

# CASPUR WI-FI OPEN SOURCE

GARR Conference 2011

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# SUMMARY

- CASPUR and Wi-Fi
- Free Italia Wi-Fi
- Open Source WISP project
- Further activities and work in progress





# CASPUR AND WI-FI



# CASPUR AND WI-FI

- CASPUR at a glance
  - Is an Inter-University computing consortium founded in 1992 and based in Rome
    - it includes eleven italian universities
  - Hosts a wide range of national and international carriers (all the major carriers operating in Italy)
  - Hosts the NaMeX Internet eXchange Point
    - one of the main IXPs in Italy
  - Has been collaborating with many italian Public Administrations since its foundation





# CASPUR AND WI-FI

- With its openWiFi project, CASPUR has build and has been maintaining some of the main Italian free Wi-Fi networks
  - Provinciawifi, **Province of Rome**
  - Surfinsardinia, **Sardinia Region**
  - Freewifigenova, **Genova municipality**
  - Pratownifi, **Province of Prato**
  - Maremmawifi, **Province of Grosseto**
  - ProvinciaGoriziaWiFi, **Gorizia municipality**





# CASPUR AND WI-FI

- Many other Public Administrations have been showing interest in the CASPUR openWiFi service
  - Friuli Venezia Giulia Region
  - Province of Siena
  - Province of Pistoia
  - Province of Bari
  - Napoli municipality
  - Umbria region
  - Torino municipality



# CASPUR AND WI-FI

- A few numbers for Provinciawifi
  - One of the most wide centralized free Wi-Fi network
  - > 800 access points
  - > 150.000 registered user
    - > 500 registrations per day
  - > 6.000 accesses per day





FREE ITALIA Wi-Fi



# FREE ITALIA WI-FI

- Free Italia Wi-Fi has been officially launched on 9 september 2011 in Venice by its promoting Public Administrations
  - Province of Rome
  - Sardinia Region
  - Venice municipality





# FREE ITALIA WI-FI

- Aims to create a national federation of free public Wi-Fi network
- Users sign-up only once and then they can use any network within the federation
- Federation rules also assure users will have
  - A minimal amount of *free* traffic / time for each federated network
  - A neutral network access (*e.g.* without filtering and shaping)



