

ABET Internal Network Documentation

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1 Setting Up Internal Network

The internal ABET network is comprised of two routers: a WiFi station that connects to “Rowan_IOT” WiFi and hosts a DHCP server that routes the internet connection through its ethernet ports, and a wireless access point (AP) that connects to the WiFi station via ethernet and hosts its own DHCP server and broadcasts a WiFi signal called “ABET WiFi.” All clients are connected to the AP router, two ABET desktops and two printers are connected via ethernet and all other devices connect via the WiFi by connecting to “ABET WiFi” (Figure 1).

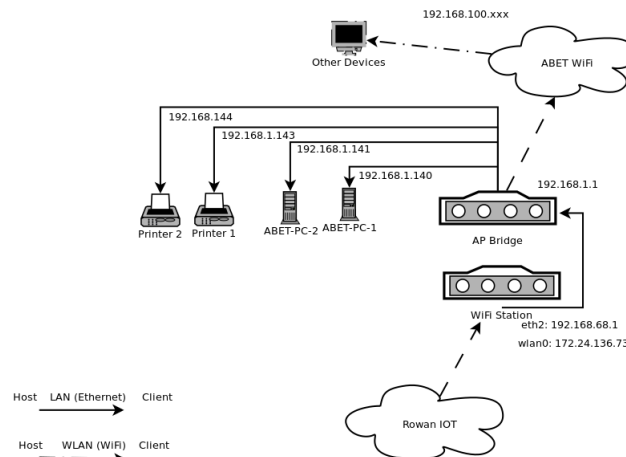


Figure 1: ABET Network Diagram

1.1 Rowan.IoT WiFi Station

A MikroTik router was used as the WiFi station. The router is configured in “router” mode, wireless set to automatically acquire an IP address from Rowan_IOT, and set configure its local network with the router’s local IP address as 192.168.88.1 (this is it’s IP relative to other devices connected to the router) a netmask of 255.255.255.0, and a DHCP range of 192.168.88.10-192.168.88.255 (this is the range of IP addresses that the router assigns to devices that connect it) (Figure 2).

