

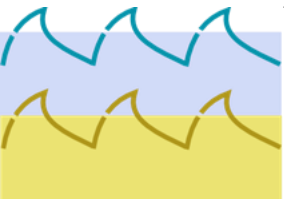
Winter School on Underwater Network Simulations (UNWiS)

Padova (Italy)

29th of January – 2nd of February 2024

Filippo Campagnaro, Roberto Francescon,
Angela Soldà, Antonio Montanari, Michele Zorzi

filippo.campagnaro@unipd.it



Thanks to our sponsors



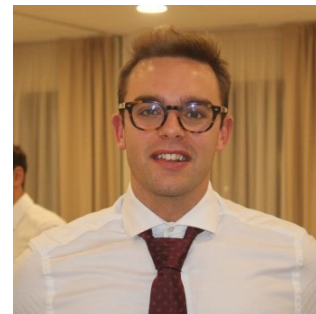
Introduction

5W – Who? What? Where? When? Why



Who?

- The winter school is organized by
 - University of Padova researchers
 - Wireless and More R&D and administration team



Who?

- Presenters from Unipd/Wireless and More

- Filippo Campagnaro
- Roberto Francescon
- Michele Zorzi
- Riccardo Tumiatì



- External presenters

- Emanuele Coccolo – Evologics Gmbh
- Dimitri Sotnik - Fraunhofer
- Sara Falleni – Northeastern University
- Andrea Panebianco – University of Catania



What?

- Winter school on Underwater network Simulations
- Focuses on the DESERT Underwater Network Framework

<https://desert-underwater.dei.unipd.it/>

- You need a laptop with a Linux OS installed
 - Debian based recommended, other distros are fine
- Basic knowledge on Linux OS and C/C++ are assumed
- The use of tools for data analysis and visualization, such as Matlab and/or python are assumed

Where?

- We are now in the Department of Information Engineering of the University of Padova
- WiFi is available to all of you
 - eduroam for those of you that have access to it
 - DEI guest
- We are in Padova, north of Italy
 - the University is more than 800 years old
 - nice city, with many interesting historical places
 - you can reach Venice in 30 minutes by train

When?

- This week 😊



Why? - 1

- Evaluation of underwater networks via sea experiments is very demanding in terms of effort and experimental costs due to ships, instruments, specialized crew
 - It should be minimized to when it makes sense
 - If the communication protocol does not work, you need days of testing wasting resources during sea experiments

Why? - 2

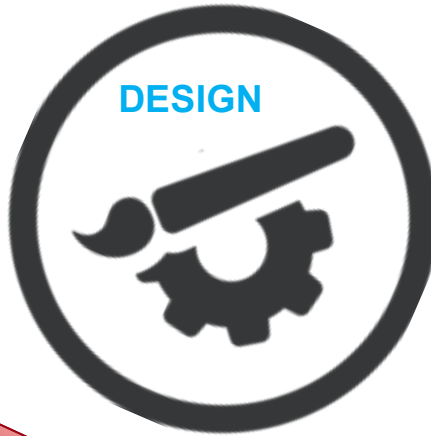
- Simulations can help evaluate the protocol without the need of sea experiment
 - The simulation should accurately characterize the environmental conditions to be accurate
 - The simulations should provide scientifically relevant results
- Sea trial can be performed once the protocol proved to work in simulation
 - Possibly without rewriting the code

