FreeBSD in geographical wireless networks for internet access

May 16th 2008 - University of Ottawa, Canada

Massimiliano Stucchi
stucchi@briantel.com
• Welcome everybody
• What do we do @ BrianTel
• How we do it
• Technologies involved
• Where are we using FreeBSD?
• Where we are _not_ using FreeBSD
• Why?
• Conclusions and future work
• Full fledged ISP running in Milan
• Present in many facilities in Italy and Europe (also owns one in Switzerland)
• Run our own BGP4 network, have IPv4 and IPv6 peerings
• Offer ADSL, SHDSL, SDH connectivity services
• Main focus is Wi-Fi connectivity
• Colocation and IP transit as well
Why Wi-Fi?

- Italy has a broadband coverage of 36% of total area, be it xDSL or fiber
- Of this 80% are major cities and big suburbs
- Incumbent telco (Telecom Italia) does not have interest in spending money to expand coverage
- Other Telcos behave in the same way
- Wi-Fi license is cheap and easy to get

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Why Wi-Fi?

- Wi-Fi is a cheaper solution, no landline is required, so no fee to pay any other telco
- We can offer VoIP services over Wi-Fi (with some restrictions)
- (in many areas) better service
Service is delivered through repeaters and towers, installed on mountains, mounts, and private buildings.

Repeaters form a partial-mesh network.

This network is connected to different facilities where fiber is present, and where we buy capacity and/or transit.
• Every repeater and/or tower runs a (private) Autonomous System on its own
• They speak BGP to exchange routing information
• (Trying to move to OSPF, though)
• Think of the repeater as a bunch of systems altogether (PTP Links, users, various)
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Wi-Fi Infrastructure

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Every fiber exchange point has a profiler, enforcing QoS policies and shaping bandwidth for users.

These factors are controlled by a custom-built application (PHP, PostgreSQL), which also does billing.

We control every aspect of the job via this application (towers, users, IP classes, delegation and reverse delegation).

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<table>
<thead>
<tr>
<th>Location</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Address</th>
<th>Model</th>
<th>Chipset</th>
<th>Frequency</th>
<th>Channels</th>
<th>Power Level</th>
<th>Duration</th>
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<td>43.32.41.98 N</td>
<td>15.60.03.16 E</td>
<td>via Emilia 22 - San Benedetto di Sambro (BO)</td>
<td>Calvo</td>
<td>Intel</td>
<td>2.4 GHz</td>
<td>10 Mbps</td>
<td>-75 dBm</td>
<td>60 mins</td>
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<td>12.22.27 E</td>
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</tr>
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</table>

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• We install an antenna on user’s roof, or any point where there’s direct eye-sight towards our cells

• POE provides power for the equipment, so no need to run power cables, just ethernet

• Every user is assigned a /30 for PTP and a /29 for their use. Moreover, a DHCP with a private class is installed on every access board

• YES, we’re “wasting a lot of IPs”, but we’re adhering to what RIPE ncc asks us to do

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Massimiliano Stucchi - stucchi@briantel.com
Rilassati.
Il tuo business
è in un posto sicuro...

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Wi-fi Coverage

- Veneto (Venice, Treviso, Belluno, Vicenza, Verona)
- Friuli-Venezia-Giulia (Udine, Pordenone, Aviano)
- Lombardia (Milan, Bergamo, Pavia, Lodi)
- Tuscany (Florence, Arezzo)
- Umbria (Perugia)
- 5 hours by car east to west northern Italy
- 3.5 hours by car north to south in Tuscany

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Summing UP

- INFRASTRUCTURE
  - Repeaters
  - Profilers
  - Web Servers
  - Peering and routing
- USERS
  - Access devices
• Need:
  • Routing (IP, BGP, OSPF)
  • Radius auth for admins
  • good wireless support

• We use:
  • Mikrotik for access repeaters
  • If possible, FreeBSD for PTP links
Repeaters

Why Mikrotik?