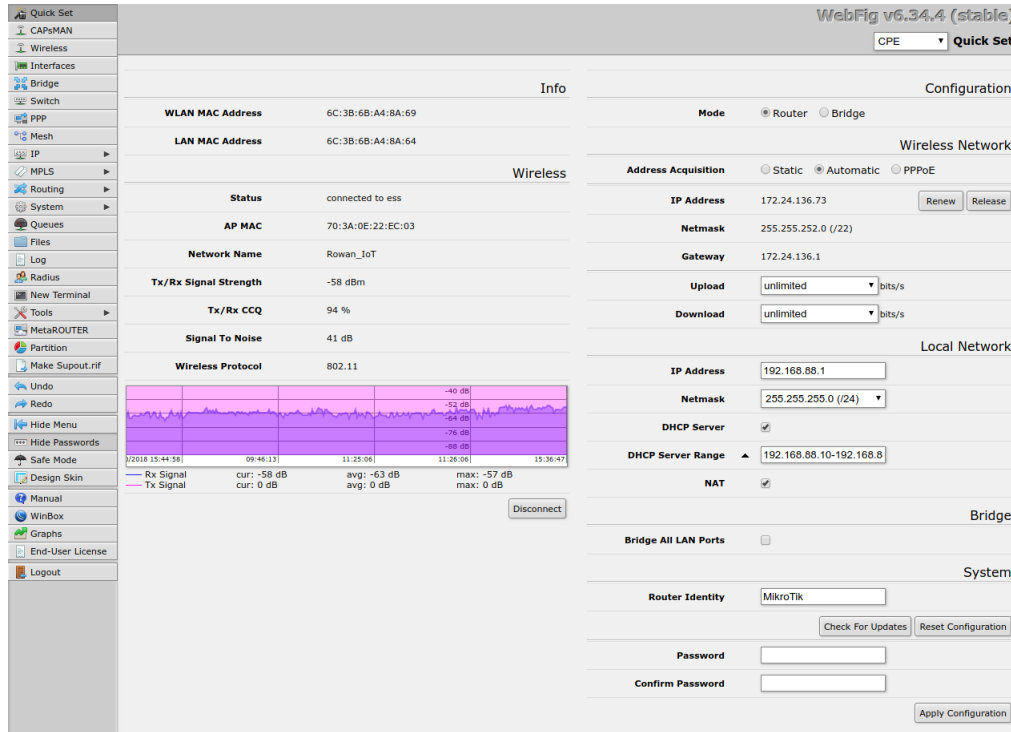


Figure 2: MikroTik Setup: Quick Set

The wireless interface of this router was called “wlan1” and it was configured to connect to Rowan_IOT (Figures 3 and 4).

Quick Set	Interfaces									
CAPsMAN	Nstreme Dual									
Wireless	Access List									
Interfaces	Registration									
Bridge	Connect List									
Switch	Security Profiles									
PPP	Channels									
Mesh	Add New									
IP	CAP									
MPLS	Scanner									
Routing	Freq. Usage									
System	Alignment									
Queues	Wireless Sniffer									
Files	Wireless Snooper									
Log	1 Item									
Radius										
New Terminal										
Tools										
MetaROUTER										
Partition										
Make Supout.tif										
Undo										
Redo										
Hide Menu										
Hide Passwords										
Safe Mode										
Design Skin										
Manual										
WinBox										

ID	Name	Type	L2 MTU	Tx	Rx	Tx Packet (p/s)	Rx Packet (p/s)	FP Tx	FP Rx
1	R wlan1	Wireless (Atheros AR9)	1600	428.8 kbps	35.3 kbps	65	59	425.8 kbps	35.3 kbps

Figure 3: MikroTik Setup: Wireless Configuration

Quick Set

CAPSMAN

Wireless

Interfaces

Bridge

Switch

PPP

Mesh

IP

MPLS

Routing

System

Queues

Files

Log

Radius

New Terminal

Tools

MetaROUTER

Partition

Maine Support.rtf

Undo

Redo

Hide Menu

Safe Mode

Design Skin

Manual

WinBox

Graphs

End-User License

Logout

WebFig v6.34.4 (stable)

Interface <wlan1>

OK

Cancel

Apply

Advanced Mode

Scan...

Freq. Usage...

Align...

Sniff...

Snooper...

Reset Configuration

Torch

connected to ess

running

not slave

Enabled

☒

General

Name

wlan1

Type

Wireless (Atheros AR9300)

