Contents

Introduction

Wireless communication is often a desired option for any mobile platform. The one, or multiple, x86 computers residing within the platform provide varied functionality, but most often also require connectivity with a remotely operating computer and/or end-user.

A combination of of wired(IEEE 802.3) and wireless(IEEE 802.11) Ethernet along with networking software provides this functionality.

Pre-configured Networking Setups

Overview

The possible network infrastructures and topologies a robot platform can be placed into are too numerous to describe here. Instead, the two most-common topologies will be shown, and configuration instructions provided.

Components

WLAN

A WLAN is a Wireless Local Area Network, most commonly implemented using 802.11-compatible hardware. Specifically, the WRAP setup accompanying this package supports only 802.11bg, for optimum range and compatibility.

Seekur Internals

Depending on the number of computers you purchased, Seekur's internals house 0-5 EBX mainboards, each outfitted with various additional components. Specifically each mainboard is also connected via its onboard Ethernet adapter to Seekur's internal switch and to the exterior-mounted WRAP board. See the next section #AP-mode Setup for an example diagram.

WRAP - Wireless Router Application Platform

Warning: Always make sure that the WRAP has both antennae attached when powered. Unterminated antennae can result in damage the wireless card and thus WRAP unit
Warning: The WRAP unit does NOT accept standard Power-Over-Ethernet according to IEEE 802.3af. See the ALIX documentation(included with this document) for more information on the custom 12VDC, no signaling POE.
"WRAP" refers to the gray box with 2 antennas and Ethernet cables attached. As one might infer, it houses an Ethernet NIC, a wireless LAN adapter, and a controlling x86 computer board. Refer to Appendix B:Hardware Specifics for more information on the components of your WRAP setup.

m0n0wall

"m0n0wall" is the operating system used for the WRAP computer, and thus it controls the network adapters. It provides a web-based GUI for configuring the various network interfaces as well as setting-up services such as firewall, NAT, ip-routing, DHCP, DNS, and many others. See the #m0n0wall basics section for additional information.