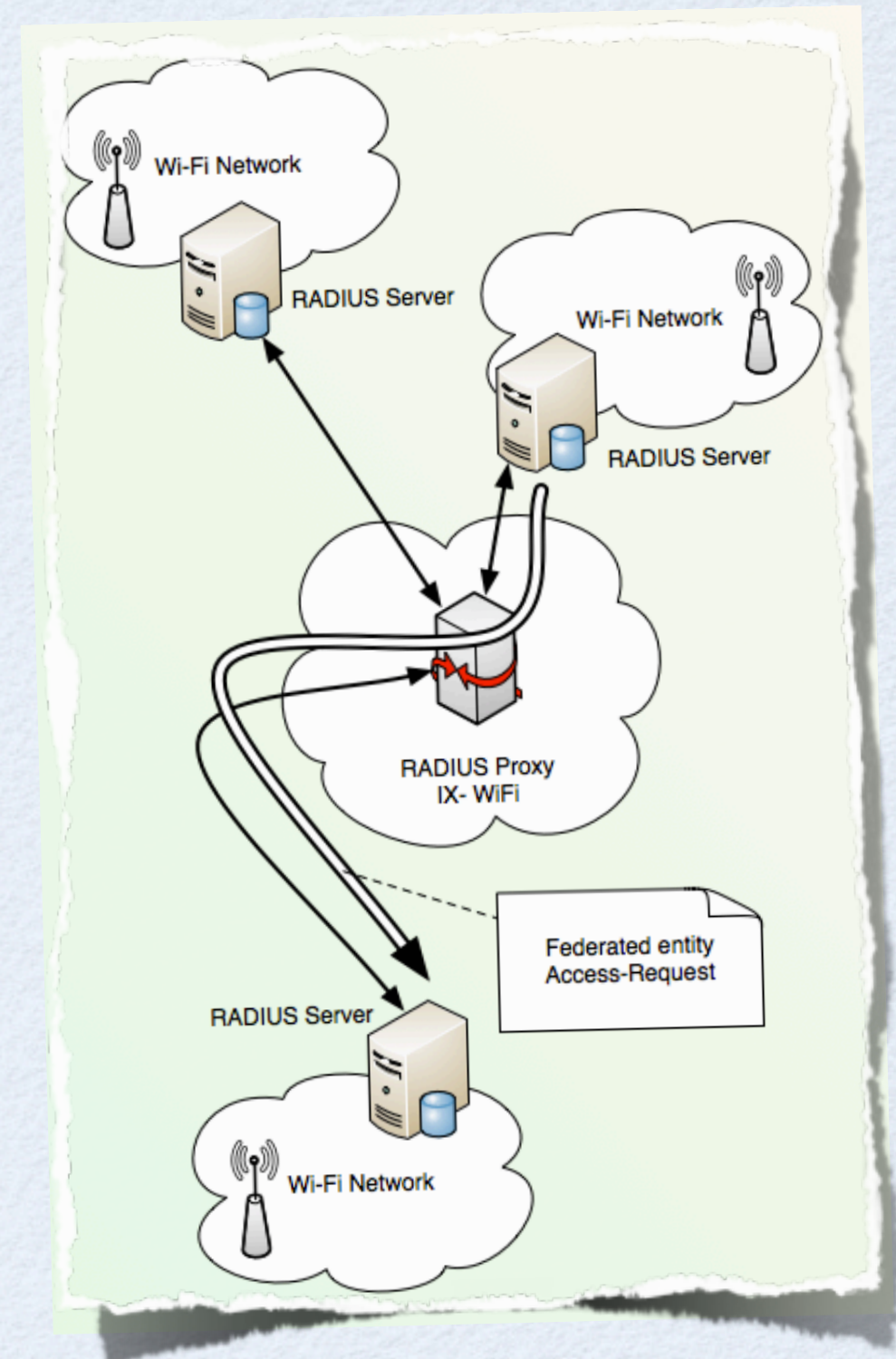
# FREE ITALIA WI-FI

- Besides its promoters, at the time of writing Free Italia Wi-Fi has the following members (in order of federation)
  - Province of **Potenza**
  - Province of **Pesaro and Urbino**
  - Province of **Cosenza**
  - **Bra** municipality
  - Province of **Pistoia**
  - Province of **Prato**
  - Province of **Trapani**
  - Province of **Gorizia**
  - Province of **Grosseto**
  - **Montevago** municipality
  - **Tortorici** municipality
  - **Torino** municipality



# FREE ITALIA WI-FI

- From a technical point of view, Free Italia WiFi is implemented by the IX-WiFi, that is:
  - A RADIUS hierarchy (i.e. proxies) and...
  - ...a bunch of dedicated (and secure) links between each federated entity and a central “dispatching” point.
- A pretty simple setup that can assure a very good robustness and a wide compatibility





# FREE ITALIA WI-FI

- CASPUR has a central role in Free Italia WiFi:
  - Is responsible for the technical regulations of the IX-WiFi;
  - Holds and runs the IX-WiFi in its data center.





**open source**

**WISP**  
MIZB

OPEN SOURCE WISP



# OPEN SOURCE WISP

- Since the beginning of 2010 CASPUR has been developing the *OpenWISP* project, that is
  - A software suite that can be used to run a Wireless Internet Service Provider (WISP)
  - An open source project. It can be downloaded and used free of charge

<http://openwisp.it/>

- Technological base on which CASPUR runs its OpenWiFi service (following the open-source software business model)

<http://openwifi.caspur.it/>



# OPEN SOURCE PROJECT

- OpenWISP includes the following software
  - OpenWISP User Management System (aka OWUMS)
  - OpenWISP Manager + OpenWISP Firmware (OWM and OWF)
  - OpenWISP Geographic Monitoring (OWGM)
  - OpenWISP Captive Portals Manager (OWCPM)
  - OpenWISP MiddleWare (OWMW)