MTU

1500

L2 MTU

1600

MAC Address

6C:3B:6B:A4:8A:69

ARP

enabled

Wireless

Mode

station

Band

2GHz-B/G/N

Channel Width

20Mhz

Frequency

2412

Mhz

SSID

Rowan IoT

Scan List

default

Wireless Protocol

802.11

Security Profile

default

Bridge Mode

enabled

VLAN Mode

no tag

VLAN ID

1

Default AP Tx Rate

bps

Default Client Tx Rate

bps

Default Authenticate

☒

Default Forward

☒

HT

Tx Chains

☒ chain0 ☒ chain1

Rx Chains

☒ chain0 ☒ chain1

AMSDU Limit

8192

AMSDU Threshold

8192

Guard Interval

any

AMSDU Priorities

☒ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7

HT MCS

HT Supported MCS

☒ MCS 0 ☒ MCS 1

☒ MCS 2 ☒ MCS 3

☒ MCS 4 ☒ MCS 5

☒ MCS 6 ☒ MCS 7

☒ MCS 8 ☒ MCS 9

☒ MCS 10 ☒ MCS 11

☒ MCS 12 ☒ MCS 13

☒ MCS 14 ☒ MCS 15

☒ MCS 16 ☒ MCS 17

☒ MCS 18 ☒ MCS 19

☒ MCS 20 ☒ MCS 21

☒ MCS 22 ☒ MCS 23

HT Basic MCS

☒ MCS 0 ☒ MCS 1

☒ MCS 2 ☒ MCS 3

☒ MCS 4 ☒ MCS 5

☒ MCS 6 ☒ MCS 7

☐ MCS 8 ☐ MCS 9

☐ MCS 10 ☐ MCS 11

☐ MCS 12 ☐ MCS 13

☐ MCS 14 ☐ MCS 15

☐ MCS 16 ☐ MCS 17

☐ MCS 18 ☐ MCS 19

☐ MCS 20 ☐ MCS 21

☐ MCS 22 ☐ MCS 23

Figure 4: MikroTik Setup: wlan1 Interface Configuration

The router has five ethernet interfaces (eth1-eth5) and a bridge that connects the interfaces together (Figure 5).

Quick Set

CAPSMAN

Wireless

Interfaces

Bridge

Switch

PPP

Mesh

IP

MPLS

Routing

System

Queues

Files

Log

Radius

New Terminal

Tools

MetaROUTER

Partition

Make Supout.rif

Undo

Redo

Hide Menu

Hide Passwords

Safe Mode

Design Skin

Manual

WinBox

Interface

Ethernet

EoIP Tunnel

IP Tunnel

GRE Tunnel

VLAN

VRRP

Bonding

LTE

Add New

7 Items

		Name	Type	L2 MTU	Tx	Rx	Tx Packet (p/s)	Rx Packet (p/s)	FP Tx	FP Rx
;;; defconf										
	D	R	bridge	Bridge	1598	221.2 kbps	77.0 kbps	45	41	74.7 kbps
	D		ether1	Ethernet	1598	0 bps	0 bps	0	0	0 bps
	D	RS	ether2-master	Ethernet	1598	0 bps	0 bps	0	0	74.7 kbps
	D	RS	ether3	Ethernet	1598	194.7 kbps	81.4 kbps	46	41	0 bps
	D	S	ether4	Ethernet	1598	0 bps	0 bps	0	0	0 bps
	D	S	ether5	Ethernet	1598	0 bps	0 bps	0	0	0 bps
	D	R	wlan1	Wireless (Atheros AR9)	1600	66.3 kbps	99.7 kbps	29	34	38.9 kbps

Figure 5: MikroTik Setup: Interfaces Overview

The purpose of this router is to transfer the wireless Rowan_IOT connection to an ethernet connection. In order to do this, we need to set the router up as a DHCP client so it can connect to Rowan.IOT similar to a computer, so we need to configure the DHCP client to use the wlan1 interface (Figures 6 and 7).

	Interface	Use Peer DNS	Add Defa... Route	IP Address	Expires After
defconf	wlan1	yes	yes	172.24.136.73	00:23:45

Figure 6: MikroTik Setup: DHCP Cllet Configuration

WebFig v6.34.4 (stable)

DHCP Client <wlan1>

OK Cancel Apply Remove Release Renew

Status: bound not invalid

Enabled ☒

Interface wlan1

Use Peer DNS ☒

Use Peer NTP ☒

DHCP Options
 hostname
 clientid

Add Default Route yes

Default Route Distance 1

	Status
IP Address	172.24.136.73/22
Gateway	172.24.136.1
DHCP Server	172.24.136.1
Expires After	00:22:53

Figure 7: MikroTik Setup: DHCP wlan1 Configuration

1.2 WiFi Station to AP Bridge

A Linksys Router with a custom DD-WRT firmware was used as the AP bridge (Access Point Bridge). This configuration sets the router as a wireless access point that takes an ethernet connection and bridges the connection to its other 4 ports as well as hosts a wireless network that is also bridged to the ethernet connection. This allows us to host our own ABET-WiFi using the connection from the MikroTik router (Figures 8 and 9).

