Overview of Wireless Access Research Laboratory

Ronan Skehill

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University of Limerick

Outline

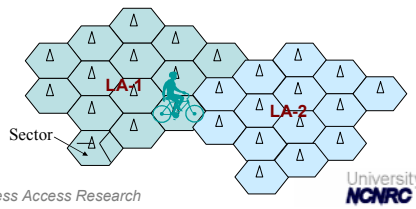
- Mobility Management
  - Architecture
  - Radio Resource Management
- Wireless Access Research Laboratory
  - ULMAN
  - Extend WLAN testbed
  - 3G
- Conclusion

Mobility Management

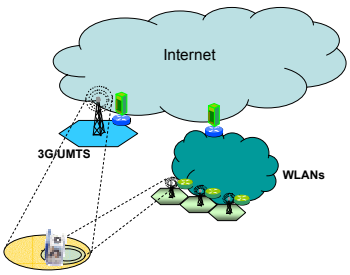
Radio Resource Management

Mobility Management

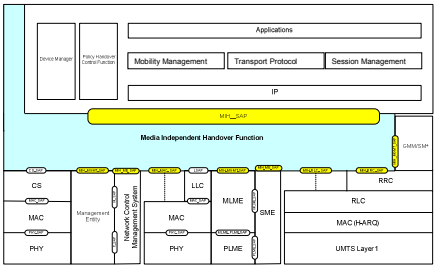
- In-session mobility management
  - Move during an active call
  - Hand-off management
- Out-of-session mobility management
  - Move in standby mode
  - Location management



Network Architecture

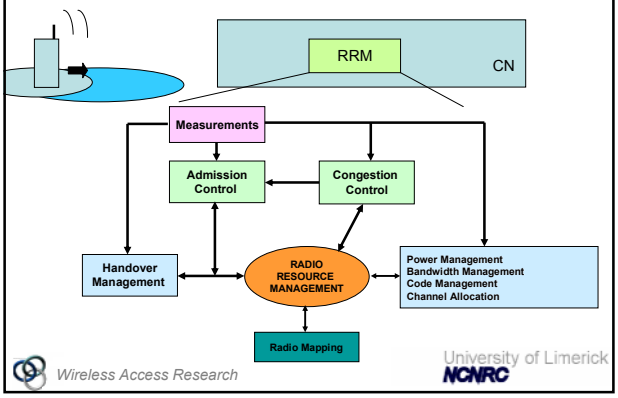


Node Architecture



802.16 802.11 UMTS

Radio Resource Management Framework

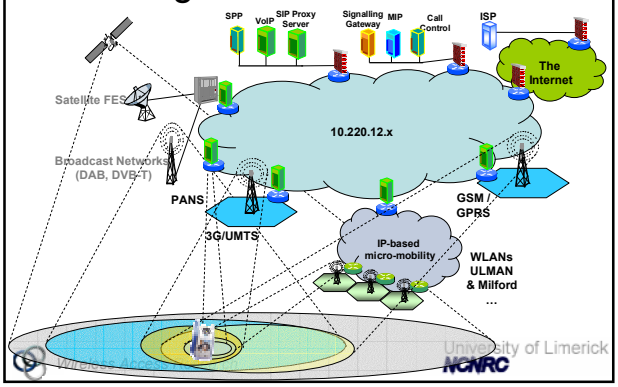


Summary

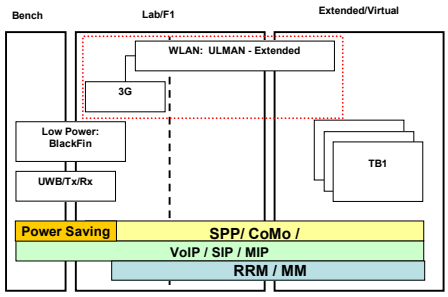
- Mobility Management and RRM are linked
- RRM Connection based functions.
  - **Handover Control (HC).**
    - Handles and makes the handover decisions.
    - Controls the active.
  - **Power Control (PC).**
    - Maintains radio link quality.
    - Minimizes and controls the power used in radio interface.
- RRM Network based functions.
  - **Admission control (AC).**
    - Handles all new incoming traffic. Check whether new connection can be admitted to the system and generates parameters for it.
    - Occurs when new connection is set up as well during handovers and bearer modification.
  - **Load control (LC).**
    - Manages situation when system load exceeds the threshold and some counter measures have to be taken to get system back to a feasible load.
  - **Packet scheduler (PS).**
    - Handles all non real time traffic, (packet data users). It decides when a packet transmission is initiated and the bit rate to be used.
  - **Resource Manager (RM).**
    - Controller over logical resources.

