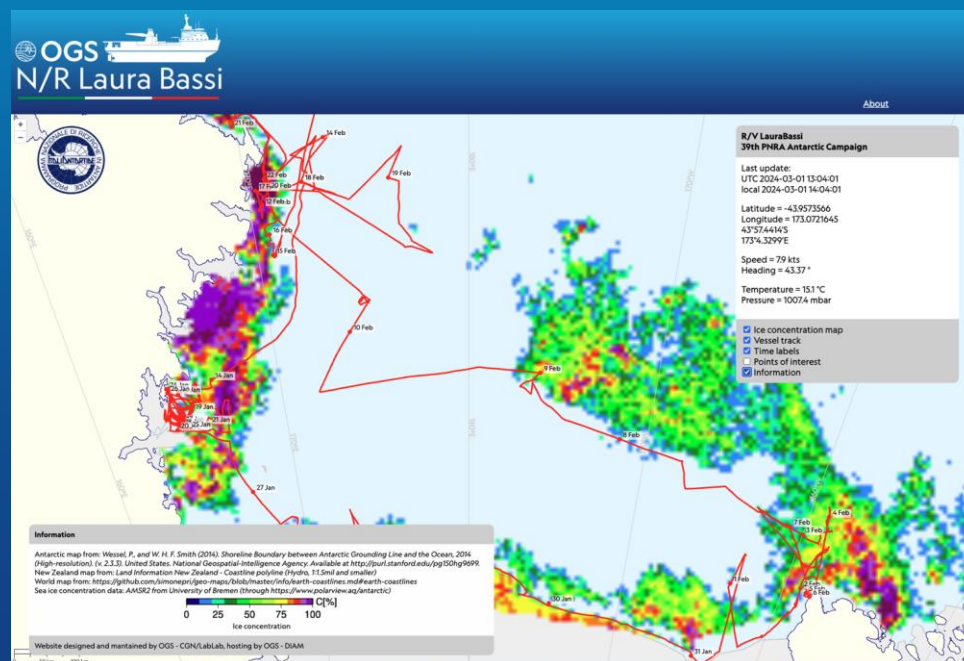
## #10: SHOWTIME!

Official web page  
with real-time position,  
vessel tracking,  
vectorial and raster maps,  
meteo info,  
ext. layers,  
POI,  
campaigns,

...

[laurabassi.ogs.it](http://laurabassi.ogs.it)

### OGS N/R Laura Bassi



# RESULTS

how did it go?

😊 very well!



- No critical issues or failures
- Remote management smooth and effective
- Minor adjustments of firewall policies
- Wi-Fi difficult to adapt/expand (e.g. refrigerators for ice cores)
- Old fashion VSAT: broken, slow, unstable
- Minor problems: e.g. screen sharing





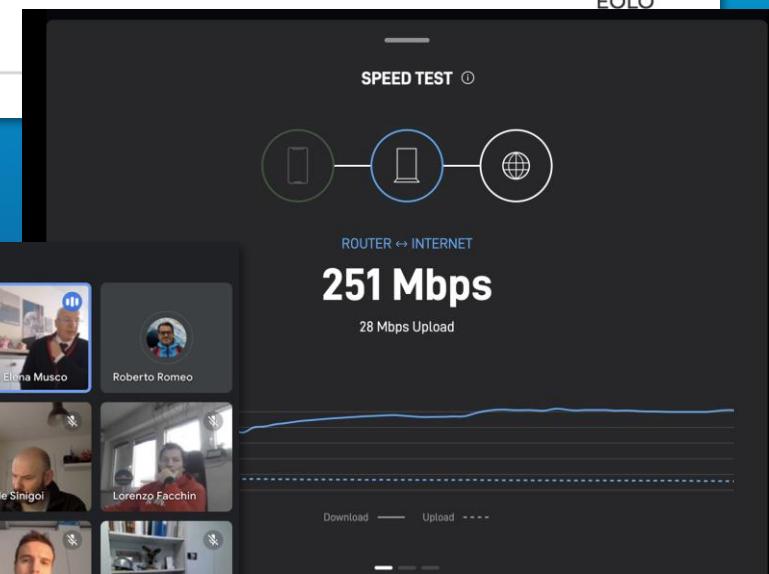
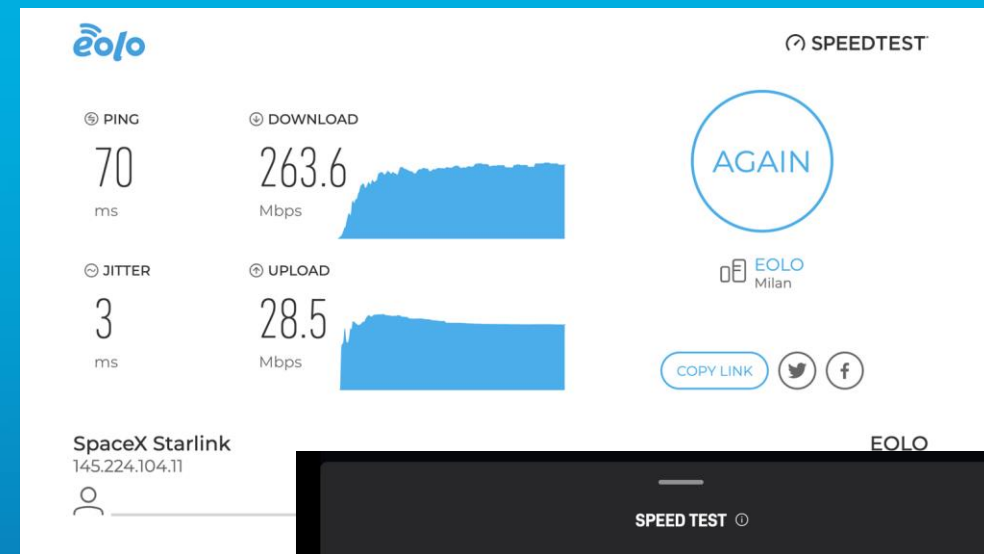
# FUTURE