# OPEN WISP USER MANAGEMENT SYSTEM



# OPEN WISP USER MANAGEMENT SYSTEM

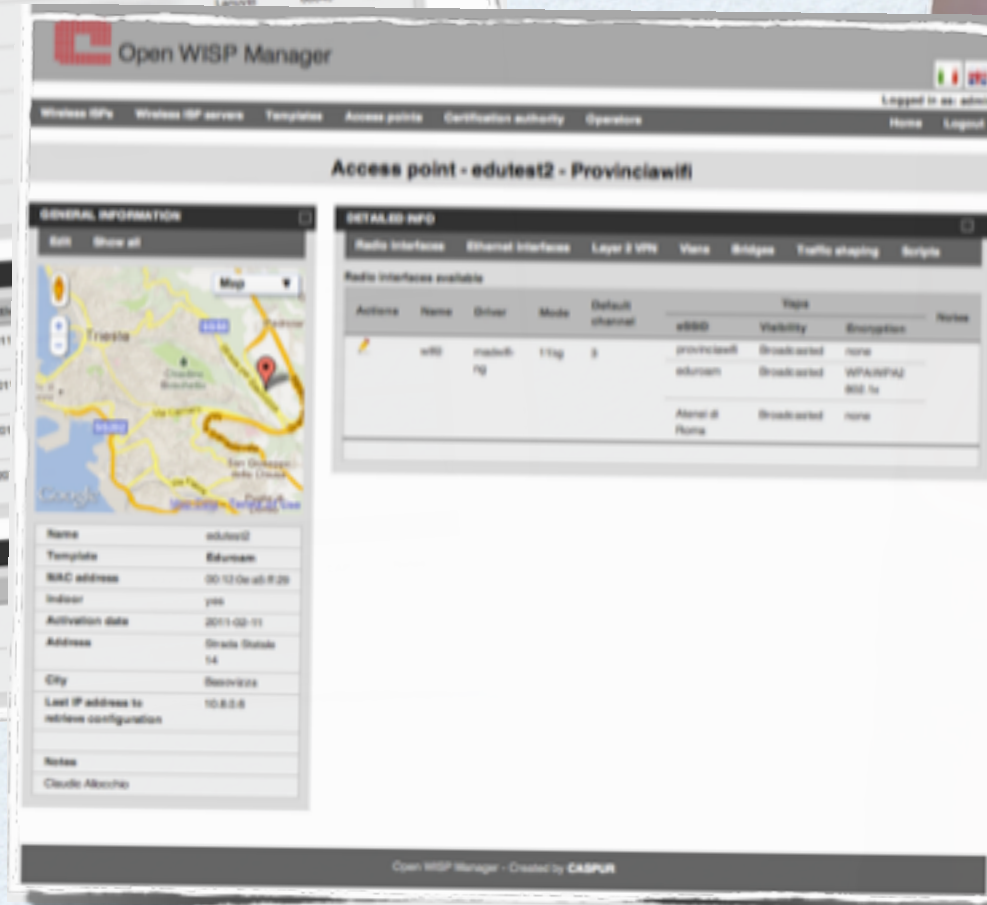
- From the users' perspective
  - Fast and easy sign-up to the Wi-Fi service
  - Account management and password recovery
  - Accesses and traffic stats history browsing
  - Gorgeous UI
    - Wonderful mobile version (iOS, Android, Symbian, etc...)
    - Fancy and animated (javascript) graphs for various statistics



# OPEN WISP USER MANAGEMENT SYSTEM

- From the perspective of a Wireless ISP
  - A powerful Ruby on Rails application that allows a reliable identification of users with one of the following methods
    - Mobile phone account
    - ID card digitalized copy acquisition (requires an operator)
    - Paypal / credit card
  - Easy yet powerful users base management
    - Everything an help-desk operator may need and much more...





# OPEN WISP MANAGER + FIRMWARE




# OPEN WISP MANAGER

- A Ruby on Rails web application for centralized management of several hundred access points
- Template-based access point modeling. Among others the following access point's components can be managed
  - 802.11a/bg/n Wi-Fi interfaces (Madwifi-ng and mac80211 driver support)
  - Ethernet interfaces
  - Bridges and 802.1Q VLAN
  - Layer 2 VPN
- Instantaneous configuration changes deploy