UoL Testbed

Logical Testbed View



Testbed

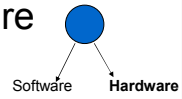


ULMAN

Description

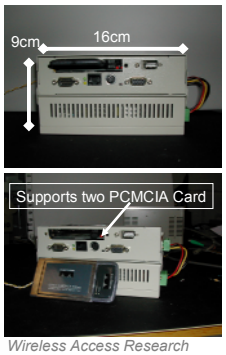
- Hardware/Software Test & Evaluation platform
  - Wireless Technology
  - Routing Protocols
  - TCP Congestion
  - VoIP
  - Etc
- Scalable
- Controlled

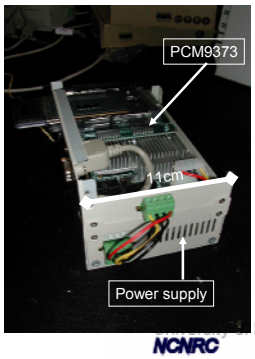
ULMT Architecture



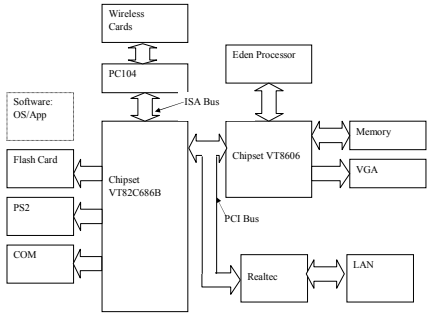
- Hardware
  - SBC PCM 9373
  - Via Eden chip 667Mhz
  - 128Mb RAM
  - 512 Flash Card
  - PC104 Adapter
  - Various wireless cards

ULMAN Node

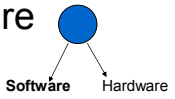




PCM 9373 Board Schematic

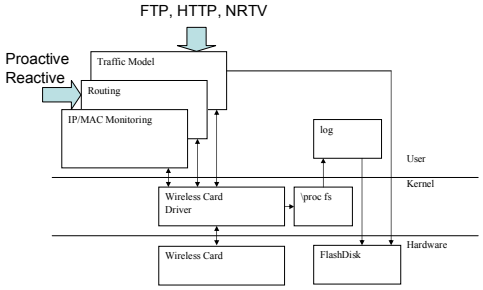


ULMT Architecture

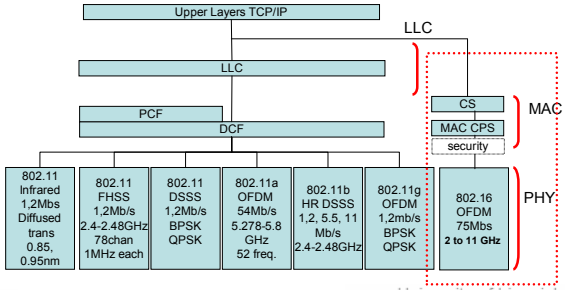


- Software
  - Linux kernel 2.4.26
  - Wireless driver (wlan_cs, airo_cs etc)
  - Traffic Generators (Voice, Video, Data)
    - netperf
  - Routing Protocols (Currently Integrated)
    - AODV
    - OSLR
    - DSR
    - Lunar
  - Traffic Monitoring
    - CoMo
    - Iptraf
    - Tethereal