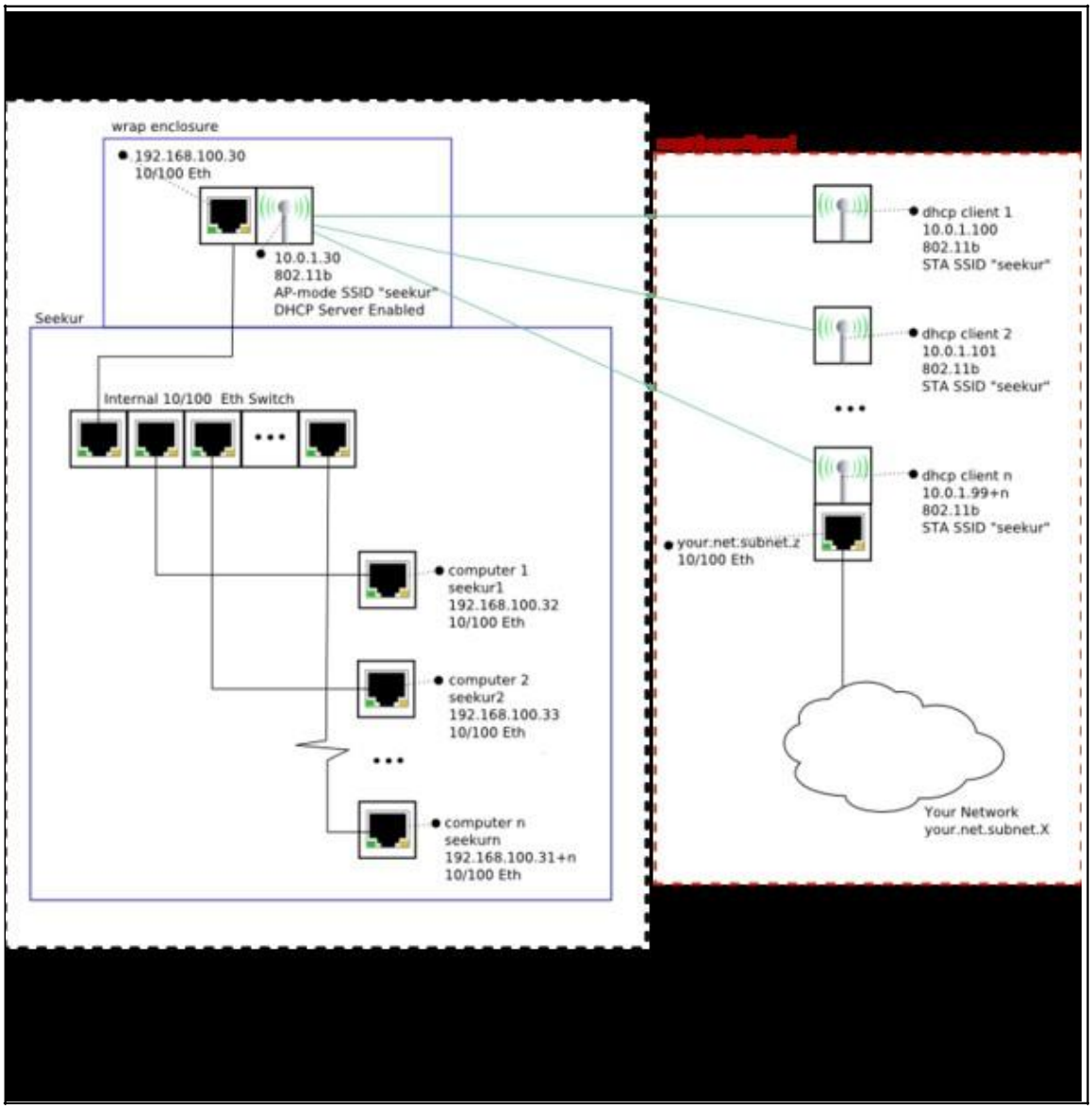
AP-mode Setup

Note: By default the onboard AP is configured as an OPEN system with ABSOLUTELY NO security enabled. Please read the #m0n0wall basics

Typical scenarios

- Outdoor operations or where no infrastructure WLAN is available.
  - Remote outdoor locations
- Network isolation is desired
  - physical separation from intra- or internets

The diagram below shows the default networking setup. The m0n0wall backup file config_AP.xml is a preset AP-mode configuration with the following parameters:

