CASPUR Wi-Fi Open Source

GARR Conference 2011

Authors: A.Ferraresi, M.Goretti, D.Guerri, M.Latini (CASPUR)
Speaker: Davide Guerri (CASPUR)

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 **I**nternet e**X**change **P**oint
    - 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
  - Pratowifi, 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

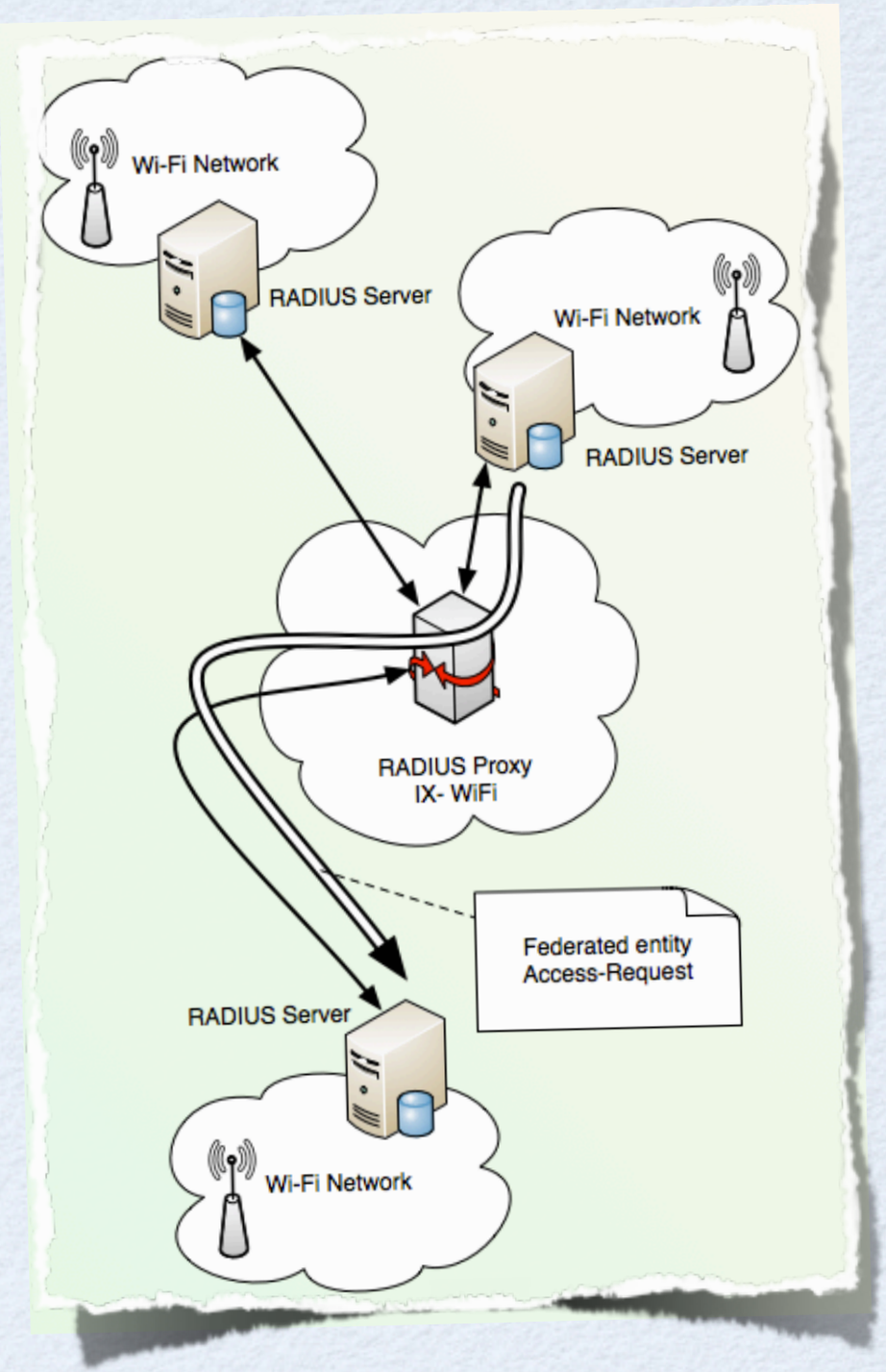
- Aims to create a national federation of free public Wi-Fi network
  - Users sign-up only once and then they can use any network within the federation
  - Federation rules also assure users will have
    - A minimal amount of *free* traffic/time for each federated network
    - A neutral network access (*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

