



KTBRN1 Border Router

Quick Start Guide

Introduction

Installation and setup of the KTBRN1 Thread Backbone Border Router.

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Revision History

Date	Revision	Changes
08/2019	1.0	Initial release.
10/2019	1.1	Updated content with more explanations and screenshots.
02/2020	2.0	New version 2.0
04/2020	2.1	New features and contents added

1. Required Components

Before beginning with KTBRN1 installation, it is recommended to have the following list of components in place:

- A KTBRN1 device.
- A micro SD card, recommended class 10 A1-rated and at least 2 GB of capacity.
- A USB Type-A male to micro USB Type-B cable.
- An Ethernet cable.
- A personal computer.

2. Installation Guide

2.1. Download required software

Make sure you get the latest release of our Debian-based image for KTBRN1 that includes KiBRA software, which you will can find on our website, in the following URL.

- [KTBRN1 + KiBRA image file](#)

Likewise, download the file [KiBRA-v2.x.x.zip](#) for later use.

The following software is needed in order to update the image stored in your SD card or to flash a new one.

- [Balena Etcher](#)

A Serial terminal or/and SSH client will be required for connecting to KTBRN1 device.

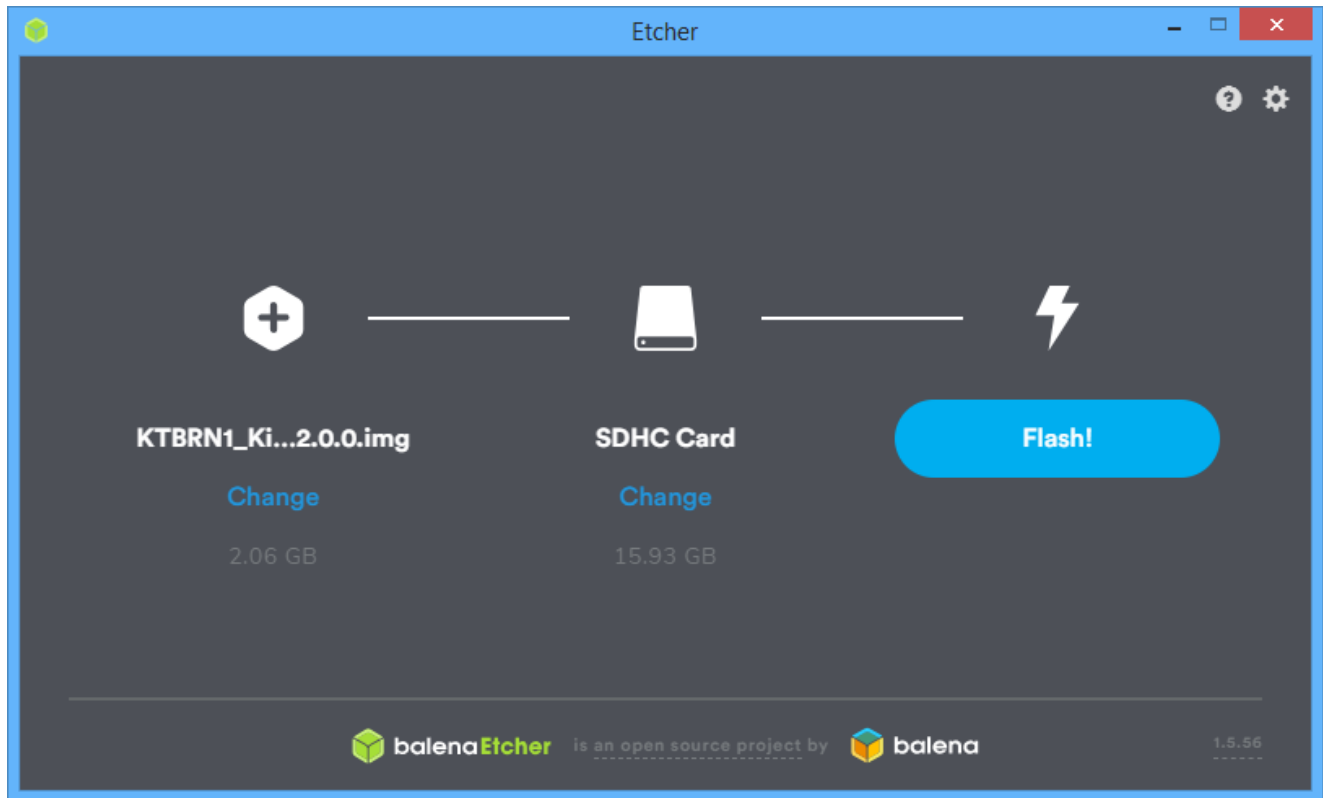
- [MobaXterm free](#) (Any other software can be used)
- [Zadig](#) (in case of needing to install USB Serial drivers)