## what next?

## FUTURE: STARLINK!

- really global
- quality of life
- videoconferences
- scientific data
- speed / cost
- RT monitoring

OUTSTANDING!



## FUTURE: STARLINK?

Potential problems:

- Increasing traffic
- Space weather
- Political issues?
- Better to have backup

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### Starlink back online after yesterday's hour-long outage

Cause of outage not yet known

May 29, 2024 By: Paul Lipscombe Have your say

Elon Musk's Starlink is back online following an outage that impacted SpaceX's satellite evening.

The incident appeared to last for around an hour, before Starlink stated on X, formerly issue has been fully resolved."

More than 41,000 users reported issues with Starlink on the outage tracking website DowntimeTracker.

The cause has not yet been identified, and Musk has yet to

Elon Musk @elonmusk · Follow

Major geomagnetic solar storm happening right now. Biggest in a long time. Starlink satellites are under a lot of pressure, but holding up so far.

Universal Time  
Space Weather Prediction Center  
Updated Time: 2024-05-11T00:00:00.000Z  
NOAA Scales Geomagnetic Storms

Kp < 5	Kp = 5 (G1)	Kp = 6 (G2)	Kp = 7 (G3)	Kp = 8, 9- (G4)	Kp = 9+ (G5)
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8:01 AM · May 11, 2024

223K Reply Copy link

Read 8.3K replies

## FUTURE: GO DIGITAL!

- Network extension
- New core switches
- Firewall in H/A
- Fiber-optic backbones
- New digital CCTV system
- Plenty of WiFi AP

New instruments: meteo, termosalinograph, nuclear radiation



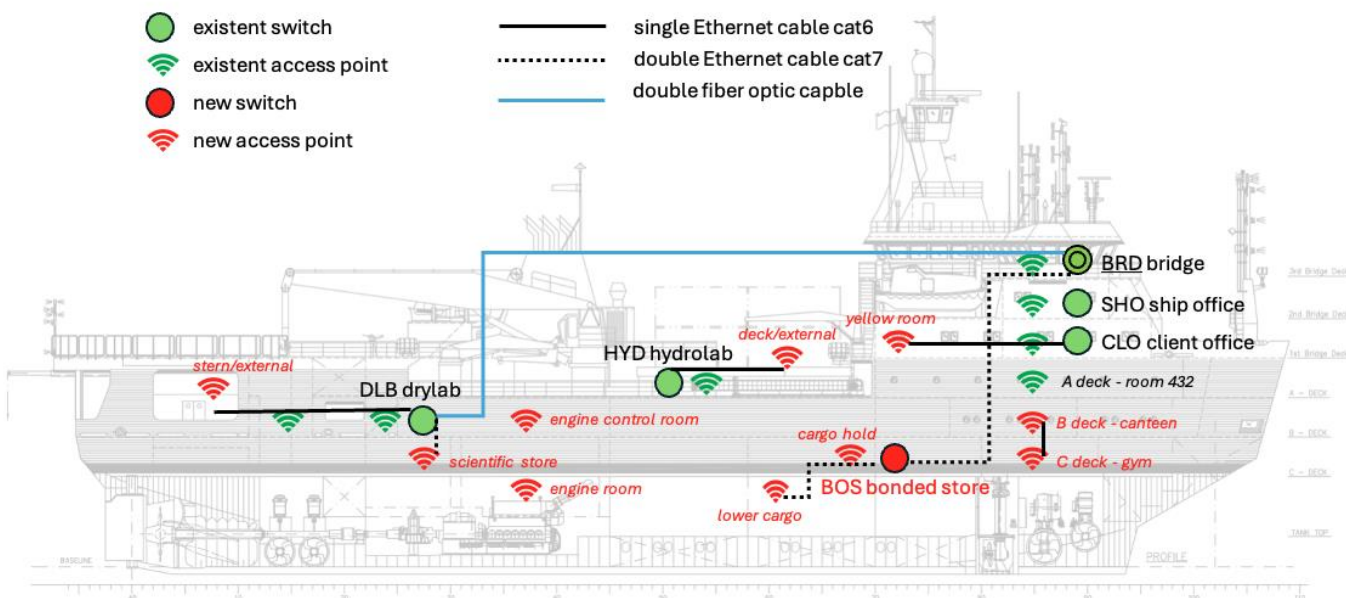
610 - indoor  
- outdoor



518 – rugged



560



# thank you!

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## Acknowledgments:

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