- Registration list
- mac-telnet (useful for installations)
- scriptable interface
- radio name
- runs on cheap, small hardware

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### Why Mikrotik?

<table>
<thead>
<tr>
<th>#</th>
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<th>RADIO-NAME</th>
<th>MAC-ADDRESS</th>
<th>AP</th>
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</tr>
</tbody>
</table>
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Repeaters

Why Mikrotik?

[max@montello-diffusione] interface wireless registration-table> /tool mac-telnet 00:8B:6f:4F:A3:92
Login: admin
Password:
Trying 00:8B:6f:4F:A3:92...
Connected to 00:8B:6F:4F:A3:92

MikroTik RouterOS 2.9.34 (c) 1999-2006 http://www.mikrotik.com/

(251165 messages not shown)
jan/04/2000 17:33:33 system,error,critical login failure for user claudia from 70.42.226.11 via ssh
jan/04/2000 17:33:37 system,error,critical login failure for user contab from 70.42.226.11 via ssh
jan/04/2000 17:33:39 system,error,critical login failure for user diala from 70.42.226.11 via ssh
jan/04/2000 17:33:42 system,error,critical login failure for user douglas from 70.42.226.11 via ssh
jan/04/2000 17:33:45 system,error,critical login failure for user erian from 70.42.226.11 via ssh
jan/04/2000 17:33:48 system,error,critical login failure for user silvia from 70.42.226.11 via ssh
jan/04/2000 17:33:54 system,error,critical login failure for user fernando from 70.42.226.11 via ssh
jan/04/2000 17:33:57 system,error,critical login failure for user fernando from 70.42.226.11 via ssh
Terminal linux detected, using multiline input mode
[admin@wmauto] >
Receivers

Why _NOT_ Mikrotik?

- It’s not opensource software
- We can’t tie it to what we want to do
- No IPv6 support
- Development is not following a straight line
Repeaters

Why FreeBSD?

• It’s opensource
• We like it!
• IPv6, all bits and pieces.
• Customizable

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Receivers

Why _NOT_ FreeBSD?

- Does not run on cheap embedded hardware (we’re really looking into a fully working MIPS port)
- No way to identify customers on a repeater
• Our control system generates QoS rules from the users database, creating config files for our profilers.

• They are downloaded by different boxes and used.

• These files are firewall configs, mainly:
  • pf + altq in northern Italy
  • ipfilter in Tuscany and Umbria (to be changed)

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Routing and peering

- We’re peering with different carriers and customers to whom we offer transit
- We also have various circuits (E3, SDH) running to different parts of Italy
- Two solutions:
  - Ethernet is done via FreeBSD with Quagga
  - E3, SDH via Cisco 7206 with PA-A3-E3 (only two per chassis...)

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Access devices

Why are we using Mikrotik?

- mac-telnet
- radio-name
- cheap hardware, POE
- easily scriptable for both setup, troubleshoot (on the phone) and any other use, Winbox (windows client, downloadable from any device via http)
- continuous association with available repeaters with same ssid

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Access devices

Why _NOT_ Mikrotik?

- license fees
- too easy to tamper with :-P
- no IPv6 support
- we don’t like it that much...
Access devices

Why FreeBSD?

• more customizable
• more secure
• IPv6 support
• we could also install full fledged proxies for home users, on more powerful hardware, though

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Access devices

Why _NOT_ FreeBSD ?

- no mac-telnet
- you need to know the assigned IP before mounting any device
- harder troubleshooting process (bad experiences)
What can then be done for FreeBSD?
• We’re working on implementing what’s missing

• It’s a slow work, we have to take care of our network (and are only 4 people)

• We’re looking into the MIPS port, so that cheaper hardware could be used
• FreeSBIE-based (obviously !)
• Working mainly on wireless, in order to integrate what’s needed
• Internal codename is AirBSD, but we’re still unsure if we’ll use it or not
• Going to be released when we actually have something working, under BSD License
• If you want to contribute, move on !

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Questions ?
Thanks for coming