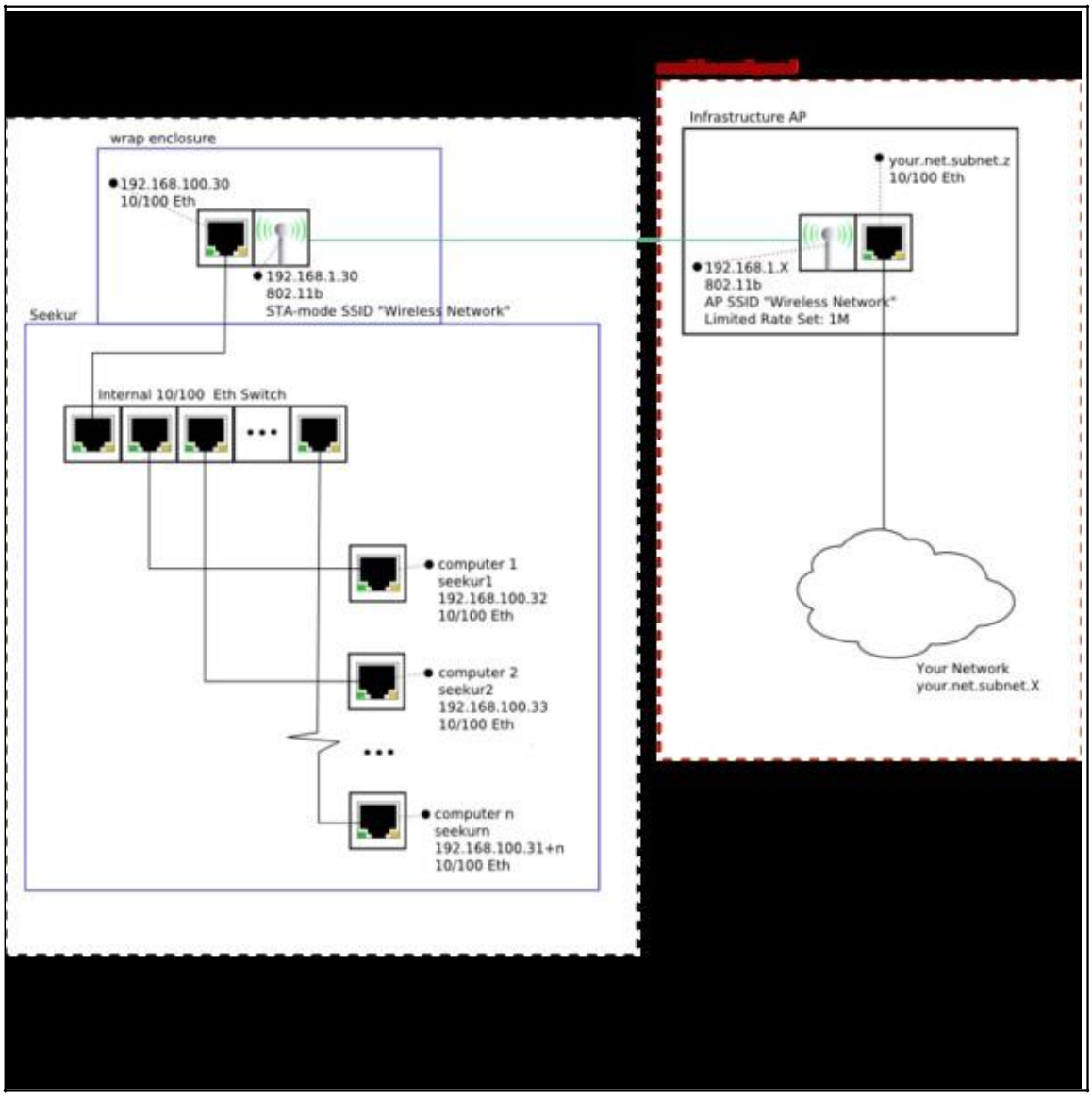


Station-mode Setup

Typical scenarios

- Connecting to a pre-existing WLAN infrastructure while inside or stationary.
  - Home or corporate WLAN
- Connecting to a well-covered pre-existing outdoor Wireless LAN infrastructure
  - University networks

The diagram below shows the other typical network layout. A m0n0wall configuration file is included for this setup, please see #m0n0wall basics for more information on configuring or adjusting this config.



Other Setups

The onboard WRAP provides for an extremely broad range of configurations through using the BSD-based m0n0wall OS. Other monitoring services such as SNMP, obtaining NTP, various DNS/DHCP and connectivity testing, and of course all types of filtering can be configured. The unit can also be configured as a filtering bridge instead of the current NATting configuration. See the next section for basic hints, or the m0n0wall website for more extensive documentation.

m0n0wall basics

m0n0wall is a mature, enterprise quality, open-source, BSD-based, appliance-type, firewall operating-system for embedded computers. For complete information and in-depth documentation, see the website at http://m0n0.ch/wall/. It was developed by Manuel Kasper and the various m0n0wall contributors.

m0n0wall provides configuration access through a secure web-interface. Several example configuration XML files are provided. Find them on your included software CD or contact support@mobilerobots.com.

Accessing and using the WebGUI

When power is applied, the WRAP will power-up with its configured setup. Initially, this means the default AP-mode setup. Accessing the WRAP platform that controls Seekur's wireless-to-internal networking can be done from either a wireless or wired setup.

From Wireless

As described in the above diagram #AP-mode Setup, by default the onboard wireless card will act as an Access Point and accept associations and give DHCP service to any wireless client. Navigate to the IP-address of your WRAP using secure https. By default, the Wireless interface is the ?LAN? interface in m0n0wall, and assigned to 10.0.126.1 subnet. After successfully associating to the "seekur" ESSID, obtain DHCP or assign yourself a 10.0.126.X address and use a web-browser to open:

https://10.0.126.1 login: '**admin**' password: '**mono**'

From Wired

Seekur has an external 10/100 port which attached to the WRAP for wireless networking. Use this port to attach Seekur's internal computers to your own switch, network-drops, or notebook computer(using a cross-over cable).

