

Wireless Battle Mesh #2
@ HSB, Brussels (Hosted by okno.be)
October 17-18th, 2009

http://hackerspace.be/Wireless_Battle_Mesh_v2



Presentation of the event

Goal : Following up the First Wireless Battle Mesh at TMPLAB, Paris (aiming at comparing different wireless networks mesh protocols at /tmp/lab hackerspace with OLSR, BABEL and BATMAN protocols) this second edition was initiated by the HackerSpaceBrussels to test out different protocols in a urban environment. WBMv2 was meant to provide a platform for discussions / experiments / development with regards to improve mesh networking on all layers (firmware / routing protocols / drivers / wifi links). This event's special focus was automated mass flashing of the firmware and performance evaluation of multi-link setups.



2. Hardware equipments and configuration issues

Hardware environnement : Mainly based on two hardware tagets :

- **FONERA1** (based on Atheros SoC AR5312 – “Atheros Wi-Fi”)
- **WRT54G and GS** (based on Broadcom BCM3302 SoC with MIPS architecture)
- **ASUS WL-HDD2.5** (based on Broadcom 4710)
- 4 AAA batteries (rechargeable and non rechargeable) for on-batteries test of the performances of the nodes

Software environnement :

- BoardSupportPackage : OpenWRT Kamikaze (trunk-r18050)
- IPK packages for each protocols :
 - OLSR : `olsrd-ninux_0.5.6-r6-1_mips.ipk`
 - BABEL : `babel_0.94-1zoo_mips.ipk`
 - BATMAN : `kmod-batman-adv-kernelland_2.6.30.8+r1439-1_atheros.ipk`

Factory Machine

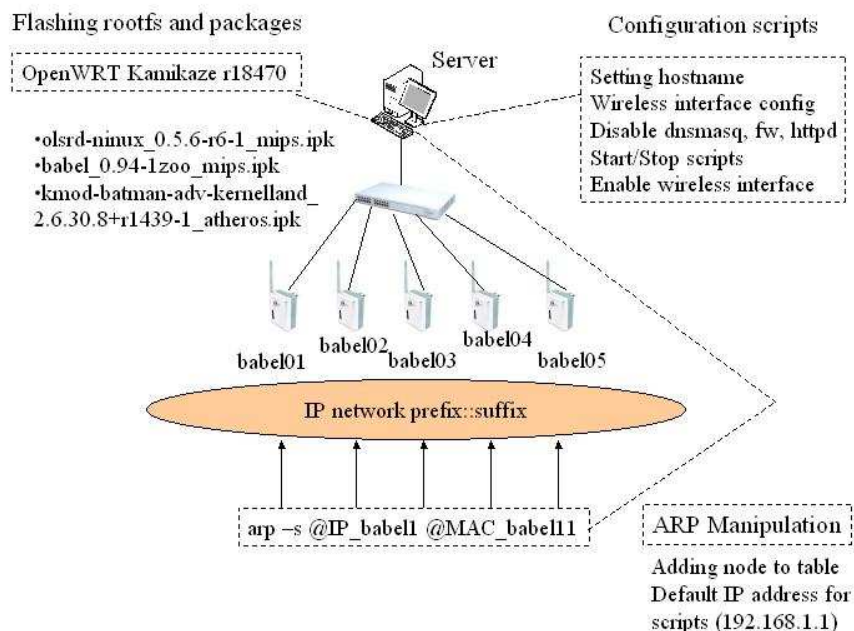




Photo above : Table with the hardware nodes freshly flashed (Kamikaze r18470 with minimal packages) and connected to the switch and the configuration server.



Photo above : Flashed BABEL nodes for mesh networking tests before deployments

Timeline of the event (see <http://hackerspace.be/Wbm2009v2/Timeline>)

Friday Oct.16th : Flashing the 40+ nodes with OpenWRT Kamiwaze 8.09

Saturday Oct.17th :

- Configuration of the nodes with the 3 protocols
- Installation of the monitoring nodes
- Local mesh networks testing in-house

Sunday Oct. 18th

- Deployments of the nodes for the different scenarii
 - Test 0 : Bitrate fixing in Adhoc
 - Test 1 : Interference in the 2.4Ghzband
 - Test 2 : Dual channel in 2.4GHz
 - Test 3 : Dual channel in 2.4GHz and 5GHz

Tests scenarii and outcomes

One of the main issue in the wireless mesh networks are the channels overlapping (even from channel 1 and 14 in the b/g band) and the MAC/PHY behaviour dealt by each wireless chipsets drivers (mac80211, madwifi, ath5k, ath9k). Different had been done to test out the bitrate parameter influence on the mesh networks, the interferences between nodes (depending on the antennas distance also) and the dual channel configuration to relay the MAC layer without same-channel interference (due to the distance between nodes with same channel configuration).

- Test 0 : Bitrate fixing in Adhoc

The idea is to force the 802.11 bitrate at the “pure54” parameter to test out the association/dissociation distance between mesh nodes.