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)

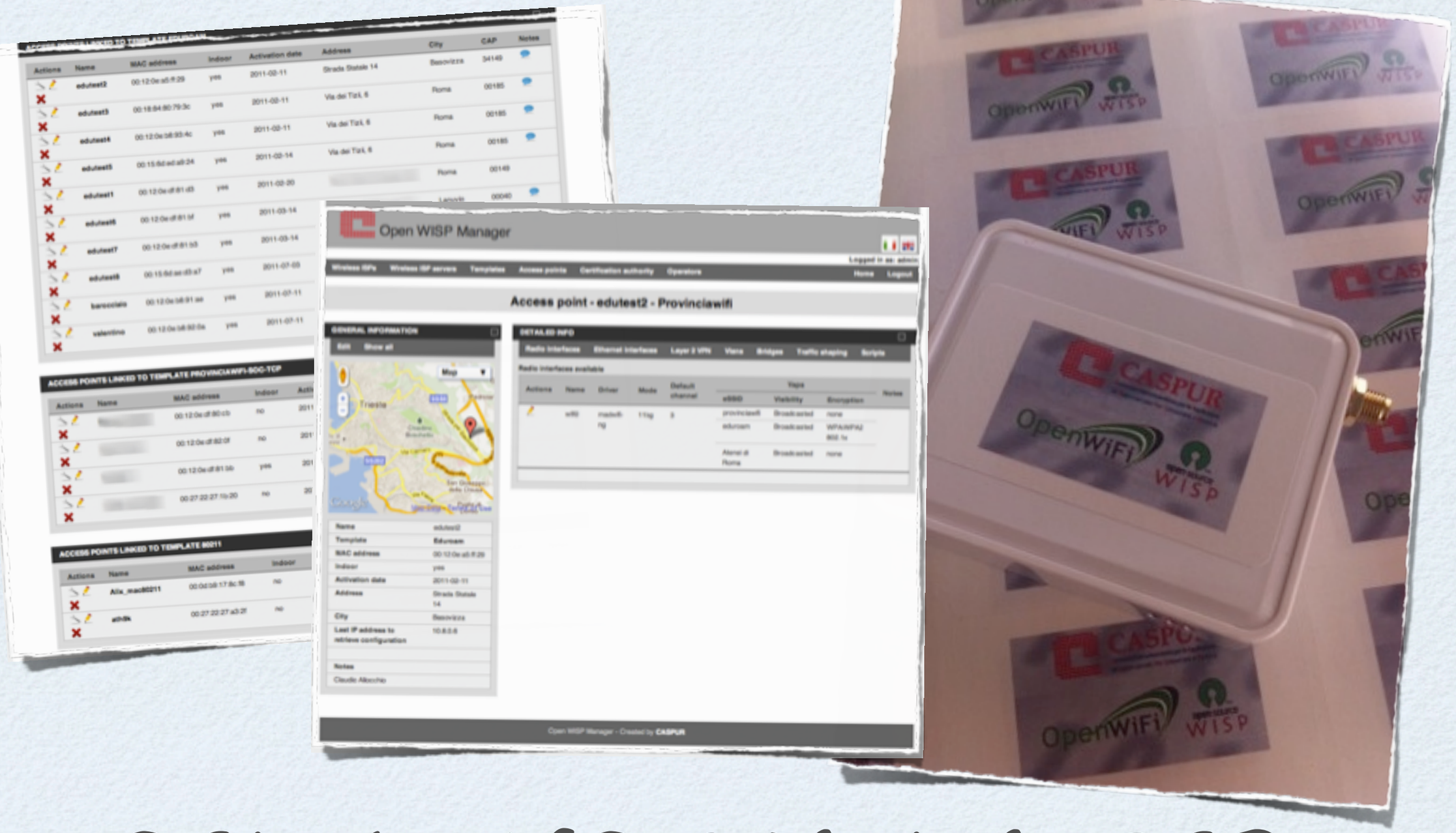
OPEN WISP USER MANAGEMENT SYSTEM

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 *Beta*
  - 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**