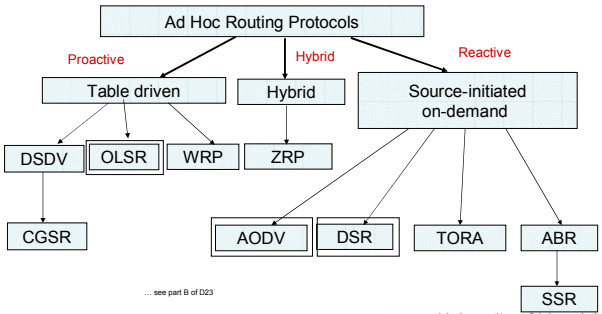
Software Interaction



ULMAN Protocol Stack

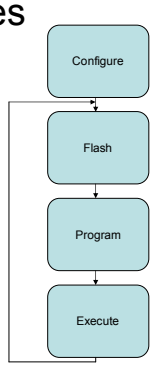


AdHoc Routing Protocols

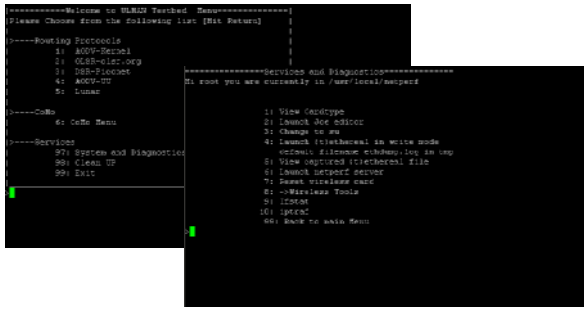


Cloning Nodes

- BIOS Setup
- Upgrade using USB Key
  - Flash image
- Blank Node
  - HOSTNAME
  - IP Address
- Scripts
  - ulman_launch
  - …

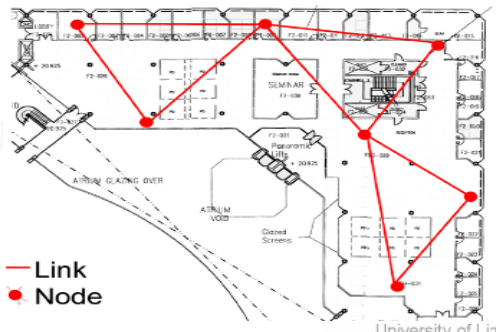


Screenshot

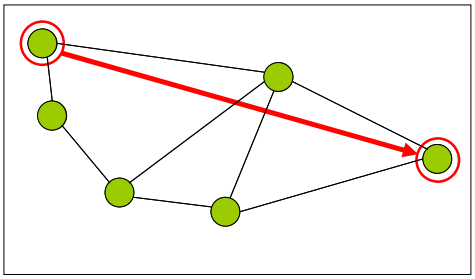


Demo

Deployed Nodes



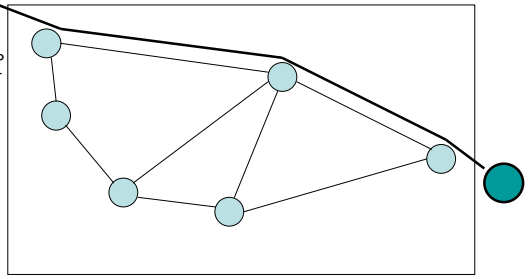
ULMAN Controller



Controller
GUI

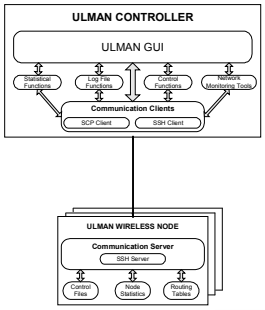
ULMAN Controller II

Traffic:
ITG VoIP
VIC/RAT
etc. etc.

