GENI WiMAX Meso-Scale Deployments and CR-GENI

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GENI WIMAX KIT AND MESO-SCALE DEPLOYMENT
GENI WiMAX Kit: Architecture

Outside Network

vBTS Substrate

ASN Substrate

Base Station (BTS)

Internal Network

Outside Trunk

VM Trunk

Instrumentation Network

Outside World

10.3.0.61

10.3.0.73

10.0.102.2

10.0.102.3

Cons-wm-02

Cons-wm-03

eth0

eth1

eth2
WiMax Kit: Base Station

- The BTS itself is a black box
- Slice isolation mechanism and control framework is outside of this box
WiMAX Base Station QoS

Supported Service Classes

<table>
<thead>
<tr>
<th>Service Class</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>rtPS</td>
<td>real-time polling service</td>
</tr>
<tr>
<td>ertPS</td>
<td>enhanced real-time polling service</td>
</tr>
<tr>
<td>nrtPS</td>
<td>non real-time polling service</td>
</tr>
<tr>
<td>UGS</td>
<td>unsolicited grant service</td>
</tr>
<tr>
<td>BE</td>
<td>best effort</td>
</tr>
</tbody>
</table>
Removed all default IP routing, simplified ASN controller*

Data path (CLICK/OPENFLOW) is purely based on MAC addresses (L2)

Shaping mechanism (CLICK) for slice isolation

*Work done at NEC
WiMax Kit: vBTS

- Redirect all traffic from VLANs to individual slices
- Similar redirection from slices to outbound VLAN interfaces
- Grid services for creation, destruction, maintenance of slices, adding clients, slice allocation control...
BTS Hardware (Profile A)

- Operational with an educational license
- Inherently IP based

Roof mounted antenna

Basestation (IDU) Unit

RF (ODU) Amplifier
Coverage Map (Tech. Center Base Station)
Rutgers WiMAX/OF Deployment
WiMAX Meso-scale Deployments
GENI COGNITIVE RADIO KIT (CRKIT)
Radio “Head”

Open Source Platform

- Range of COTS baseband FPGA platforms
  - Medium size (LX50)
  - Large size (SX95)
- Standard interfaces:
  - 1000 BaseT, (SFP)
  - USB
  - (8x PCIeExpress)
- 4 (2) configurable radio modules for phased or smart antenna applications:
  - SDR/F – 25 MHz, 100 M -2.4/5GHz
  - WDR – 25 MHz, 100MHz -7.5GHz
  - XDR – 500 MHz, 100MHz-7.5GHz
- Application framework with support for both RTL and Matlab (Simulink)
WDR RF Front-end (Curr: WDR v2.02)

- Full duplex operation.
- One to four independent radio modules on one (FPGA) processor.
- Each module allows two up to 40 MHz bands from 100 to 7500 MHz
  - 12 bit ADC sampling up to 80MSps on both I and Q rails.
  - NF = 6dB, optional external LNA for customized applications.
  - 70dB of RX gain control.
  - 14 bit DAC sampling upto 200MSps on both I and Q rails.
  - +20dBm TX output power with fast gain control.
  - 60 dB of TX gain control
- 1 usec RF frequency switching time
- Switched antenna diversity for both TX and RX channels
- Comprehensive reference clock selection or generation with internal, external or digitally derived sample clocks.
- Multiple infrastructure-class data pipes.
- Extensive built-in-test for monitoring system status and health (including loopback).

- 14 layer PCB with high-frequency 5.5 mil thick NELCO N4000-13 material
- 6000 part footprints with more than 4800 parts
Cognitive Radio Node Deployment

- Radio Head: baseband (i.e. DSP) processing
- Computing Node: MAC, higher layer, cognitive / coordination functions and applications
INSTEAD OF CONCLUSION
OpenFlow based software defined network

- vBTS
- ASN Substrate
- Base Station (BTS)
- CRKit Comp. Node
- CRKit Radio Head

Internal Network

Instrumentation Network

Instrumentation Network

OpenFlow based software defined network