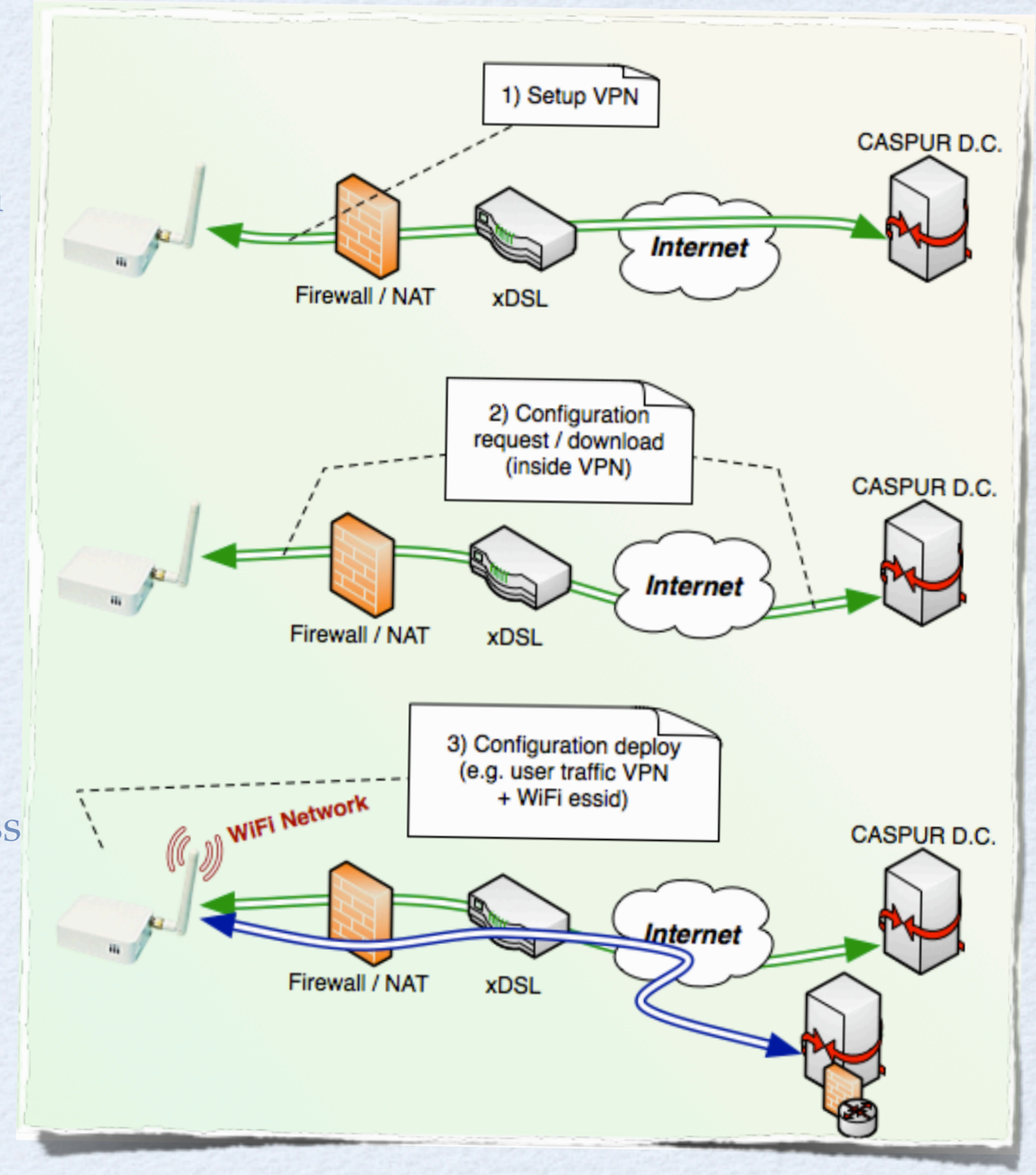
1. At boot time every OWF access point creates a *setup VPN* (***openVPN***) with the OWM server