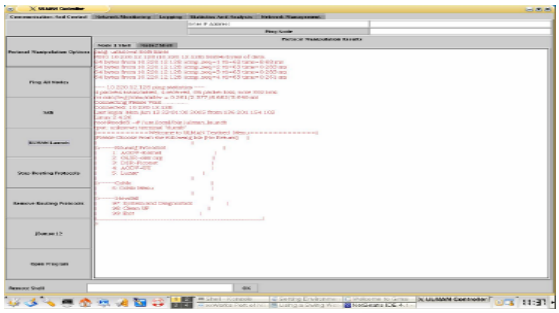


Controller
GUI

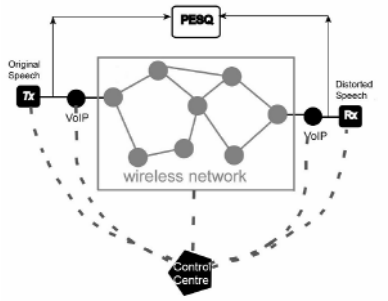
PROCESS INTERACTION BLOCK DIAGRAM



GUI Screenshot



Example



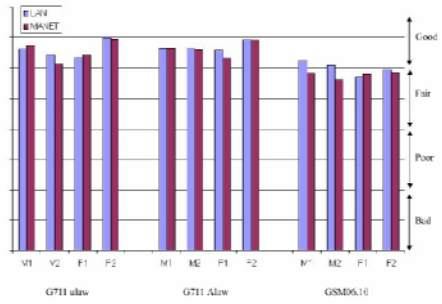
Ronan J. Skehill, Dorel Picovici, and William Kent
"Wireless MANET Testbed for Reproducible Voice over IP Evaluation"
MeshNets, Budapest, July 2005.

Configuration

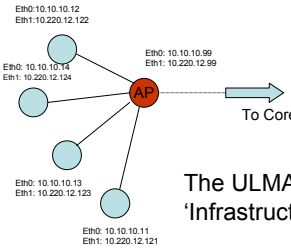
- Real Voice
  - Female
  - Male
- Nortel Network Voice Database
- Evaluated using the PESQ method
- Various Configurations used

Case	Hops	Test	Technology	Power	Topology	Routing Protocol
1	2	G.711$_\mu$ /A Law,GSM06.10	802.11a/b/g	30-100mW	Mesh,P2P	AODV,OLSR,DSR
2	3	G.711$_\mu$ /A Law,GSM06.10	802.11a/b/g	30-100mW	Partial Mesh	AODV,OLSR,DSR
3	4	G.711$_\mu$ /A Law,GSM06.10	802.11a/b/g	30-100mW	Partial Mesh	AODV,OLSR,DSR

Results



Infrastructure Mode

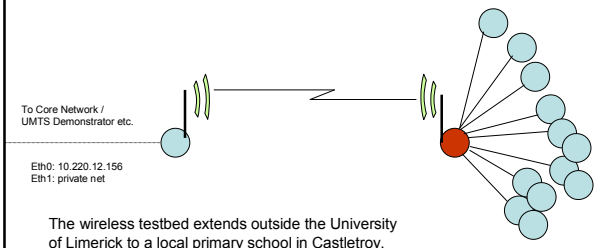


The ULMAN nodes can be used in 'Infrastructure' mode also.

Extended Testbed

Milford, Castletroy

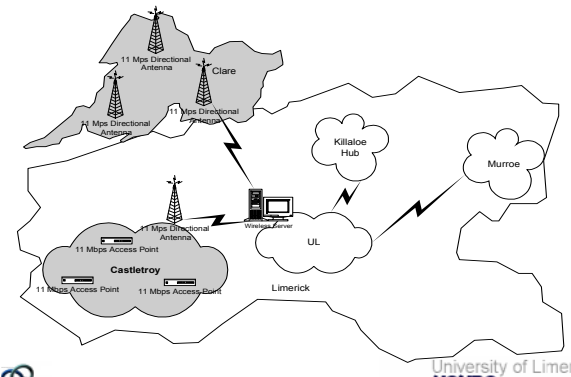
Milford School



The wireless testbed extends outside the University of Limerick to a local primary school in Castletroy.
- Point-to-Point Bridge
- 12 wireless clients

Milford Photo

ULMAN External Testbed

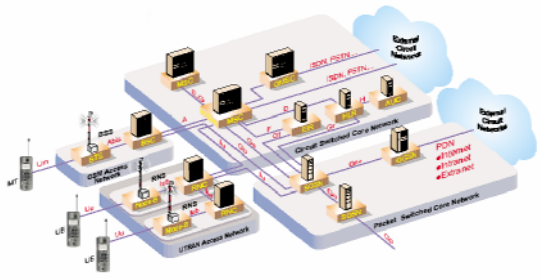


Summary

- Open Dedicated Hardware/Software testbed.
- Currently ULMAN WLAN can be used to evaluate:
  - Wireless technologies
  - Routing protocols
  - etc
- Future of ULMAN
  - Mobility Management
  - QoS
  - Radio Resource Management
  - etc.