Note: !!WARNING!! Do Not mistake the stereo-vision camera ports, which also use Cat-5/6 cables and connectors, for the Ethernet network interface attached to the computers. Always verify against the port-labels and operation manual before connecting.
As described in the above diagram #AP-mode Setup, the internal computers are assigned addresses on the 10.0.125.X subnet, where computers start at X=32 (and incremented by one for each computer), and the wireless WRAP wired-interface is located at X=1. After verifying link on the Ethernet port, assign yourself a 10.0.125.Y address and use a web-browser to open:

https://10.0.125.1 login: '**admin**' password: '**mono**'

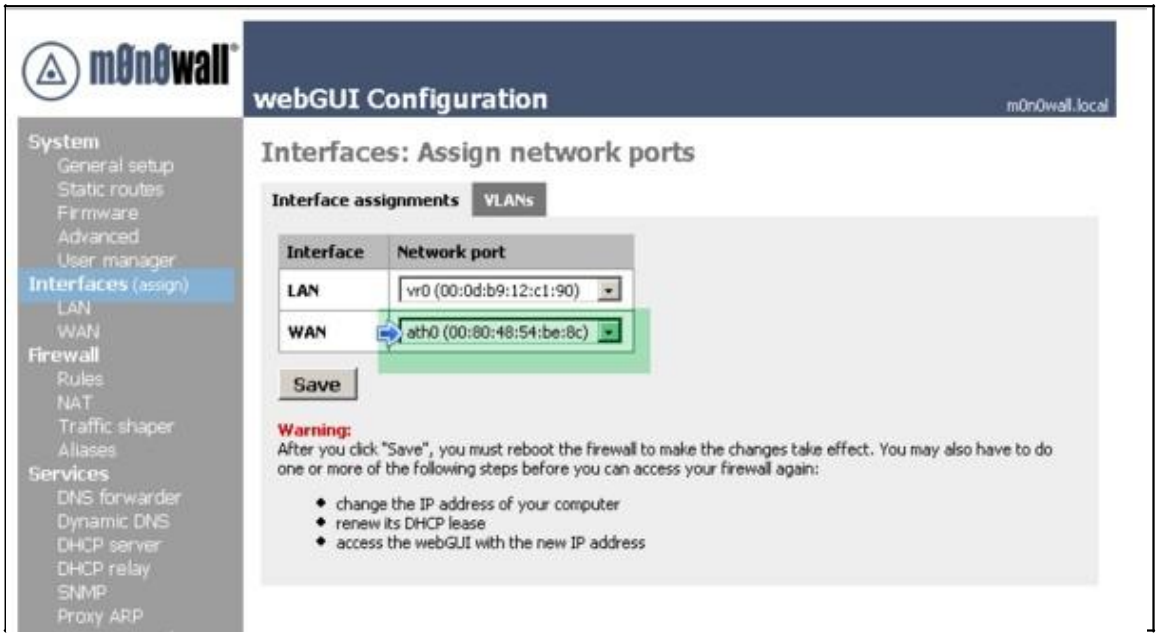
Here the network interfaces can be reconfigured, pass/block rules described, and various services enabled or disabled through this interface.