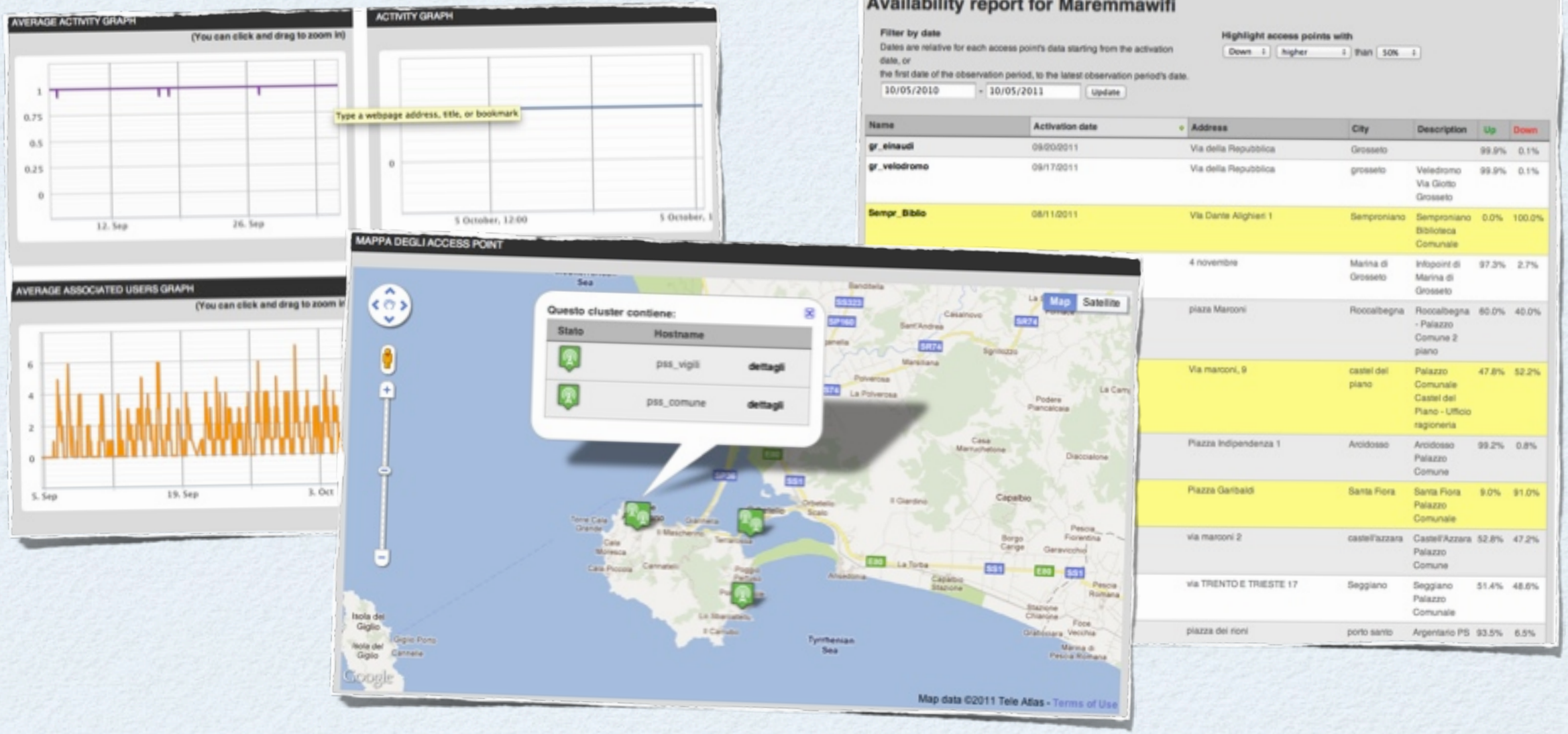
2. OWF access point requests and downloads its configuration inside this *setup VPN*

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 form the point number 2.