3G/UMTS Demonstrator

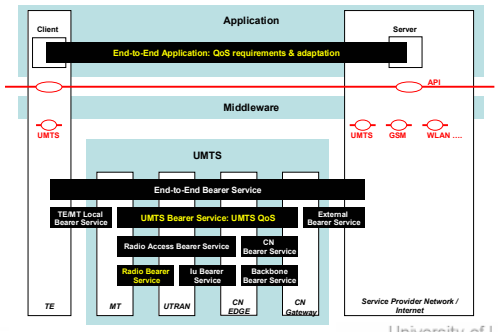
UMTS Block Architecture



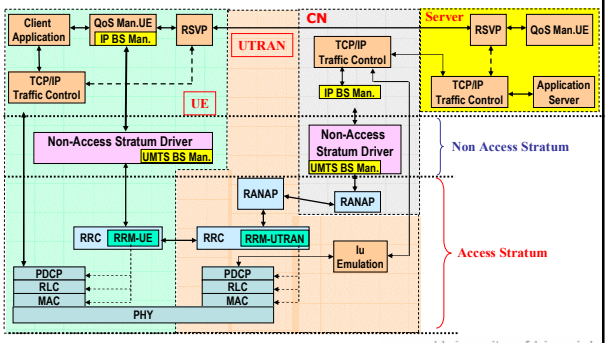
QoS in UMTS

Traffic Class	Conversational Class	Streaming Class	Interactive Class	Background Class
Fundamental Characteristic	Preserve time relation (variation) between information entities of the stream Conversational pattern (stringent and low delay)	Preserve time relation (variation) between information entities of the stream	Request response pattern Preserve data integrity	Destination is not expecting the data within a certain time Preserve data integrity
Example of the Application	Voice, videotelephony, video games	Streaming multimedia	Web browsing, network games	Background download of emails

QoS Framework



3G - LAB



Testbed Characteristics (1)

Flexible HW/SW tool that allows:

- To test innovative RRM algorithms in an easy way
- To provide QoS for standard non-aware QoS applications (i.e without modifying the application itself)
- To evaluate the performances of the associated signalling mechanisms
- To assume different scenarios (i.e layouts, propagation characteristics, traffic load conditions, service configurations, etc..) in an easy way.

Testbed Characteristics (2)

Testbed configuration including:

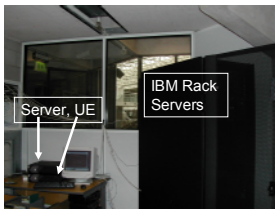
- Both rural and urban macro-cell scenarios. (In each scenario 14 tri-sectored sites are assumed).
- Up to 5000 simultaneous users can be allocated in the layout, and all of them are emulated in detail from the radio protocols point of view.
- The user under test can use any of the following applications: **Conversational** services (VIC and RAT for videoconference); **Streaming** (Mpeg4ip package); **Interactive** (Mozilla, Apache Web server) and **Background** (Mozilla/Qmail)
- For each application different PDP context with the corresponding QoS profile can be configured.

Testbed Characteristics (3)

Integrated Testbed Managers and Tools

- Communications Manager allows transparent inter-module communication, session logging etc.
- 3G Graphical Management Tool allows centralised control of modules and off-line RRM algorithm validation

3G Demonstrator



Conclusion

- Open dedicated WLAN/3G laboratory
  - Interoperability
  - Emerging wireless systems
  - Network protocol
  - Network management strategies.
  - Radio Resource Management
  - QoS
  - etc