dd-wrt.com ... control panel

Firmware: DD-WRT v24 RC-5 (11/22/07) micro
Time: 22:02:02 up 3:14, load average: 0.10, 0.02, 0.00
WAN IP: 192.168.88.253

Setup Wireless Services Security Access Restrictions NAT / QoS Administration Status

Basic Setup DDNS MAC Address Clone Advanced Routing VLANs

WAN Setup

WAN Connection Type

Connection Type: Automatic Configuration - DHCP

STP: ☒ Enable ☐ Disable

Optional Settings

Router Name: ABET_Linksys

Host Name:

Domain Name:

MTU: Auto 1500

Network Setup

Router IP

Local IP Address: 192.168.1.1

Subnet Mask: 255.255.255.0

Gateway: 0.0.0.0

Local DNS: 0.0.0.0

Network Address Server Settings (DHCP)

DHCP Type: DHCP Server

DHCP Server: ☒ Enable ☐ Disable

Start IP Address: 192.168.1.100

Maximum DHCP Users: 50

Client Lease Time: 1440 minutes

Static DNS 1: 0.0.0.0

Static DNS 2: 0.0.0.0

Static DNS 3: 0.0.0.0

WINS: 0.0.0.0

Use DNSMasq for DHCP: ☒

Use DNSMasq for DNS: ☒

DHCP-Authitative: ☒

Time Settings

NTP Client: ☒ Enable ☐ Disable

Time Zone: UTC+01:00

Summer Time (DST): last Sun Mar - last Sun Oct

Server IP Name:

Save Apply Settings Cancel Changes

Help more...

Automatic Configuration - DHCP:
This setting is most commonly used by Cable operators.

Host Name:
Enter the host name provided by your ISP.

Domain Name:
Enter the domain name provided by your ISP.

Local IP Address:
This is the address of the router.

Subnet Mask:
This is the subnet mask of the router.

DHCP Server:
Allows the router to manage your IP addresses.

Start IP Address:
The address you would like to start with.

Maximum DHCP Users:
You may limit the number of addresses your router hands out.

Time Settings:
Choose the time zone you are in and Summer Time (DST) period. The router can use local time or UTC time.

Figure 8: DDWRT Setup: Basic Setup

dd-wrt.com ... control panel

Firmware: DD-WRT v24 RC-5 (11/22/07) micro
Time: 22:00:49 up 3:13, load average: 0.00, 0.00, 0.00
WAN IP: 192.168.88.253

Setup Wireless Services Security Access Restrictions NAT / QoS Administration Status

Basic Settings Radius Wireless Security MAC Filter Advanced Settings WDS

Wireless Physical Interface wif0

Physical Interface wif0 - SSID (ABET_WIFI) HWAddr (00:1D:7E:19:9A:5C)

Wireless Mode: AP

Wireless Network Mode: Mixed

Wireless Network Name (SSID): ABET_WIFI

Wireless Channel: 6 - 2.437 GHz

Wireless SSID Broadcast: ☒ Enable ☐ Disable

Network Configuration: ☐ Unbridged ☒ Bridged

Virtual Interfaces

Add

Save Apply Settings Cancel Changes

Help more...

Wireless Network Mode:
If you wish to exclude Wireless-G clients, choose B-Only mode. If you would like to disable wireless access, choose Disable.
Note: when changing wireless mode, some advanced parameters are susceptible to be modified ("Afterburner", "Basic Rate" or "Frame Burst").

Figure 9: DDWRT Setup: AP Bridge Mode

The next step is setting up a DNS which points <http://abetshare> to the ABET_1 IP address (Figure 10).

