

# Underwater Multimodal Networks

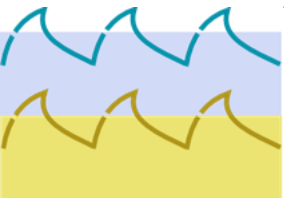
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**UNWiS - Padova (Italy)**

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# uwphysical and noise time variability

- Uses shipping factor (faraway ships) and wind speed (m/s) to compute the colored noise in the desired bandwidth
- Check test\_uwtdma.tcl as an example
  - MPropagation/Underwater set windspeed\_ 10
  - MPropagation/Underwater set shipping\_ 1
- These parameters can be changed upon tcl event, with ns at <time> <event>

ns at 1000 "\$phy(1) set windspeed 20"

# test\_uwtdma.tcl

```
# Stack of the nodes
# +-----+
# | 7. UW/CBR |
# +-----+
# | 6. UW/UDP |
# +-----+
# | 5. UW/STATICROUTING |
# +-----+
# | 4. UW/IP |
# +-----+
# | 3. UW/MLL |
# +-----+
# | 2. UW/TDMA |
# +-----+
# | 1. UW/PHYSICAL |
# +-----+
# |           |           |
# +-----+
# | UnderwaterChannel |
# +-----+
```



# test\_uwtdma.tcl

```
set opt(nn) 3 ;# Number of Nodes
set opt(starttime) 1
set opt(stoptime) 1001
set opt(txduration) [expr $opt(stoptime) - $opt(starttime)]
set opt(txpower) 160;#158.263 ;#Power transmitted in dBm
set opt(propagation_speed) 1500;# m/s

set opt(maxinterval_) 200
set opt(freq) 50000.0 ;#Frequency used in Hz
set opt(bw) 26000.0 ;#Bandwidth used in Hz
set opt(bitrate) 20768.0 ;#150000;#bitrate in bps
set opt(cbr_period) 10
set opt(pktsize) 1250
set opt(rngstream) 1
```

# test\_uwtdma.tcl

```
### TDMA MAC ###
Module/UW/TDMA set frame_duration 3.5
Module/UW/TDMA set debug_ -7
Module/UW/TDMA set sea_trial_ 1
Module/UW/TDMA set fair_mode 0
# FAIR Modality on
# Remeber to put silent the SetSlotDuration, SetGuar
# down below
# Module/UW/TDMA set guard_time 0.1
# Module/UW/TDMA set tot_slots 3

### Channel ###
MPropagation/Underwater set practicalSpreading_ 2
MPropagation/Underwater set debug_ 0
MPropagation/Underwater set windspeed_ 17
MPropagation/Underwater set shipping_ 1
```



# Windspeed realistic values

Beaufort Scale	Description	Wind speed (w)
0	Calm	$< 0.3 \text{ m/s}$ (2 km/h)
1	Light air	$0.3 \text{ m/s}$ (2 km/h) $\leq w < 1.6 \text{ m/s}$ (6 km/h)
2	Light breeze	$1.6 \text{ m/s}$ (6 km/h) $\leq w < 3.4$ (12 km/h)
3	Gentle breeze	$3.4$ (12 km/h) $\leq w < 5.5 \text{ m/s}$ (20 km/h)
4	Moderate breeze	$5.5 \text{ m/s}$ (20 km/h) $\leq w < 8 \text{ m/s}$ (29 km/h)
5	Fresh breeze	$8 \text{ m/s}$ (29 km/h) $\leq w < 10.8 \text{ m/s}$ (39 km/h)
6	Strong breeze	$10.8 \text{ m/s}$ (39 km/h) $\leq w < 13.9 \text{ m/s}$ (50 km/h)
7	High wind	$13.9 \text{ m/s}$ (50 km/h) $\leq w < 17.2 \text{ m/s}$ (62 km/h)
8	Gale	$17.2 \text{ m/s}$ (62 km/h) $\leq w < 20.8 \text{ m/s}$ (75 km/h)
9	Strong gale	$20.8 \text{ m/s}$ (75 km/h) $\leq w < 24.5 \text{ m/s}$ (89 km/h)
10	Storm	$24.5 \text{ m/s}$ (89 km/h) $\leq w < 28.5 \text{ m/s}$ (103 km/h)
11	Violent storm	$28.5 \text{ m/s}$ (103 km/h) $\leq w < 32.7 \text{ m/s}$ (118 km/h)
12	Hurricane	$\geq 32.7 \text{ m/s}$ (118 km/h)

# test\_uwtdma.tcl

```
#Setup positions
$position($id) setX_ [expr $id*20]
$position($id) setY_ [expr $id*20]
$position($id) setZ_ -100
```



# test\_uwtdma.tcl

- Change node position:
  - x and y from \$id\*20 to \$id\*200
- Change wind speed from 0 to 35
  - MPropagation/Underwater set windspeed\_ 10
  - You can decide if changing to windspeed\_ manually or adding a bash parameter
- Observe the network performance and compute the  $PDR = rx\_pkts / tx\_pkts$
- Plot PDR vs windspeed, with CI (5 reps per run)
  - set opt(bash\_parameters) 1