Basic Configuration

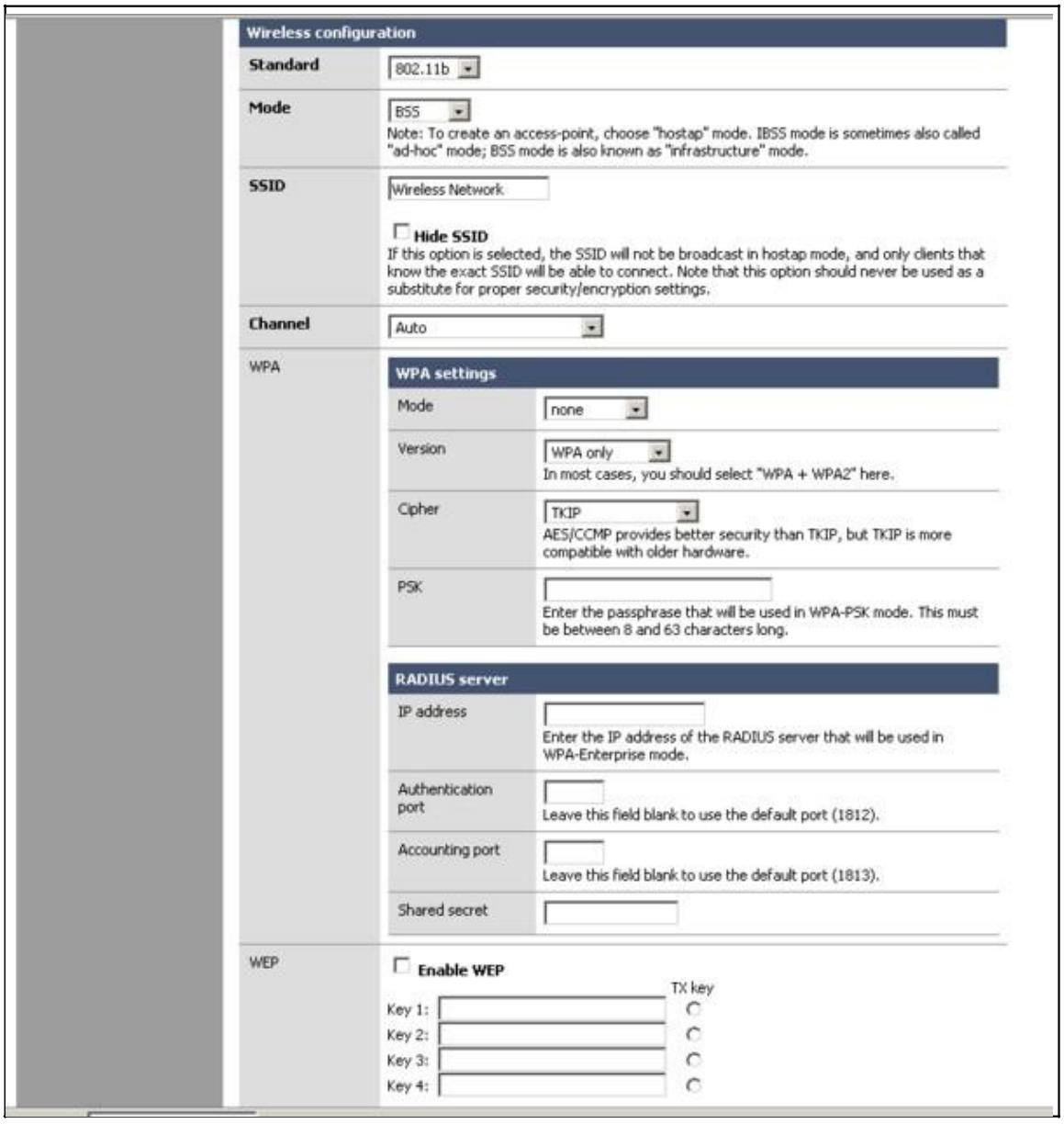
Since m0n0wall is intended for use as first and foremost a firewall, the interfaces must be assigned to either LAN or WAN.

wireless

Verify which interface your wireless card is assigned to under the **Assign** heading. The wireless card, usually an Atheros-based chipset, can be identified by the **athX** name under the drop-down menus.