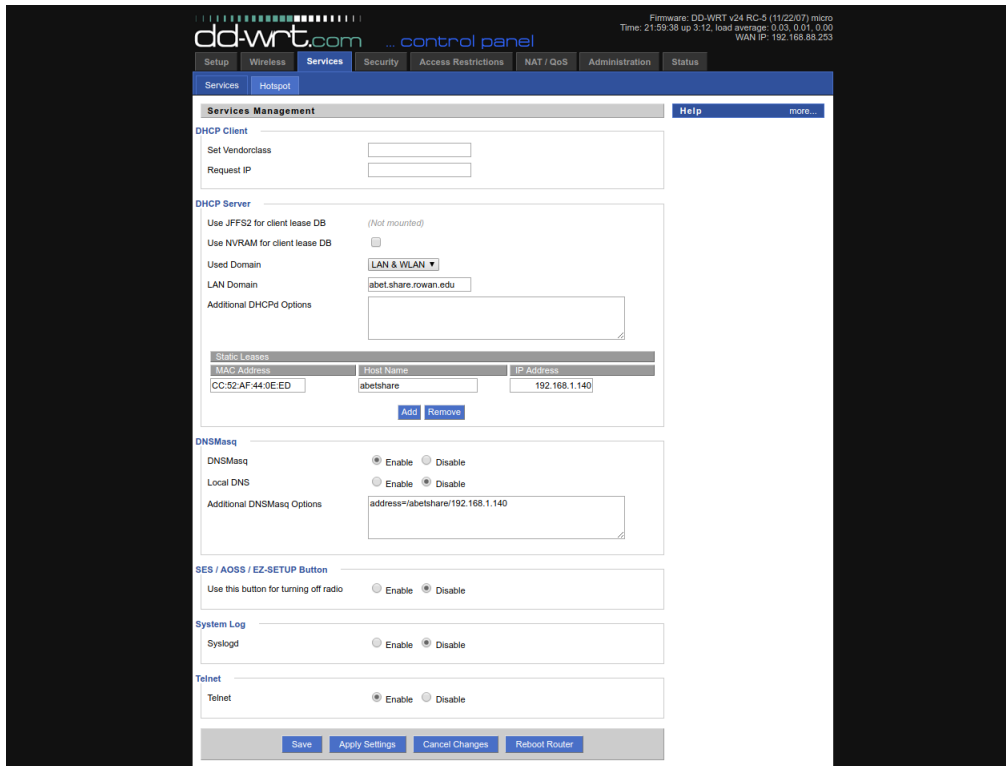


Figure 10: DDWRT Setup: DNS

2 Setting Up the Printers

Two printers were shared on the ABET network. This was done by connecting each printer to the WiFi to AP Bridge via Ethernet. One printer was connected via USB to ABET_1 and the other to ABET_2 and the printer drivers were installed on each desktop.

3 Setting Up the Desktops

The two ABET desktops, ABET-PC-1 and ABET-PC-2, are public desktops that are connected to the ABET network. One of the desktops hosts the ABET fileshare while the other continuously syncs with the fileshare.

3.1 Convert a “Rowan Desktop” to an “ABET Desktop”

Both desktops were taken from the labs in REXT, which means they are configured to connect to Rowan’s Network and only Rowan Administrators can modify networking and install software on them. In order to get these desktops to do what we want for the ABET network, we need to “un-Rowanify” them, meaning get them to boot to a fresh install of Windows where we have control over how they are configured.

3.1.1 Add a New Internal Drive

The first step in converting the desktops is to open them up, replace the current bootable drive that boots the locked-down Windows with a new drive on which we will install a fresh version of Windows. The following steps will accomplish this:

*Note: When taking apart desktops, you should **never** force anything open, remove rivets, or need to use any power tools. If you are ever unsure how to detach a component, refer to the manufacturer's documentation.*

1. Opening the Desktop Chassis

The procedure to remove the side panel varies based on the manufacturer of the case, however it should be intuitive, it typically involves unscrewing two large screws on the back of the case or squeezing a tab that unhooks the side panel. Just make sure you have a clean working environment so things don't get lost. Once the side panel is removed, you may find that the inside of the desktop is dusty, in which case you'll want to use compressed air to clean out the dust.