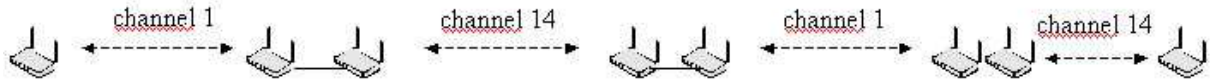
Results : The communication distance is rather decreased by forcing this parameter

- Test 1 : Interference in the 2.4GHz

The idea is to measure the interferences (channel overlapping between non-adjacent numbers) in the wireless environnement where each node are reaching each-other. For exemple, 10 nodes on channel 5 and others wireless nodes in the 1 and 14 channels in the same wireless covered space.

Results : The global througput is fairly affected and this test should be run with a spectrum analyzer to measure exactly the channel frequency occupation.

- Test 2 : Dual channel in the 2.4GHz



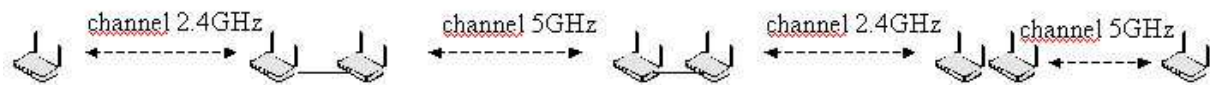
The figure above shows the configuration used to measure the interferences in dual-channel configuration. The radio link were set-up with different distances.
Results : For short distance, the interferences can be measured and should decrease the overall throughput





The photos above shows the famous “Club Mate” racks used to put the wireless node by group of two nodes (connected through a wired bridge) and deployed on the different bridges on the canal bank near the OKNO building in Brussels.

- Test 3 : Dual-channel (2.4GHz and 5GHz) interferences



Results : If the “same-channel” nodes are away enough for the PHY layer to sense other “same-channel” node, the routing gets improved and the throughput improved to get wireless link up to 50meters.

- Test 4 : Static routing

Some tests had been done by statically setting up the routes on each nodes of the wireless networks by using the configuration here :

<http://hackerspace.be/Wbm2009v2/config-StaticRouting>

The outcome was 1MB/sec stable end to end over 4 radio hops. The radio were forced in adhoc mode 54mbps but the foneral was only able of outputting 1.5MB/s in the 54M mode. Not equivalent tests were done with the WRT54g

Monitoring and captures of the tests

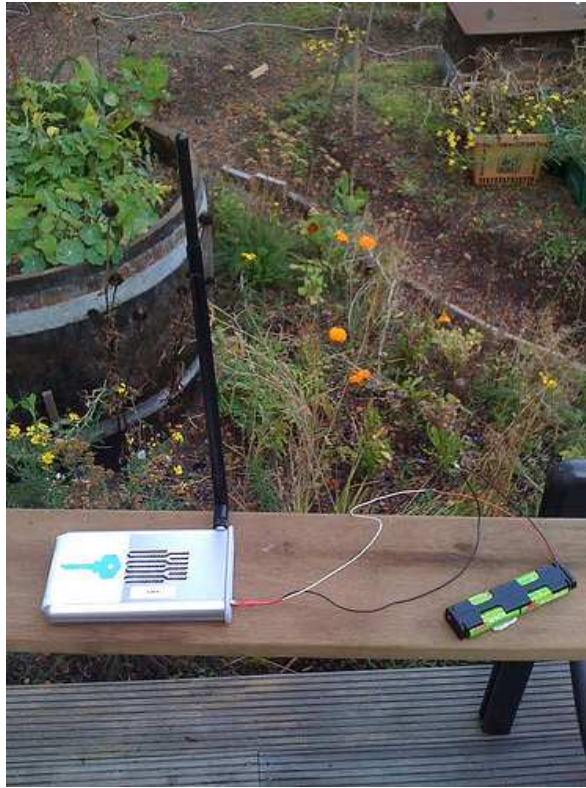


Photo above : Monitoring node with tcpdump traces on a monitor-ed wireless interface (powered with 4 AAAs lasting 3 hours with tcpdump process)

Conclusion

This second edition of the WirelessBattleMesh had been helping the wireless community to build up a testing environment for real-case test scenarios. This build-up process had been improved thanks to the help from Nico, core developer for the OpenWRT project and will lead to a simple flashing server with the automatic scripting back-end to flash a group of nodes faster. The outputs from the tests showed us a lack of tools to monitor the MAC/PHY layer (wprove is not verbose enough, madwidi nor ath9k give informations from the PHY layer, only *iwlist wlan0 peers* gives some informations from the 802.11 stack) to measure the influence of the radio link on the mesh protocols. Even some hardware equipment (such as airpcap cards or a spectrum analyzer) could be a great improvement for next editions. The WirelessBattleMesh is definitely a great occasion to meet the wireless community working on the protocols and namely the OLSR, BABEL and BATMAN developers and users for real-case scenarios.