WiSHFUL Interfacing Via Extensions towards A REM

(WiSH-I-VE-A-REM)

Ss Cyril and Methodius University in Skopje, Faculty of Electrical Engineering and Information Technologies, WinGroup

Goals

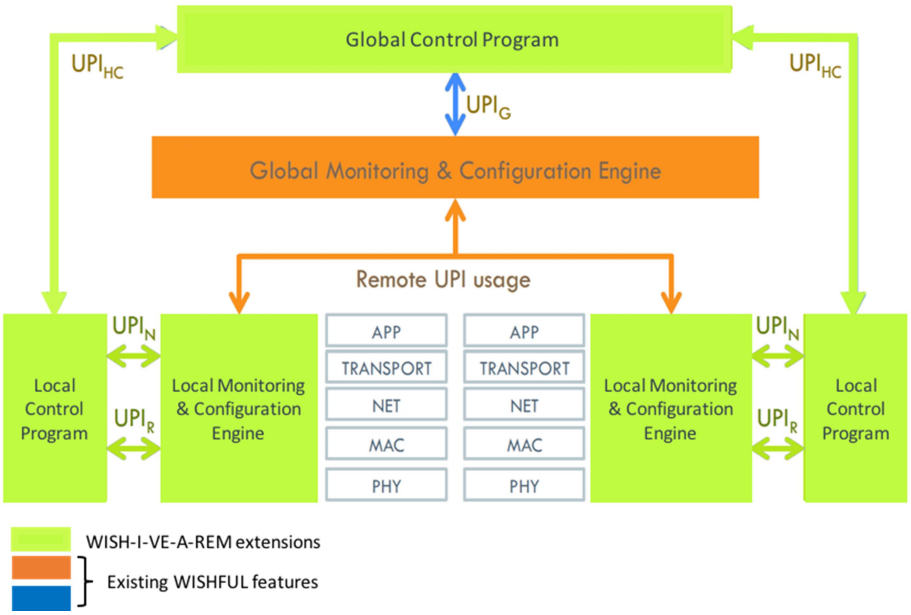
- The WiSH-I-VE-A-REM extension fosters integration of the REM platform functionalities within WiSHFUL, **providing extension of the WiSHFUL testbeds with REM-based WiFi capabilities**.
- The newly embedded capabilities will facilitate subsequent experimentation and validation in larger-scale environments and enable WiSHFUL contribution to the Radio Environmental Awareness value chain.

Main challenges

- Develop a modular REM architecture with easy accessible interfaces.
- Provide a testbed that is easily deployable and can facilitate re-runs of the experiments.
- Develop a software framework for automatic and on-the-fly (re)configuration of commercial WiFi devices

Architecture design

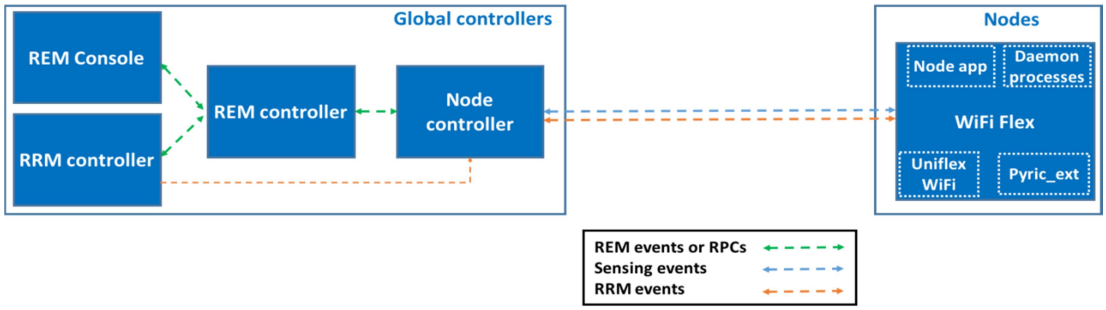
- The WISH-I-VE-A-REM extensions and contributions in the WISHFUL platform are highlighted with green color.



WISH-I-VE-A-REM extension arrangement in WISFUL architecture

Implementation details

- WISH-I-VE-A-REM provides four **new** global controllers, i.e. the *Node controller*, *REM controller*, *REM console* and *RRM controller*.
- WISH-I-VE-A-REM also **extends** the existing WISHFUL platform by adding additional functionalities to the communication interfaces, i.e. incorporates a novel interface module, *REM events*
- WISH-I-VE-A-REM **broadens** the existing sensing and communication capabilities of the platform's WiFi devices by **extending** the Uniflex-WiFi module, with the newly developed *WiFi flex module*



WISH-I-VE-A-REM logical topology and developed/extended modules

Main results

- Validation performed with the REM console and RRM controller
  - Both applications developed for validation purposes
  - The RRM controller also fosters know-how on interconnecting to the extension *(Valuable for future users of the experiment)*
- **REM console validation example:** Localizing an active transmitter of interest
- **RRM controller validation example:** WiFi AP and station reconfiguration due to degraded quality of communication link

```
Please choose from the selection:
1. WiFi device localization
2. Duty cycle calculation
3. Path loss model estimation
0. Quit
 >>  1
Loc:Enter the channel of interest
 >>  1
Select the index of the device of interest
1. 00:00:00:00:00:00
2. a0:cf:5b:0e:fe:90
3. a0:cf:5b:0e:fe:91
 >>  2
a0:cf:5b:0e:fe:90
The location of devices a0:cf:5b:0e:fe:90 is:
x:16.64 y:15.0 z:10.79 Pt:17.385949913553778 dBm
```

REM console validation example: Device localization

```
2017-08-26 16:20:57,590 - RRMController.periodic_evaluation() - INFO - Degraded APs:
[('48:5d:60:77:86:72', 7.49382666179112)]
[ 4 10  8  6  2  3  9  7  5  1 11]
[[17.489999999999998, 0.80000000000000004, 6.9877661069234209]]
[[17.489999999999998, 0.80000000000000004, 5.6643270083836148]]
[[17.489999999999998, 0.80000000000000004, 6.5265487035115557]]
[[17.489999999999998, 0.80000000000000004, 6.6273217995961504]]
[[17.489999999999998, 0.80000000000000004, 9.0807472864786778]]
[[17.489999999999998, 0.80000000000000004, 9.7373781204223633]]
[[17.489999999999998, 0.80000000000000004, 5.753941535949707]]
[[17.489999999999998, 0.80000000000000004, 7.0291497707366943]]
[[17.489999999999998, 0.80000000000000004, 6.3619363307952881]]
[[17.489999999999998, 0.80000000000000004, 8.8758958180745449]]
[[17.489999999999998, 0.80000000000000004, 5.4343402385711671]]
2017-08-26 15:21:08,061 - RRMController.reconfigure_ap() - INFO - Configuration: ap_mac
= 48:5d:60:77:86:72, ssid = SMARTAP, channel = 11, power = 16.0, hw mode = g
```

RRM controller validation example: WiFI AP reconfiguration

Conclusions

- The WiSH-I-VE-A-REM extension enables Radio Environmental Map (REM) and REM-based WiFi Resource Management capabilities within the WiSHFUL platform.
- It extends the WiSHFUL framework to accommodate the REM information flow
- Facilitates easy deployable and scalable experimentation platform for any WiFi-based RRM functionalities that use the REM data

Feedback

- WiSHFUL provides a playground for fostering and experimenting with new ideas in the area of wireless networks. It is easy to use and deploy experiments on the platform.
- Thanks to the software tools and hardware provided to me by WiSHFUL I was able to **develop the envisioned extension swiftly and with relative ease.**