2. Locating the Drive Bay

The drive bay is a compartment that holds the hard drives (HDD's) or solid state drives (SSD's) which are hold the system's internal storage. The drive bay is usually in the front-bottom corner of the case. You should see two cables that go to a drive in the drive bay, one from the motherboard, and one from the power supply, this drive is the one you will be replacing.

3. Replacing the Bootable Drive

Similar to opening the side panel, there should be an intuitive way to open the drive bay and remove the bootable drive. Remove the cables from the drive, unmount the drive from the drive bay, label this drive and store it in a safe place (you will have to re-install this drive when it goes back to being a Rowan desktop so don't lose it), place a new HDD or SSD into the drive bay, and connect the two cables you disconnected to the new drive. At this point, you should be able to install an OS on this drive.

3.1.2 Fresh Install Windows

1. Insert a bootable Windows install media into the desktop.

2. Entering the BIOS or UEFI

Before you turn on the computer, it is important that you know how to configure the booting sequence to boot from you bootable Windows drive instead of the empty drive that you inserted earlier. To do this, you will need to enter the BIOS (Basic Input/Output System) or the UEFI (Unified Extensible Firmware Interface). This is done by pressing a specific key on the keyboard during booting. Usually this key is one of the function keys F1-F12, the Delete Key, or the Escape Key. You can try to mash all the keys randomly at first and see if a text-based menu opened up, or you can look at the manufacturer's specific instructions for entering the BIOS.

3. Modifying the Boot Order

In the BIOS/UEFI menu, you should see a menu that says "Boot Order" or something similar. Navigate to that menu and you should see be able to modify the boot sequence that the computer performs at startup. The highest item in the boot order is the drive that the computer tries to boot from if it can. If that drive is unavailable, it goes to the next drive in the list and tries to boot from it. Modify this order so that the first drive in the list is your Windows USB flash drive or CD. Once this is done, save and exit the BIOS, the computer will restart and if successful, boot into the Windows installation menu.

4. Installing Windows

The installation process for Windows should be straight-forward. Choose the unallocated drive to be where Windows is installed and wait for all steps to complete. When prompted for a system and a user account name, enter something like "ABET-1-PC" and "ABET-1" to keep things simple. Once installation is complete, you should restart enter the BIOS again and change the boot order again so the Windows installation drive has the highest priority.

3.2 Setting Up File Sync

The file sync software used was Syncthing, a free, open-source, and light-weight application that syncs folders between computers over a local network. Syncthing was installed on both ABET desktops and used to sync the ABET_SHARE folder on each desktop. Configuring Syncthing is done via a web-interface and it should be done on one desktop at a time to avoid conflicts (Figure 11).