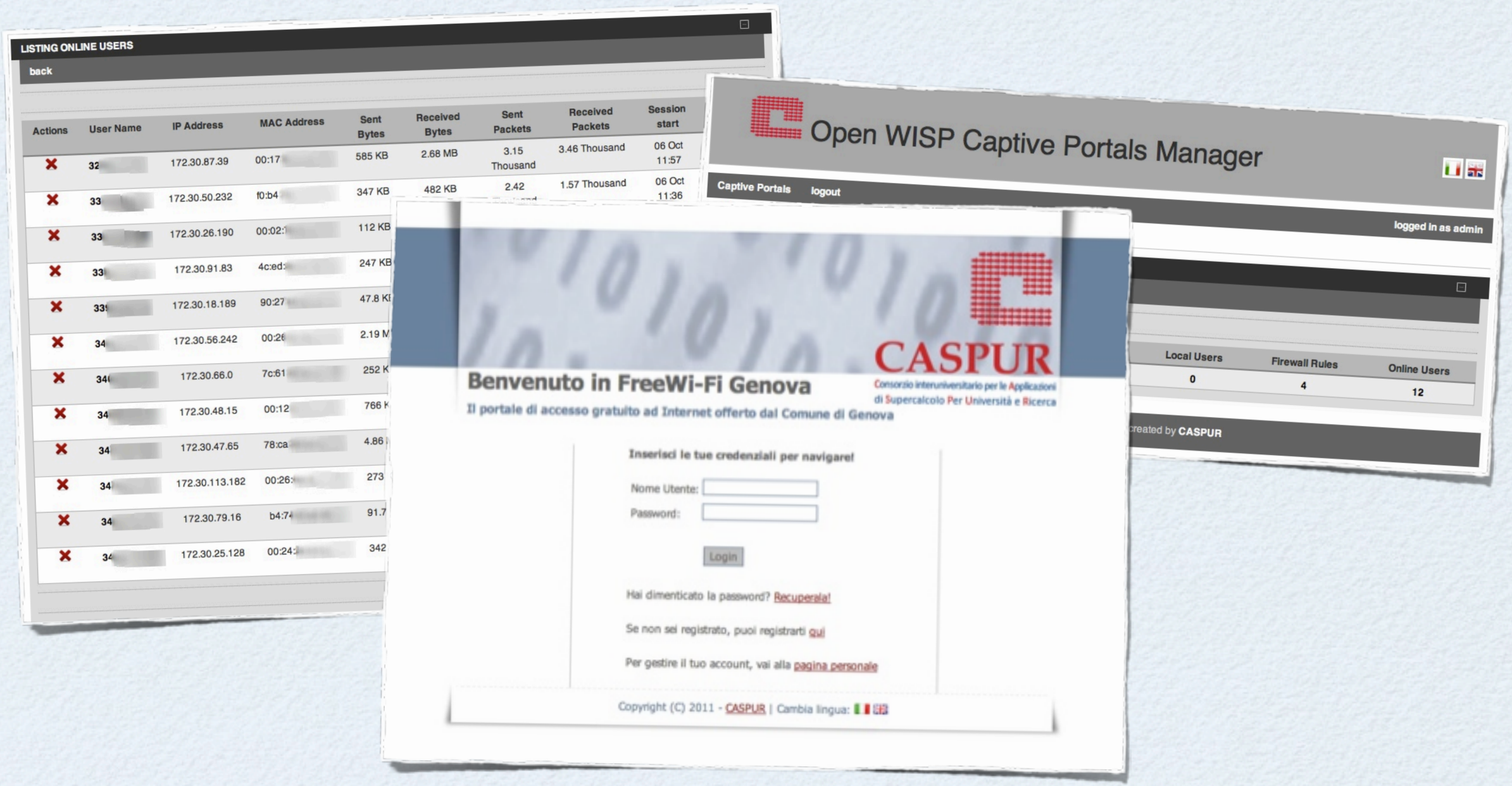




OPEN WISP GEOGRAPHIC MONITORING

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



OPENWISP CAPTIVE PORTAL MANAGER

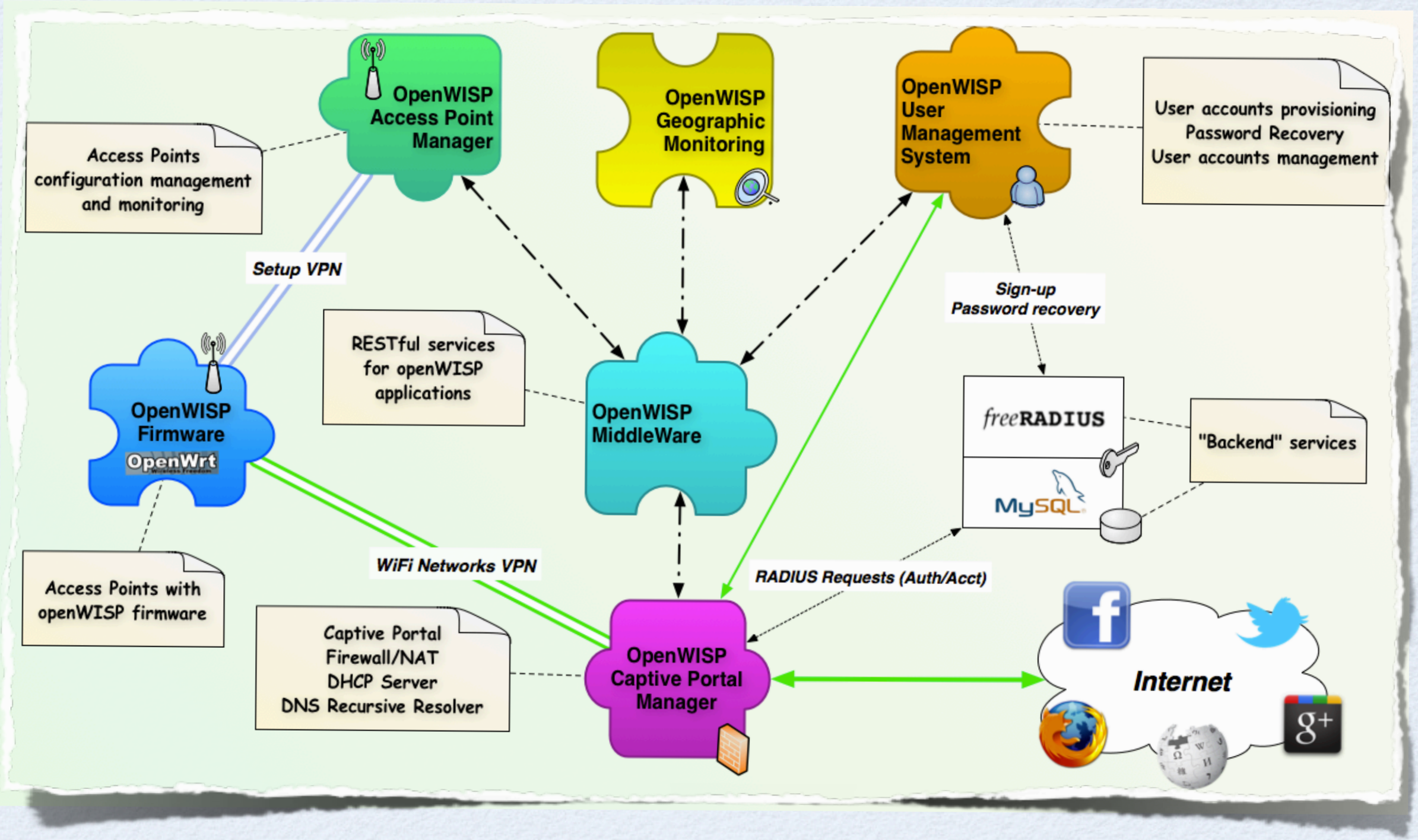
OpenWISP Captive Portal Manager

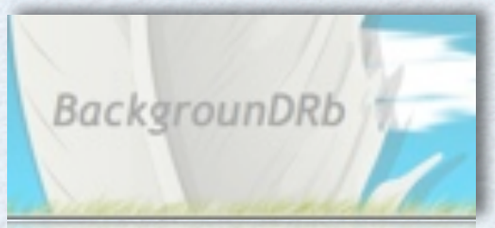
- Written from scratch with Ruby on Rails
  - multiple captive portal support: one per physical/virtual interface
  - RADIUS / Local authentication
  - per-user traffic shaping *Beta*
  - multiple OS support
    - IPv4/GNU-Linux (iptables/tc) already implemented
    - other OS support can be implemented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

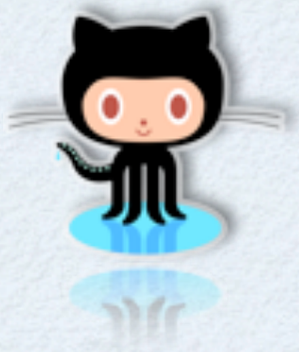
OpenWISP Middleware

- 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?