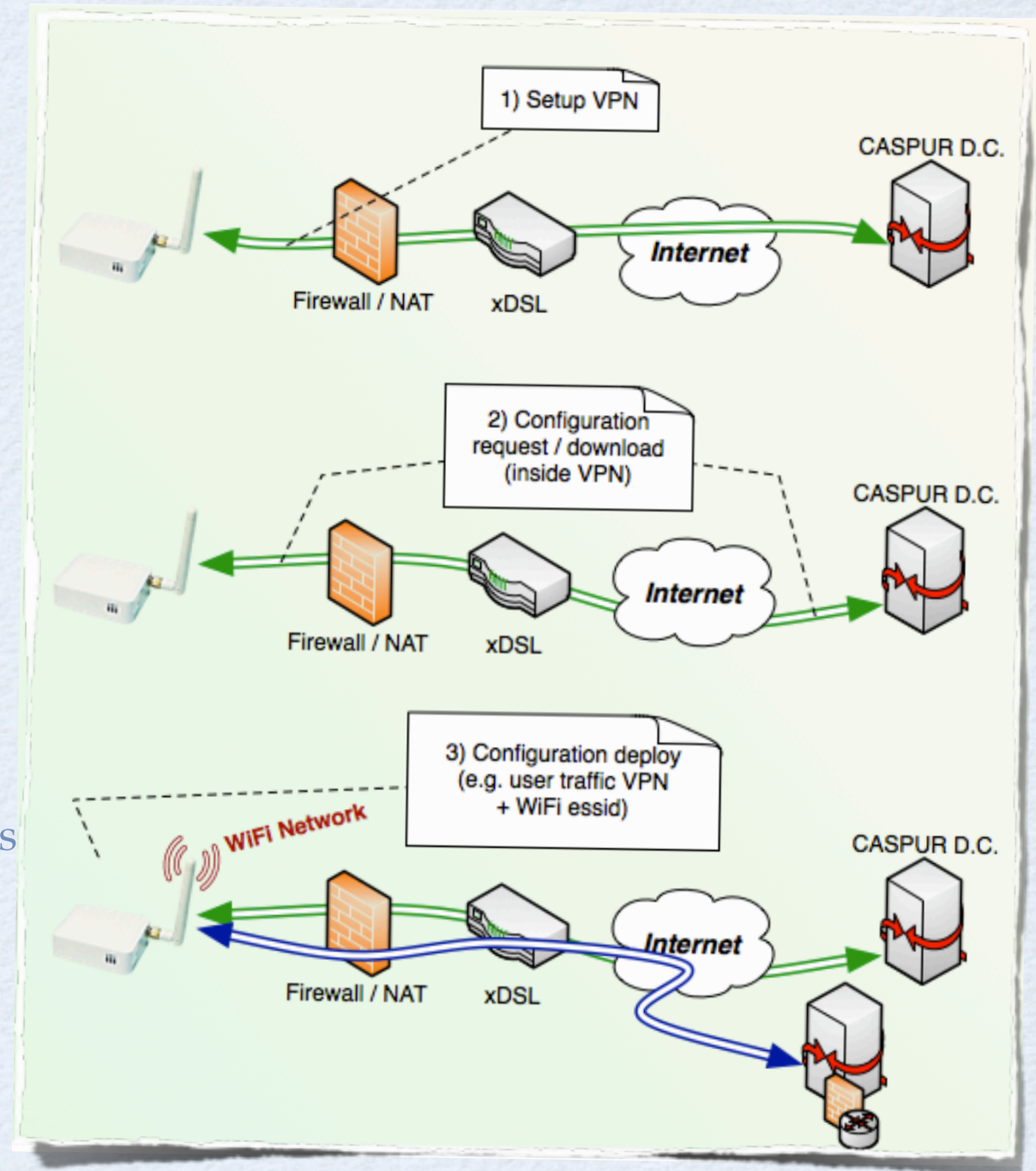
# OPEN WISP FIRMWARE

- Is a bunch of shell (ash) scripts that sit on top of *openWRT*
  - Support any device supported by openWRT with an Atheros WiFi Radio interface (*i.e. mac80211* or *Madwifi-ng* drivers)
- Permits a simple installation of devices with an easy-to-use web based UI
- Has native support for multiple connectivity backhaul with automatic failover 
  - OLSR mesh over a WPA WiFi ad-hoc network (*i.e. IBSS WPA-None*)
  - UMTS/HSDPA connectivity for a limited number of UMTS USB modem