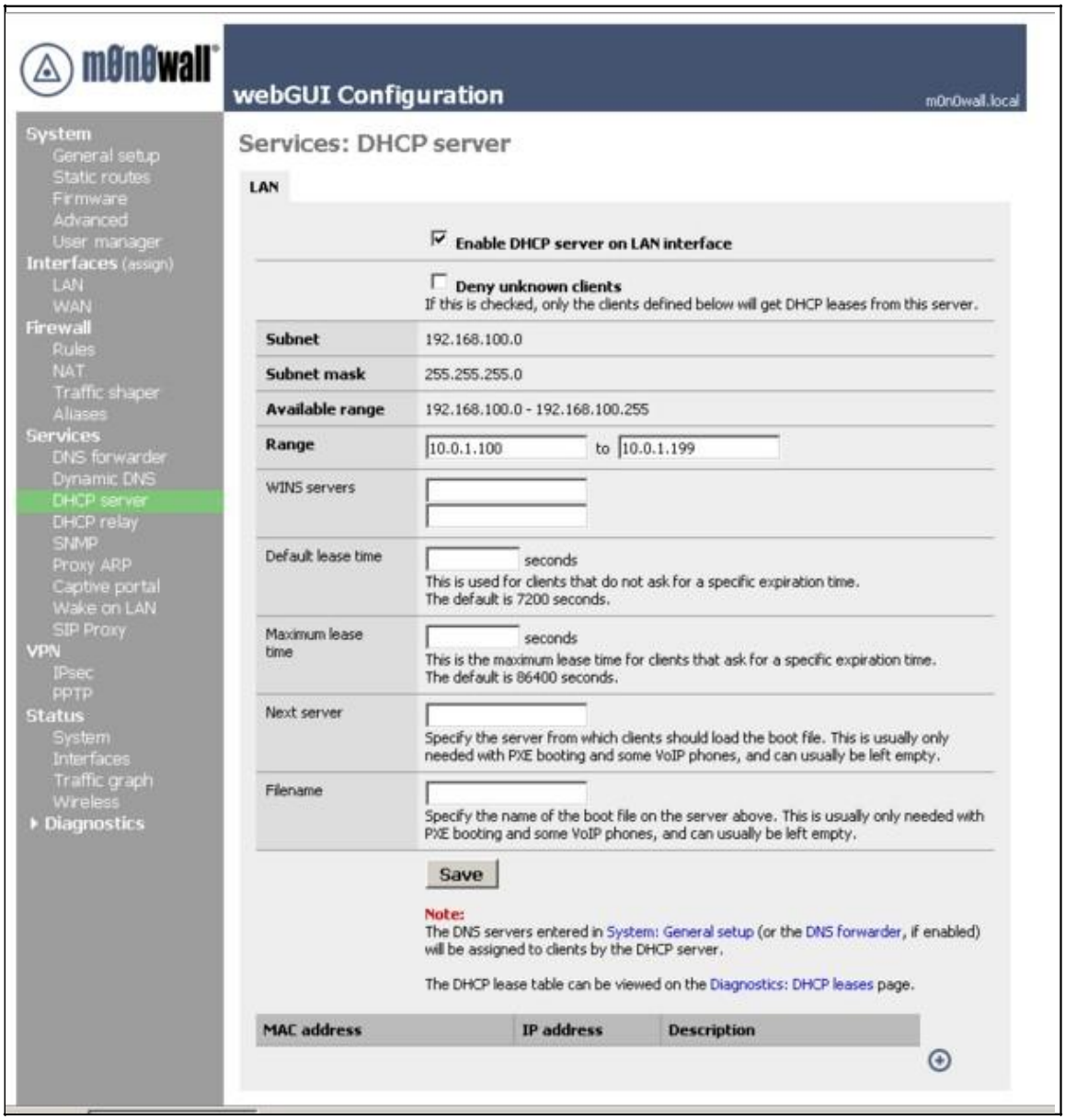
then select the corresponding interface underneath the "assign". You should encounter a configuration section as shown below:



Configure wireless security, if desired. Note the various options ranging from OpenSystem to WPA-EAP(requiring a local RADIUS server).