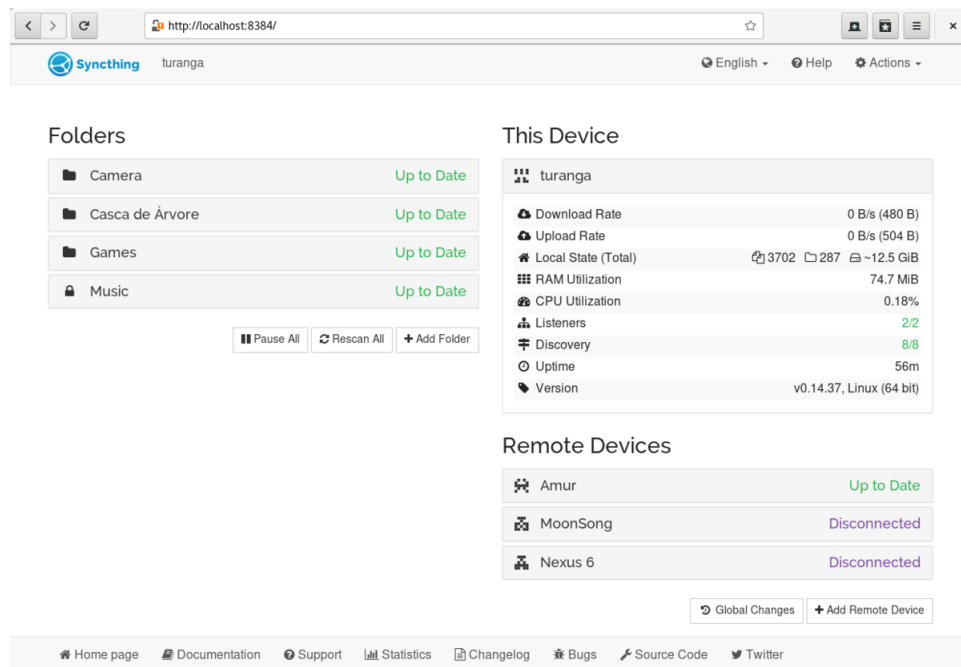


Figure 11: Syncthing Screenshot

1. Launch Syncthing on both desktops.
2. On ABET_1, open the Syncthing web-interface.
3. Select “Add Remote Device.” Syncthing should be able to detect the other Syncthing instance it should prompt to add the other desktop in which case, add this device and give it a name “ABET_2-PC”. If Syncthing is unable to detect the other instance, you will have to manually type ABET_2’s device id.
4. Next, in the main menu, select “Add Folder” and choose the ABET_SHARE folder. You should see ABET_2-PC in the sharing options menu, check the box next to ABET_2-PC to share this folder with ABET_2.
5. Finally, on ABET_2’s Syncthing web interface, a notification will pop up asking to accept the ABET_SHARE file sync. Click accept, choose its location as “Desktop/ABET_SHARE.”
6. At this point, Syncthing should working on both desktops and the contents of the ABET_SHARE folder should sync between both desktops.

3.3 Setting Up Fileshare Server

The fileshare software used was HFS (HTTP File Share), a free, open-source, and lightweight file server that runs on Windows. This was installed on the ABET_1 desktop. HFS takes care of generating a web-interface for uploading and downloading documents, all that needs to be configured is a local folder path with the files your wish to share. A folder named ABET_SHARE was created on the ABET_1 desktop and used as the entry point for the fileshare.

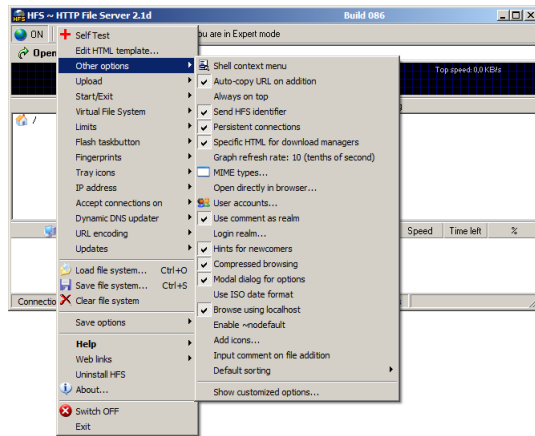


Figure 12: HFS Server Configuration

When HFS is running, you can access the fileshare webpage at the IP address of ABET_1 on the ABET network. To make things as seamless as possible, a DNS name was setup on the WiFi Station to AP Bridge (Figure 10) so users can type “abetshare” into their browsers instead of an IP address to access the HFS web-interface. If configured correctly, all devices on the ABET network should be able to access the file share as <http://abetshare> (Figures 13 and 14).