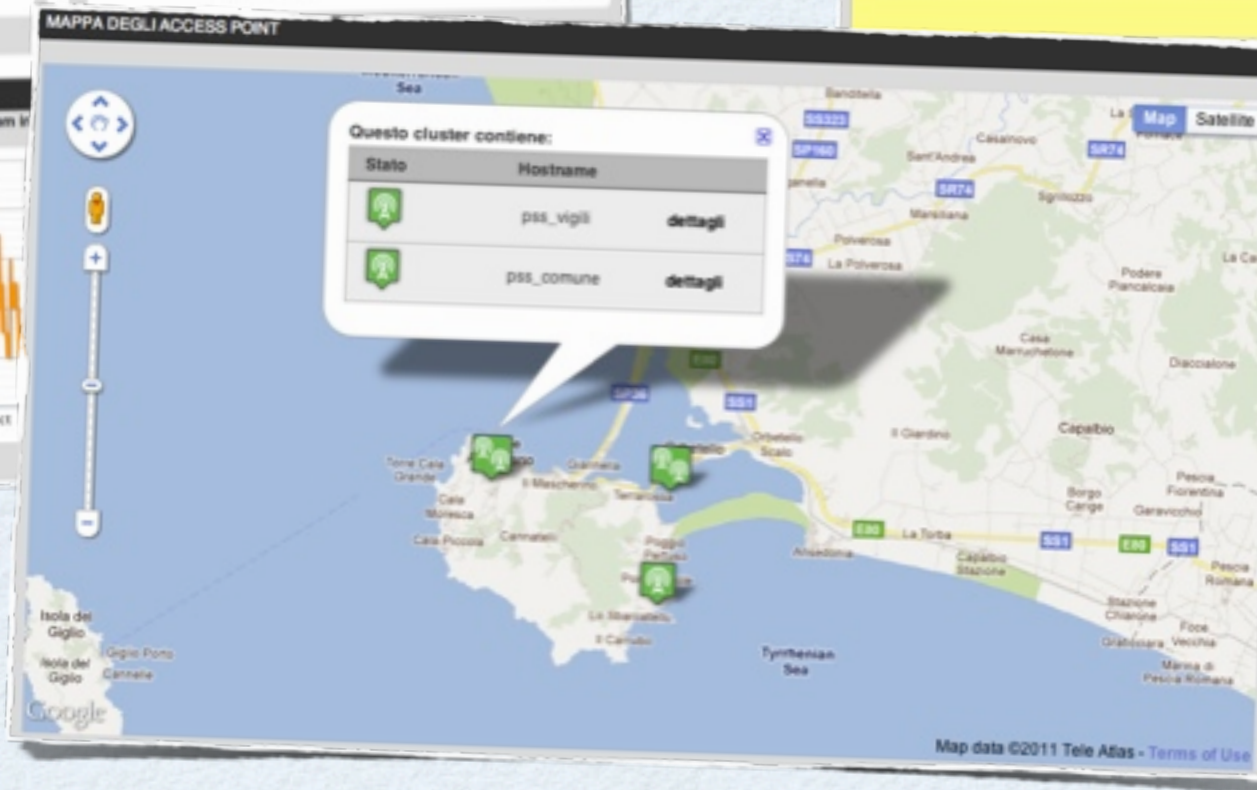
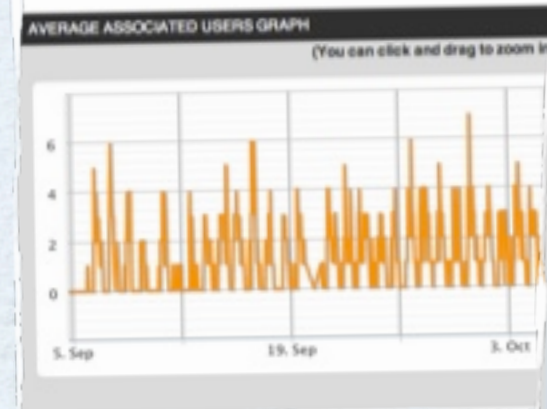
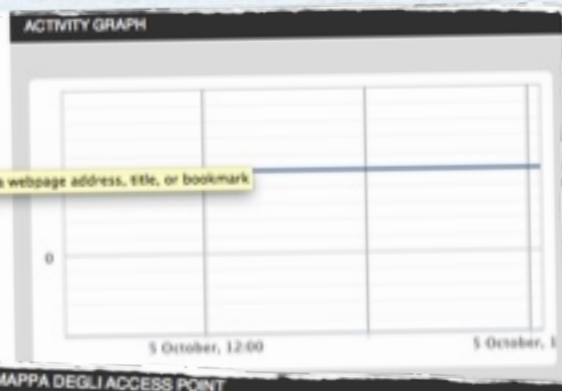


# OPEN WISP FIRMWARE

- The OpenWISP Firmware works **behind a firewall**, even if NAT is used
  1. At boot time every OWF access point creates a *setup VPN (openVPN)* with the OWM server
  2. OWF access point requests and downloads its configuration inside this *setup VPN*
  3. The new configuration is deployed. For instance another VPN is created for WiFi users traffic encapsulation
- The *setup VPN* remains up, so it is possible the monitoring and the administration of the access point (even if it's behind a firewall/NAT).
- 4. Periodically the access point asks the OWM server if its configuration is changed and, if so, restarts from the point number 2.







**Availability report for Maremmawifi**

Filter by date  
Dates are relative for each access point's data starting from the activation date, or the first date of the observation period, to the latest observation period's date.  
10/05/2010 - 10/05/2011 [Update](#)

Highlight access points with  
Down ☐ higher ☐ than

Name	Activation date	Address	City	Description	Up	Down
gr_einaudi	09/20/2011	Via della Repubblica	Grosseto		99.9%	0.1%
gr_velodromo	09/17/2011	Via della Repubblica	Grosseto	Velodromo Via Giotto Grosseto	99.9%	0.1%
Sempr_Biblio	08/11/2011	Via Dante Alighieri 1	Semproniano	Semproniano Biblioteca Comunale	0.0%	100.0%
4 novembre		Marina di Grosseto		Infopoint di Marina di Grosseto	97.3%	2.7%
piazza Marconi		Roccalbegna		Roccalbegna - Palazzo Comune 2 piano	60.0%	40.0%
Via marconi, 9		castel del piano		Palazzo Comunale Castel del Piano - Ufficio ragioneria	47.8%	52.2%
Piazza Indipendenza 1		Aridosso		Aridosso Palazzo Comune	99.2%	0.8%
Piazza Garibaldi		Santa Fiora		Santa Fiora Palazzo Comunale	9.0%	91.0%
via marconi 2		castell'azzara		Castell'Azzara Palazzo Comune	52.8%	47.2%
via TRENTO E TRIESTE 17		Seggiano		Seggiano Palazzo Comunale	51.4%	48.6%
piazza dei rioni		porto santo		Argentario PS	93.5%	6.5%