Methodology

REQUIREMENTS



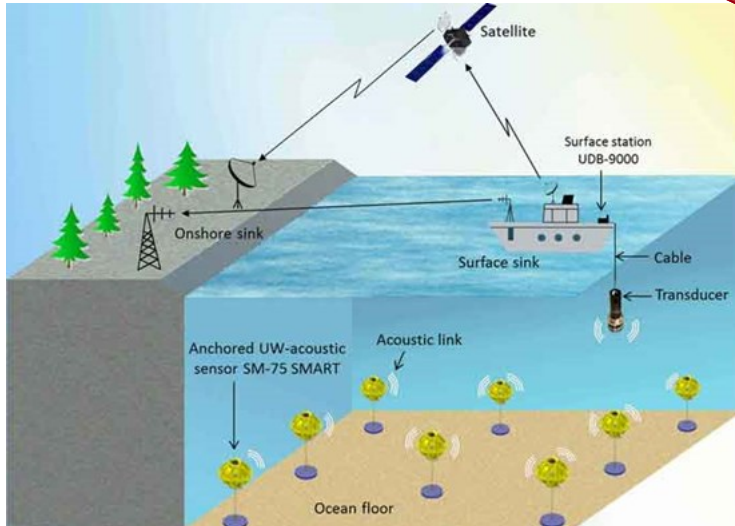
DESIGN



ANALYSIS & SIMULATION



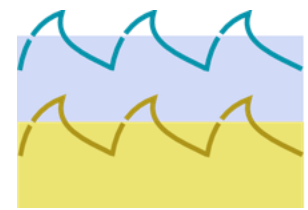
DEPLOYMENT



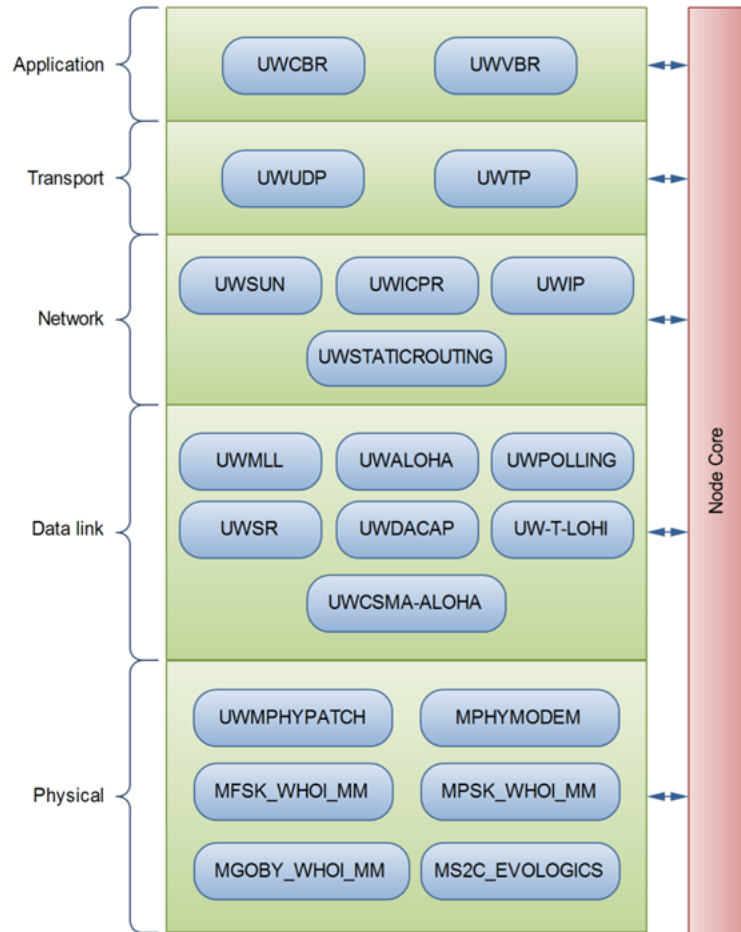
SEA TRIAL



DESERT Underwater v3



“DEsign, Simulate, Emulate and Realize Test-beds for Underwater network protocols”



□  - miracle



□ Code reuse for simulation, emulation and sea trial

Organization

Basic & Advanced

- Basic track
 - For people new to underwater networks and that did not use DESERT Underwater before (i.e., first year PhD students)
 - For Unipd DEI PhD students: this is your PhD course.
- Advanced track
 - For attendees of last year UNWiS
 - For experience users of DESERT
 - For experience scientists working in underwater networks

Day organization

- “Early” morning (9:30-10:30): joint track and keynote speeches
 - 10:30-10:45 Coffee break
- 10:45-12:30 frontal lesson
- 12:30-14:00 lunch break
 - Lunch is included in the fee for people registered to the winter school
- 14:00-15:00 frontal lesson
 - 15:00-15:15 Coffee break
- 15:15-17:00 hand-on exercises

Agenda

Day 1 – Warm up

- Common track:
 - Introduction
 - Understand when simulation results are statistically relevant.
- Basic track:
 - Protocol stack, simulation, emulation, sea trial, Linux commands and tcl
 - Exercise: DESERT Underwater installation and examples
- Advanced:
 - Desert installation and examples
 - Adaptivity, crosslayer messages, time varying channel in simulation
 - Exercise: change physical parameters in simulation

Day 2 – Multimodal Networks and PHY

- Common track:
 - Underwater multimodal networks
- Basic:
 - Underwater acoustic, optical and EM physical layers in DESERT
 - Exercise: use optical, acoustic and EM in examples
- Advanced:
 - OFDM in acoustic, OFDM simulation in DESERT
 - Time varying acoustic channel: ASUNA and Markov models
 - Exercises with OFDM and Markov channel

Day 3 – DESERT in real-time

- Common track:
 - Evologics modems and DMACE
- Basic:
 - DESERT real-time scheduler and Packer add-ons
 - DESERT Adaptation Layer and modem drivers
 - Exercise of DESERT in realtime with modems
- Advanced:
 - Use DESERT in sea trials
 - Cross-compile DESERT for arm architectures
 - Exercise: Preparation for an acoustic network deployment

Day 4 – practice

- Common track
 - IEEE OES WiE and YP panel, discussion of applications of uw networks and discussion with stakeholders
- Basic track:
 - Structure of DESERT and how to develop a DESERT module and an addon
 - Exercise: develop a DESERT module and an addon
- Advanced track:
 - Experiment setup and preparation
 - In field experiment
 - Data collection and results, data parsing

Day 5 –DESERT and external tools

- Only Common track:
 - DESERT with GUWAL and GUWMANET
 - DESERT with neural networks
 - Exercise of DESERT with neural networks
 - DESERT with the WOSS framework
 - Exercise of DESERT with WOSS

Social event – for registered users

- Lunch and coffee breaks
 - One coffee break in the morning, one in the afternoon
 - Other quick 5 minutes breaks will be done every hour
 - Lunch break from 12:30 to 2 p.m. at Pizzeria Al Porteo
- Guided tour of Palazzo Bo (University main and ancient campus) on Wednesday afternoon
 - We go on foot
- Social dinner will take place on Thursday at 19:30
 - We will organize transport from and to the DEI (this building)
 - Departure: 19:00 from the DEI

Material

Material

- Slides
 - <https://cloud.dei.unipd.it/index.php/s/pBEX8yFj5NsZArK>
- DESERT
 - https://github.com/signetlabdei/DESERT_Underwater
 - <https://desert-underwater.dei.unipd.it/>
 - https://signetlabdei.github.io/DESERT_Underwater_doc/html/index.html

Material – WOSS databases

WOSS databases

- <https://woss.dei.unipd.it/woss/files/WOSS-dbs-v1.6.0.tar.gz>

GEBCO

- https://www.bodc.ac.uk/data/open_download/gebco/gebco_2023/zip/

Contacts

If you have any requests, please, do not hesitate to contact us (to all of us, the quickest will answer)

- filippo.campagnaro@unipd.it
- roberto.francescon@wirelessandmore.it
- angela.solda@wirelessandmore.it