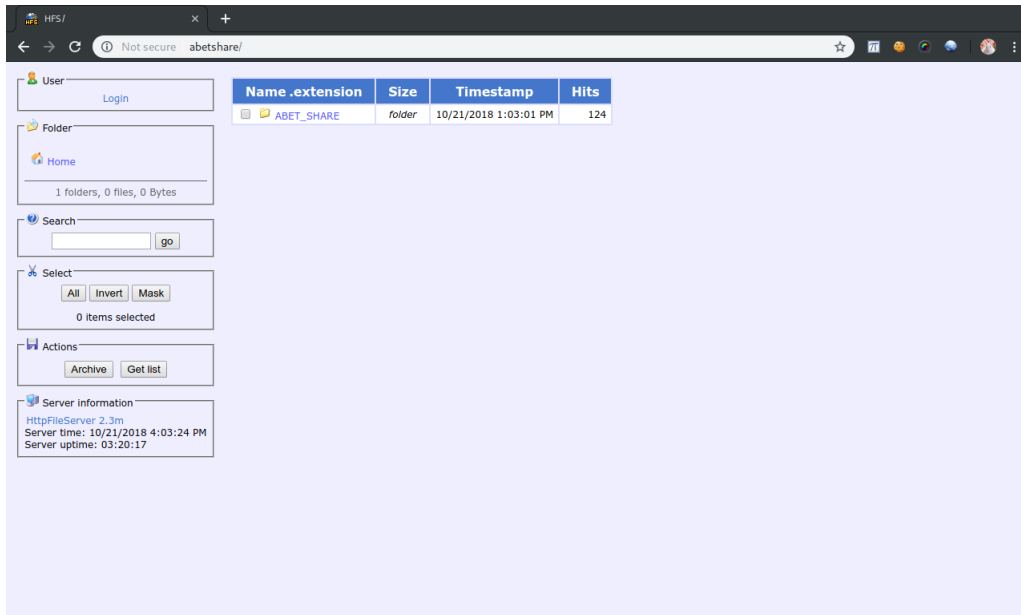


Figure 13: Fileshare Client

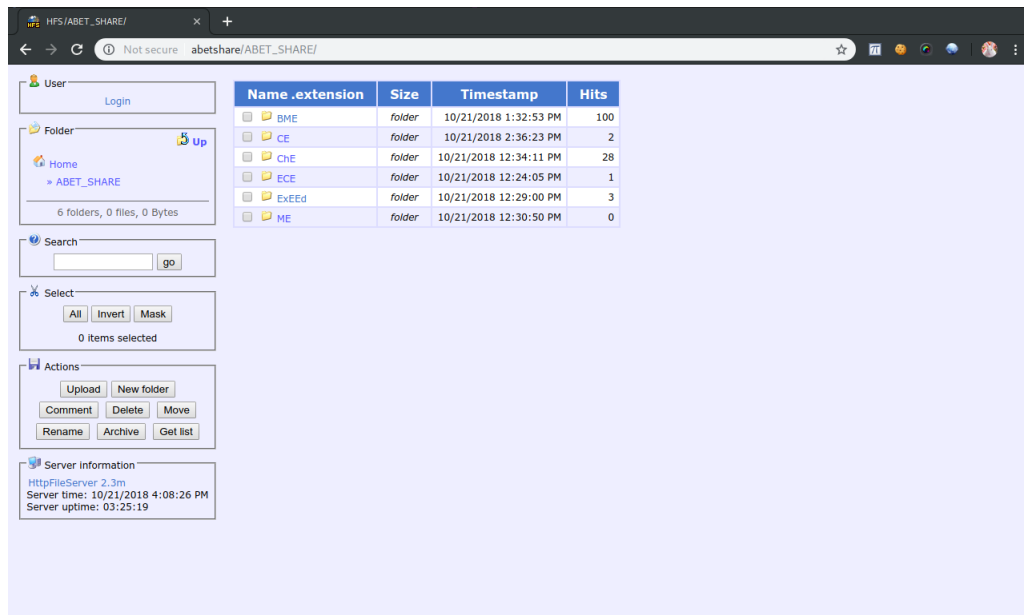


Figure 14: HFS Client