# OPEN WISP GEOGRAPHIC MONITORING



# OPEN WISP GEOGRAPHIC MONITORING

- WiFi network status with many different levels of detail
  - Access point status on google maps with street view (v3 API)
  - Detailed reports and statistics with browsable graphs
- Access points can be annotated to keep track of their history
- GeoRSS feed for public maps and for third party applications



LISTING ONLINE USERS

back

Actions	User Name	IP Address	MAC Address	Sent Bytes	Received Bytes	Sent Packets	Received Packets	Session start
X	32	172.30.87.39	00:17	585 KB	2.68 MB	3.15 Thousand	3.46 Thousand	06 Oct 11:57
X	33	172.30.50.232	10:b4	347 KB	482 KB	2.42	1.57 Thousand	06 Oct 11:36
X	33	172.30.26.190	00:02:1	112 KB				
X	33	172.30.91.83	4c:ed:3	247 KB				
X	33	172.30.18.189	90:27	47.8 K				
X	34	172.30.56.242	00:26	2.19 M				
X	34	172.30.66.0	7c:61	252 K				
X	34	172.30.48.15	00:12	766 K				
X	34	172.30.47.65	78:ca	4.86				
X	34	172.30.113.182	00:26:3	273				
X	34	172.30.79.16	b4:74	91.7				
X	34	172.30.25.128	00:24:3	342				

Open WISP Captive Portals Manager

Captive Portals
logout

logged in as admin

Local Users	Firewall Rules	Online Users
0	4	12

created by CASPUR

CASPUR

Benvenuto in FreeWi-Fi Genova

Consortio interuniversitario per le Applicazioni di Supercalcolo Per Università e Ricerca

Il portale di accesso gratuito ad Internet offerto dal Comune di Genova

Inserisci le tue credenziali per navigare!

Nome Utente:

Password:

Login

Hai dimenticato la password? [Recuperala!](#)

Se non sei registrato, puoi registrarti [qui](#)


Per gestire il tuo account, vai alla [pagina personale](#)

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# OPENWISP CAPTIVE PORTAL MANAGER



# OPENWISP CAPTIVE PORTAL MANAGER

- Written from scratch with Ruby on Rails
  - multiple captive portal support: one per physical / virtual interface
  - RADIUS / Local authentication
  - per-user traffic shaping  *Beta*
  - multiple OS support
    - IPv4 / GNU-Linux (iptables / tc) already implemented
    - other OS support can be implemented within the proper subclass
  - IPv6 support can be easily implemented