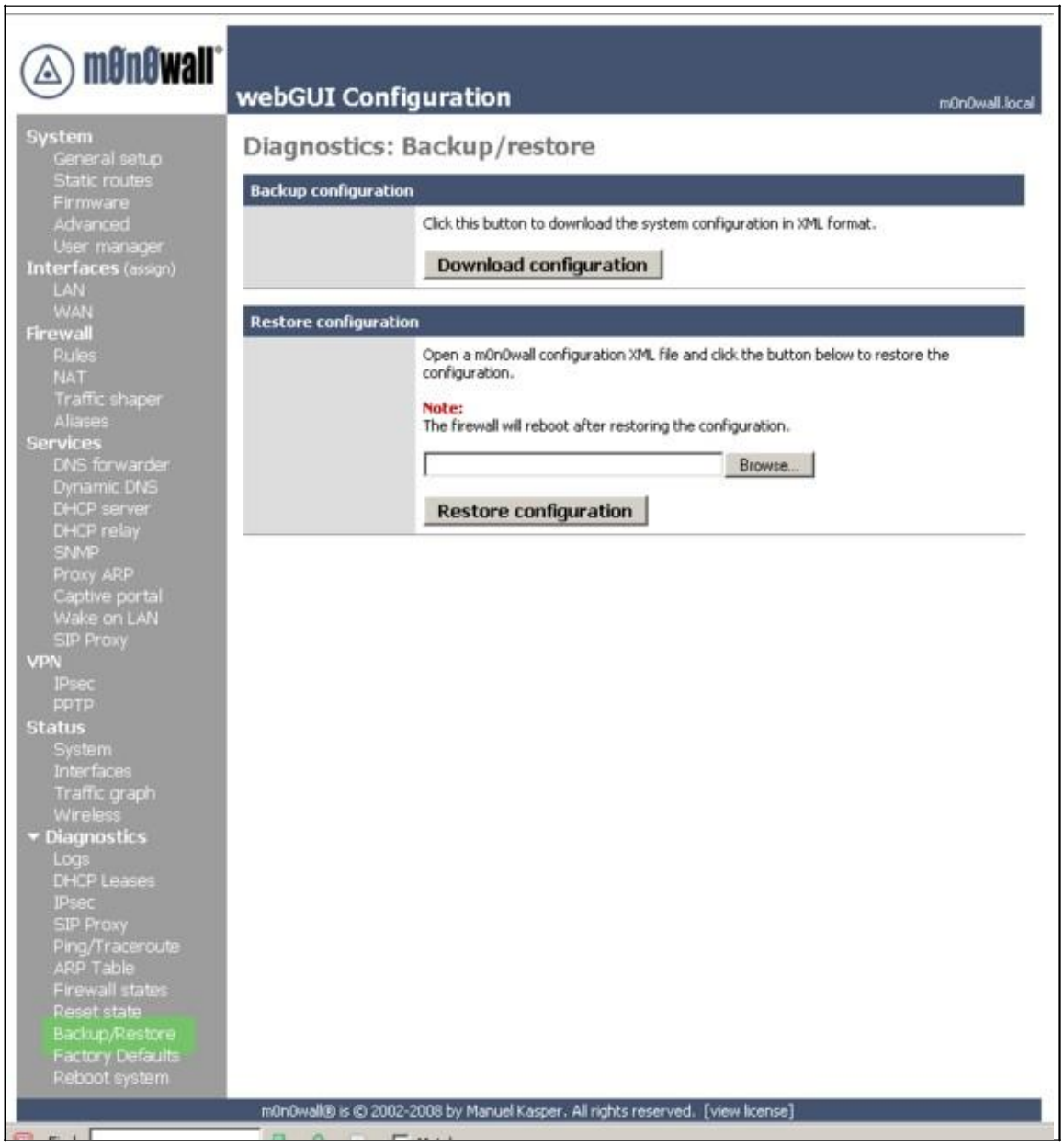
dhcp

To enable/disable the DHCP server, select it from the menu and configure the address range:



Loading a configuration file

If you wish to reload one of the pre-configured XML-file configurations, they can be loaded and saved through the "Backup and Restore" page, which is under the **Diagnostics** heading. Check your CD-ROM for available demonstration config-files.



Appendices

Appendix A: Hardware Component Specifics

Rev A

- PC Engines ALIX3C2 Board with 1 LAN and 2 miniPCI
  - LX-800 with integrated 256MB RAM,
  - CPU: 500 MHz AMD Geode LX800
  - see **MBD-P-ALIX.3C2-manual.pdf** included with this document, for more information on the ALIX system boards
- Compex WLM54G 200mW B/G

- IEEE 802.11b/g (2.4GHz)
- R2414 Atheros Chipset
- WPA2/WPA/WEP support

• 1G Compact Flash
- Silicon Systems SSD-C01Gi-3500
- industrial temperature range

Appendix B: m0n0wall License

License

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m0n0wall is a registered trademark of Manuel Kasper.

The following persons have contributed code to m0n0wall:

Bob Zoller (bob at kludgebox dot com)

- Diagnostics: Ping function; WLAN channel auto-select; DNS forwarder

Michael Mee (m0n0wall at mikemee dot com)

- Timezone and NTP client support

Magne Andreassen (magne dot andreassen at bluezone dot no)

- Remote syslog'ing; some code bits for DHCP server on optional interfaces

Rob Whyte (rob at g-labs dot com)

- Idea/code bits for encrypted webGUI passwords; minimalized SNMP agent

Petr Verner (verner at ipps dot cz)

- Advanced outbound NAT: destination selection

Bruce A. Mah (bmah at acm dot org)

- Filtering bridge patches

Jim McBeath (monowall at j dot jimmc dot org)

- Filter rule patches (ordering, block/pass, disabled); better status page;
- webGUI assign network ports page

Chris Olive (chris at technologEase dot com)

- enhanced "execute command" page

Pauline Middelink (middelink at polyware dot nl)

- DHCP client: send hostname patch

Björn Pålsson (bjorn at networksab dot com)

- DHCP lease list page

Peter Allgeyer (allgeyer at web dot de)

- "reject" type filter rules; dial-on-demand; WAN connect/disconnect; auto-add proxy ARP
- firewall log filtering; DynDNS server/port; OpenVPN improvements; Diag: ARP improvements

