GreenSoft

Green Communications' Software
for OEM Licensing

Green PI

Green Communications' software (the GreenSoft) is the key enabler of Green PI, a low carbon impact Internet with edge cloud and services.
The GreenSoft allows hardware to:

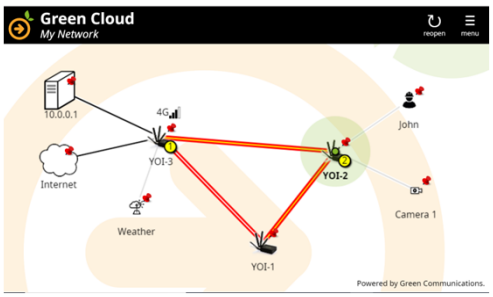
i) **connect with nearby Green PI devices to create a dynamic and self-configuring wireless network with quality of service (QoS);**
ii) **access and share a common edge cloud with edge-based services.**

GreenSoft is a set of software components dedicated to wireless networking. It features a wide range of applications, from low-level programs to web applications for end users. GreenSoft's low-level programs are mostly routing software for mesh networks, but also feature an SNMP module and helpers for Zeroconf networking. High-level utilities feature web applications such as a chat, a network setup app and a live network visualization tool.

Automatic Configuration and Intelligent Routing

GreenSoft features an intelligent routing protocol implemented as a userspace daemon in charge of the following tasks:

- It detects the other devices that are part of the network.
- It estimates QoS properties for each link.
- It computes (possibly indirect) routes to other devices and sets the system's routing table up accordingly (thus ensuring that every device forwards data properly. and that any network host can reach any other host).
- When some devices forward data from the mesh network to other networks (e.g., the Internet), it ensures that all network hosts may reach these other networks.



Live Network Visualization

Network Coverage That Features Mobility and Zeroconf

GreenSoft features a handoff manager program. This is a userspace daemon that helps routers provide access points to regular Wi-Fi users. These users, though outside the core network, may associate to the access points and get regular network connectivity through the mesh network. The handoff manager ensures users can move from an access point to another without disrupting their connections.

E-mail: contact@green-communications.fr - Web: www.green-communications.fr

Green communications

GreenSoft

Green Communications' Software
for OEM Licensing

The handoff manager performs the following tasks:

- It either acts as a distributed DHCP server or as a DHCP relay. relaying DHCP requests from users to a designated DHCP server.
- It snoops on DHCP transactions and informs the network accordingly so routers can map MAC addresses to IP addresses.
- It snoops on Wi-Fi association and disassociation events, so routers can detect handoffs.
- It updates the system's routing tables accordingly and configures access point interfaces to act as a gateway to associated users.

In addition, GreenSoft features an mDNS helper. This is a userspace daemon that ensures Zeroconf works. In practice, this means that devices that run the GreenSoft may advertise Zeroconf services to other devices and users; and that users may also advertise their own Zeroconf services to the network (including other users).

Edge Cloud and Services

GreenSoft features a web framework that provides users with a number of web applications (chat, network setup, live network visualization tool, etc.). This framework uses client-side JavaScript and static HTTP, except for three dynamic HTTP resources:

- A resource that provides a GraphML (XML) representation of the current network. The network visualization tool uses this resource. A custom GreenSoft program provides this resource to the web server using the SCGI protocol.
- A resource that converts GET and POST HTTP requests including JSON data to SNMP GetBulk and Set requests. The network setup app uses this resource. A custom GreenSoft program provides the SNMP/JSON converter to the web server using the CGI protocol. Also note that GreenSoft features a Net-SNMP module that implements the SNMP configuration backend.

GreenSoft's framework

- A resource that maps XMPP traffic to HTTP using the BOSH protocol. The chat app uses this resource. Green Communications' routers (YOI) relies on ejabberd for this resource.

GreenSoft web apps therefore need a web server. Any software can provide this server as long as it supports SCGI and CGI (Green Communications' routers uses nginx with fcgiwrap for CGI). One can easily use the web server to provide local content to users. One can also easily develop new applications to integrate to the framework.

E-mail: contact@green-communications.fr - Web: www.green-communications.fr

Green communications

GreenSoft

Green Communications' Software
for OEM Licensing

OEM Requirements

To have a custom hardware (or system) use the GreenSoft, one has two options:

- either start with a Green Communications system image and add custom software to it, or
- start with a custom system image and add the GreenSoft to it.

Green Communications uses Buildroot to generate its system images (therefore, the image installed on GreenBox is Buildroot image). Clients that intend to add their software to these images need to either have Buildroot support their hardware, or to provide us with an appropriate toolchain and Linux kernel (see requirements below). Green Communications does provide the Buildroot sources it uses to generate the images, using a GPLv2 license.

One can however integrate the GreenSoft to any system as long as it features:

OEM Integration Requirements

- A toolchain with a modern C++ compiler. GCC 4.8.2, GCC 4.9 and Clang 3.5 are known to work.
- A Linux kernel with version 4 or above.
- Wi-Fi interfaces with drivers that support RSN over IBSS, nl80211, RX signal level reporting through nl80211, and **`SO_WIFI_STATUS`** on packet sockets.
- libdbus, and a running D-Bus daemon.
- libcurl.
- The following Boost libraries: Program Options, Filesystem, System, Regex, and Locale.
- For the SNMP module, Net-SNMP, ifup/ifdown, **`hostapd`** and **`wpa_supplicant`**.
- For the live network visualization tool, a web server that supports SCGI.
- For the network setup app, a web server that supports CGI, and the SNMP module.
- For the chat web app, an XMPP server that supports BOSH.

GreenSoft

Green Communications' Software
for OEM Licensing

Performance

Videoconferencing Over Multihops:

Green Communications partnering with the leading energy provider EDF tested the rapid deployment of an instant communication network: a set of YOI (GreenSoft enabled routers) was spread out. Routers connected instantaneously using our advanced Device-to-Device technology, creating a Wi-Fi network without the need of either a preliminary audit or previous infrastructure.

Within minutes, two people located at each end of the network were able to exchange calls and videoconference over multihops (up to 30). GreenSoft's Handoff functionality allowed them to move along the network without interruption.

It is the first time a real-time video is operated over a high number of Wi-Fi hops validating our routing algorithm for large-scale deployment and for mobility.

E-mail: contact@green-communications.fr - Web: www.green-communications.fr