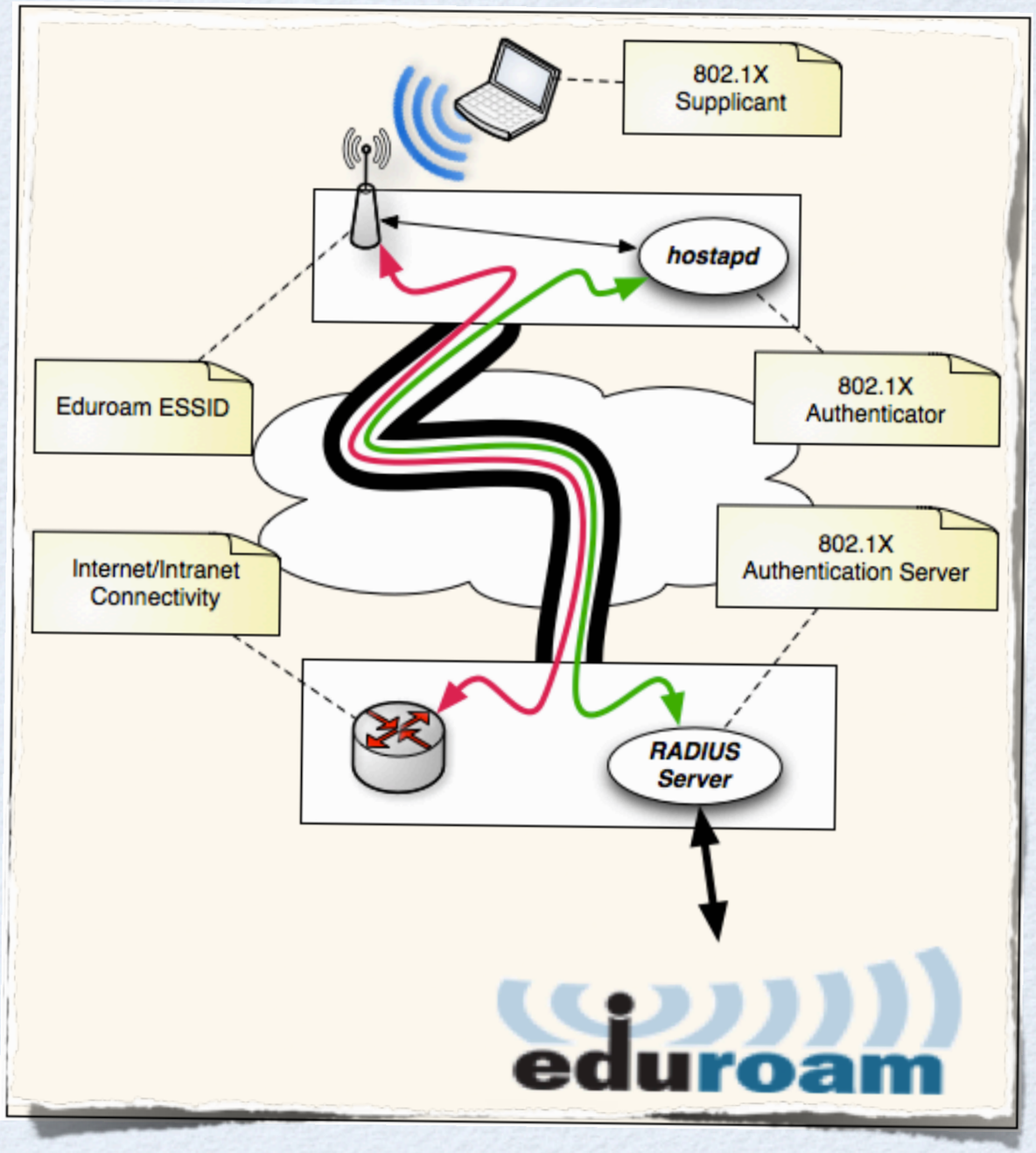
FURTHER ACTIVITIES AND WORK IN PROGRESS

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
    - BackgrounDRB (a Ruby/Rails job server and scheduler)
    - Rails 3 Italian i18n
    - RADIUStar (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/
--
mailto:wifi@caspur.it

CASPUR Wi-Fi Open Source Q&A

Authors: A.Ferraresi, M.Goretti, D.Guerri, M.Latini (CASPUR)
Speaker: Davide Guerri (CASPUR)