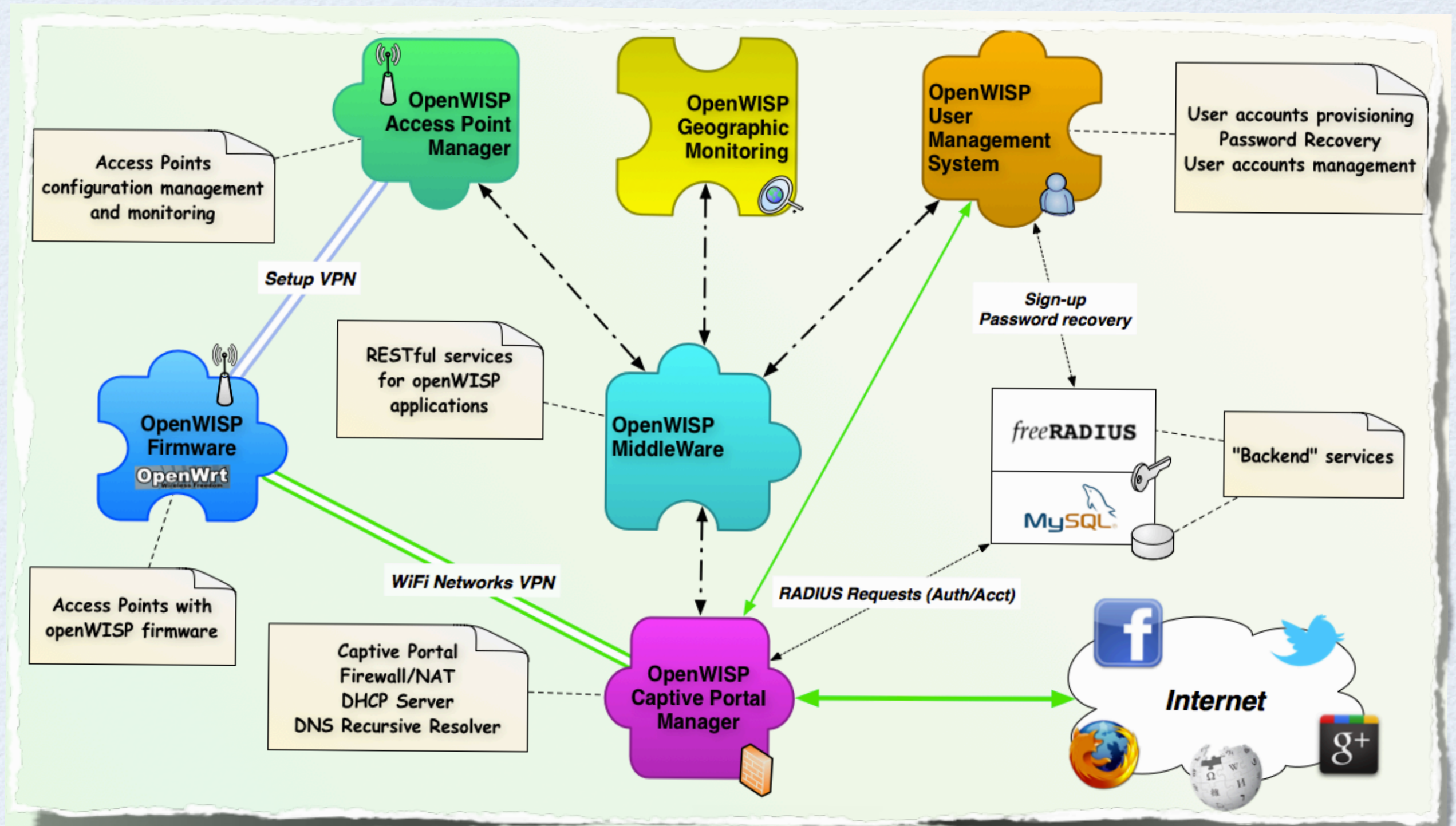


# OPENWISP MIDDLEWARE

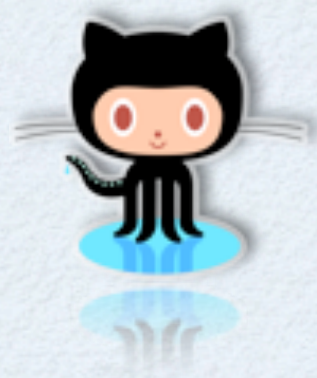
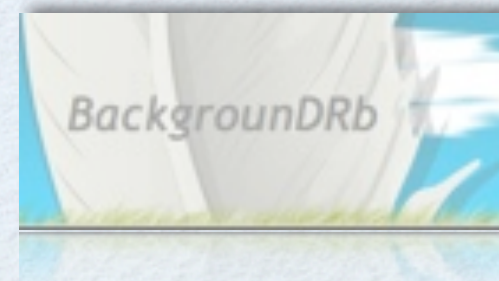
- A Ruby / Sinatra application that implements a RESTful web service
- Provides user-localization-related informations
- Used for OpenWISP applications integration
- Permits integration of 3rd party applications with an OpenWISP WiFi infrastructure