Thierry Lechat (dev at lechat dot org)

- SVG-based traffic grapher

Steven Honson (steven at honson dot org)

- per-user IP address assignments for PPTP VPN

Kurt Inge Smådal (kurt at emsp dot no)

- NAT on optional interfaces

Dinesh Nair (dinesh at alphaque dot com)

- captive portal: pass-through MAC/IP addresses, RADIUS authentication
- HTTP server concurrency limit

Justin Ellison (justin at techadvise dot com)

- traffic shaper TOS matching; magic shaper; DHCP deny unknown clients;
- IPsec user FQDNs; DHCP relay

Fred Wright (fw at well dot com)

- ipfilter window scaling fix; ipnat ICMP checksum adjustment fix; IPsec dead SA fixes;
- netgraph PPP PFC fixes; kernel build improvements;
- updated DP83815 short cable bug workaround

Michael Hanselmann (m0n0 at hansmi dot ch)

- IDE hard disk standby; exec.php arrow keys

Audun Larsen (larsen at xqus dot com)

- CPU/memory usage display

Peter Curran (peter at closeconsultants dot com)

- OpenVPN support

Pavel A. Grodek (pg at abletools dot com)

- Traffic shaper packet loss rate/queue size

Rob Parker, Keycom PLC (rob dot parker at keycom dot co dot uk)

- Captive portal per-user bandwidth restrictions

Pascal Suter (d dash monodev at psuter dot ch)

- Captive portal local user database

Matt Juszczak (matt at atopia dot net)

- Captive portal logging

Enrique Maldonado (enrique at directemar dot cl)

- IPsec certificate support

Ken Wiesner (ken dot wiesner at clearshout dot com)

- Ping source interface selection

Joe Suhre (jsuhre at nullconcepts dot com)

- DNS forwarder domain overriding

Paul Taylor (paultaylor at winn dash dixie dot com)

- ARP table, Traceroute and Filter state pages
- captive portal: disable concurrent logins, file manag
- webGUI users/groups

Jonathan De Graeve (m0n0wall at esstec dot be)

- Complete captive portal RADIUS overhaul, cleanup
- captive portal: file manager, volume stats, FW rulepool (virtual port pool)
- MAC formatting, per-user bandwidth limitation

Marcel Wiget (mwiget at mac dot com)

- captive portal: Voucher authentication
- SIP: SIP proxy/masquerading based on siproxd

m0n0wall is based upon/includes various free software packages, listed below. The author of m0n0wall would like to thank the authors of these software packages for their efforts.

FreeBSD (http://www.freebsd.org)

Copyright © 1994-2007 FreeBSD, Inc. All rights reserved.

This product includes PHP, freely available from http://www.php.net.

Copyright © 1999 - 2007 The PHP Group. All rights reserved.

mini_httpd (http://www.acme.com/software/mini_httpd)

Copyright © 1999, 2000 by Jef Poskanzer <jef@acme.com>. All rights reserved.

ISC DHCP server (http://www.isc.org/products/DHCP)

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ipfilter (http://coombs.anu.edu.au/ipfilter)

Copyright © 1993-2002 by Darren Reed.

MPD - Multi-link PPP daemon for FreeBSD (http://www.dellroad.org/mpd)

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ez-ipupdate (http://www.gusnet.cx/proj/ez-ipupdate)

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Circular log support for FreeBSD syslogd (http://software.wwwi.com/syslogd)

Copyright © 2001 Jeff Wheelhouse (jdw@wwwi.com)

Dnsmasq - a DNS forwarder for NAT firewalls (http://www.thekelleys.org.uk)

Copyright © 2000-2003 Simon Kelley

Racoon (http://www.kame.net/racoon)

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msntp (http://www.hpcf.cam.ac.uk/export)

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UCD-SNMP (http://www.ece.ucdavis.edu/ucd-snmp)

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choparp (http://choparp.sourceforge.net)

Copyright © 1997 Takamichi Tateoka (tree@mma.club.uec.ac.jp)

Copyright © 2002 Thomas Quinot (thomas@cuivre.fr.eu.org)

BPALogin (http://bpalogin.sourceforge.net) - lightweight portable BIDS2 login client

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wol (http://ahh.sourceforge.net/wol)

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ATAidle (http://www.cran.org.uk/bruce/software/ataidle.php)

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Siproxd (http://siproxd.sourceforge.net/)

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