# HOW DO OPENWISP APPLICATIONS INTERACT?







# FURTHER ACTIVITIES AND WORK IN PROGRESS



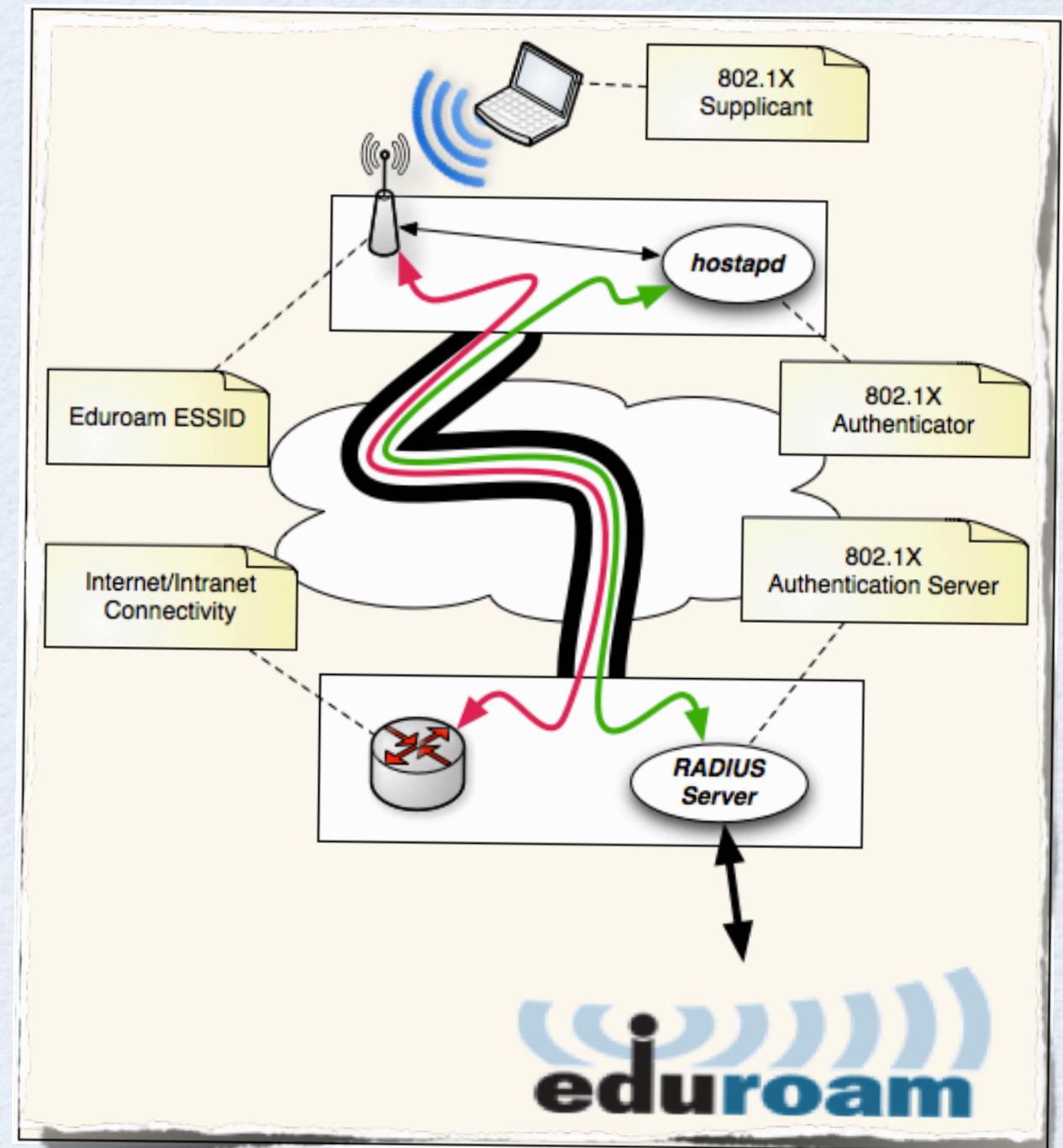
# FURTHER ACTIVITIES AND WORK IN PROGRESS

- **EDUROAM** experimentation in collaboration with GARR
- EDUROAM (*EDU*cation *ROAM*ing) is the secure, world-wide roaming access service developed for the international research and education community.
- Uses the state-of-the-art technology for network Security
  - WPA / WPA2 Enterprise (*i.e.* 802.1x) with EAP-TTLS



# FURTHER ACTIVITIES AND WORK IN PROGRESS

- Our setup for EDUROAM
  - We use two 802.1Q VLAN incapsulated into a single (layer 2) openVPN tunnel
    - One VLAN for auth'ed user traffic
    - One VLAN for RADIUS traffic (*i.e.* between authenticator and authentication server)
  - The authentication server (hosted by GARR) uses the EDUROAM proxy server hierarchy for end-user credential verification





# FURTHER ACTIVITIES AND WORK IN PROGRESS

- During the experimentation we had the opportunity to fix a couple of bugs in the openWISP firmware
  - We would like to thank Claudio Allocchio for his help in fixing a memory leak
- A small set of Provinciawifi's hotspots are now in production with this fixed firmware and they are broadcasting EDUROAM eSSID
- We're waiting for the opportunity to spread EDUROAM along with a Public Administration WiFi networks
  - We're technically ready, but...
  - ...high level agreements are WiP and so the resources :)



# FURTHER ACTIVITIES AND WORK IN PROGRESS

- We also contributed (and we are still contributing), in various ways, to some open source projects
  - during the implementation of our software we had developed, tested and than we released some patches and wrote some documentation
    - OpenVPN
    - BackgroundDRB (a Ruby / Rails job server and scheduler)
    - Rails 3 Italian i18n
    - RADIUSStar (a RADIUS Ruby gem)
    - Libarchive-ruby (a Ruby gem for various archive formats support)
    - OpenWRT wiki pages and scripts for some routers re-flashing procedure





## *Links and further informations*

<http://openwisp.it/>

<http://www.freeitaliawifi.it/>

<http://openwifi.caspur.it/>

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<mailto:wifi@caspur.it>

# CASPUR WI-FI OPEN SOURCE

## Q&A

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