2.2. Flash image to SD card

In case it is needed to update or flash an image to SD card, please follow the instructions bellow:

- 1) Install and launch Balena Etcher.
- 2) Select the file with extension .gz in Etcher.
- 3) Put the micro SD card in a card reader in the computer and select it in Etcher. It is recommended to use micro SD card class 10 A1-rated and at least 2 GB of capacity.

- 4) Press Flash and wait to finish.
- 5) Eject the SD card from the computer and place it in the KTBRN1 card holder.



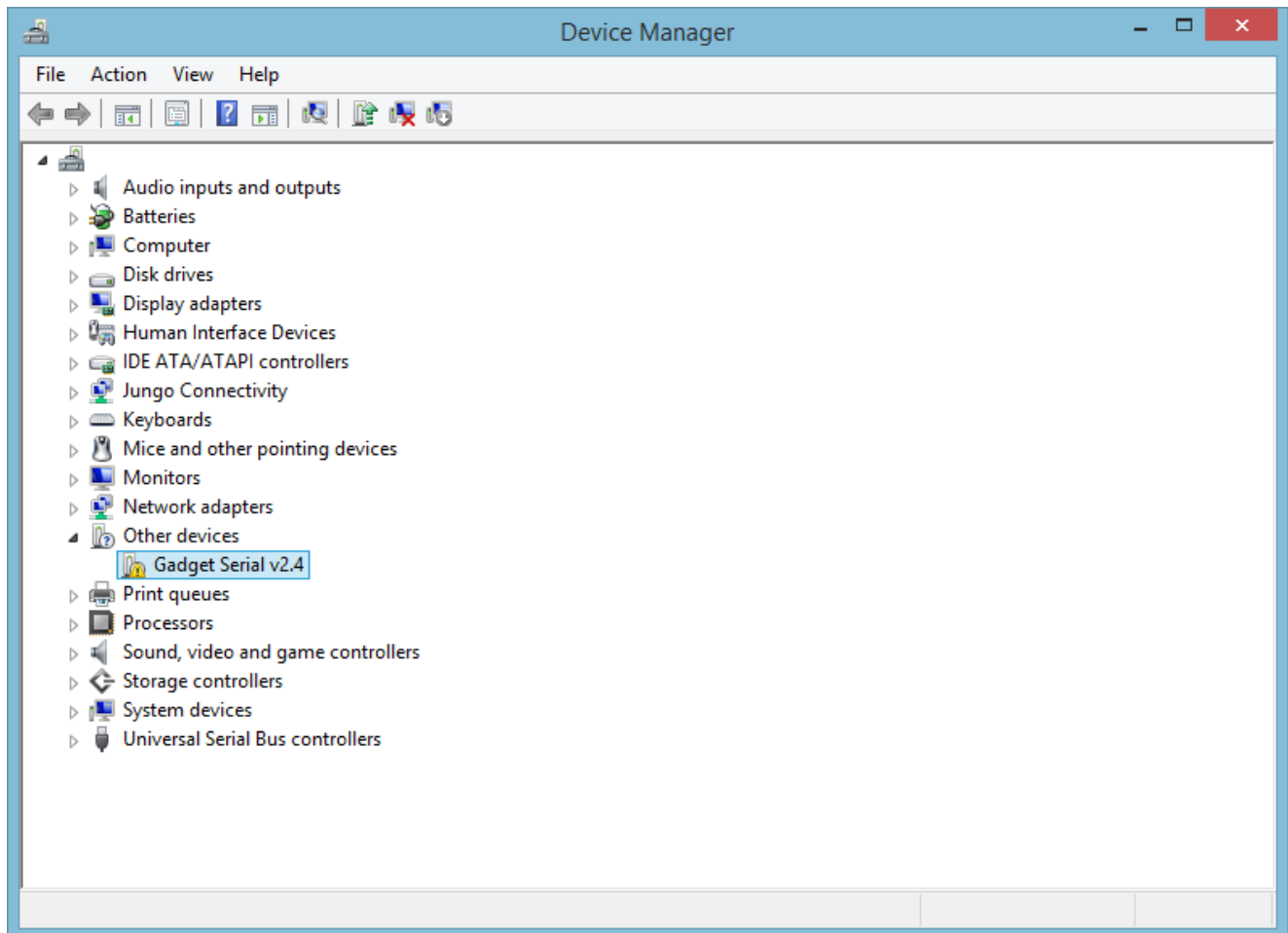
2.3. First time installation

Connect a USB cable to the KTBRN1 and to PC or USB hub. The first time you turn on the KTBRN1 device, **it will take about a couple of minutes** to be ready to accept connections. Please do not turn off the system until the first-time installation process has completely finished.

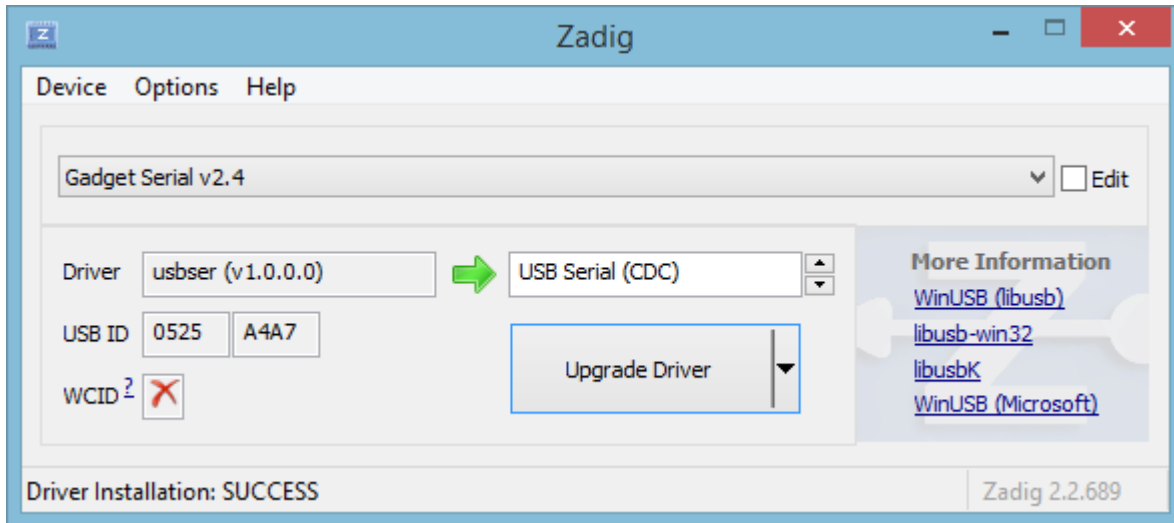
After that, you can access KTBRN1 through USB Serial port by following the instructions bellow.

2.3.1. Connecting via USB Serial port

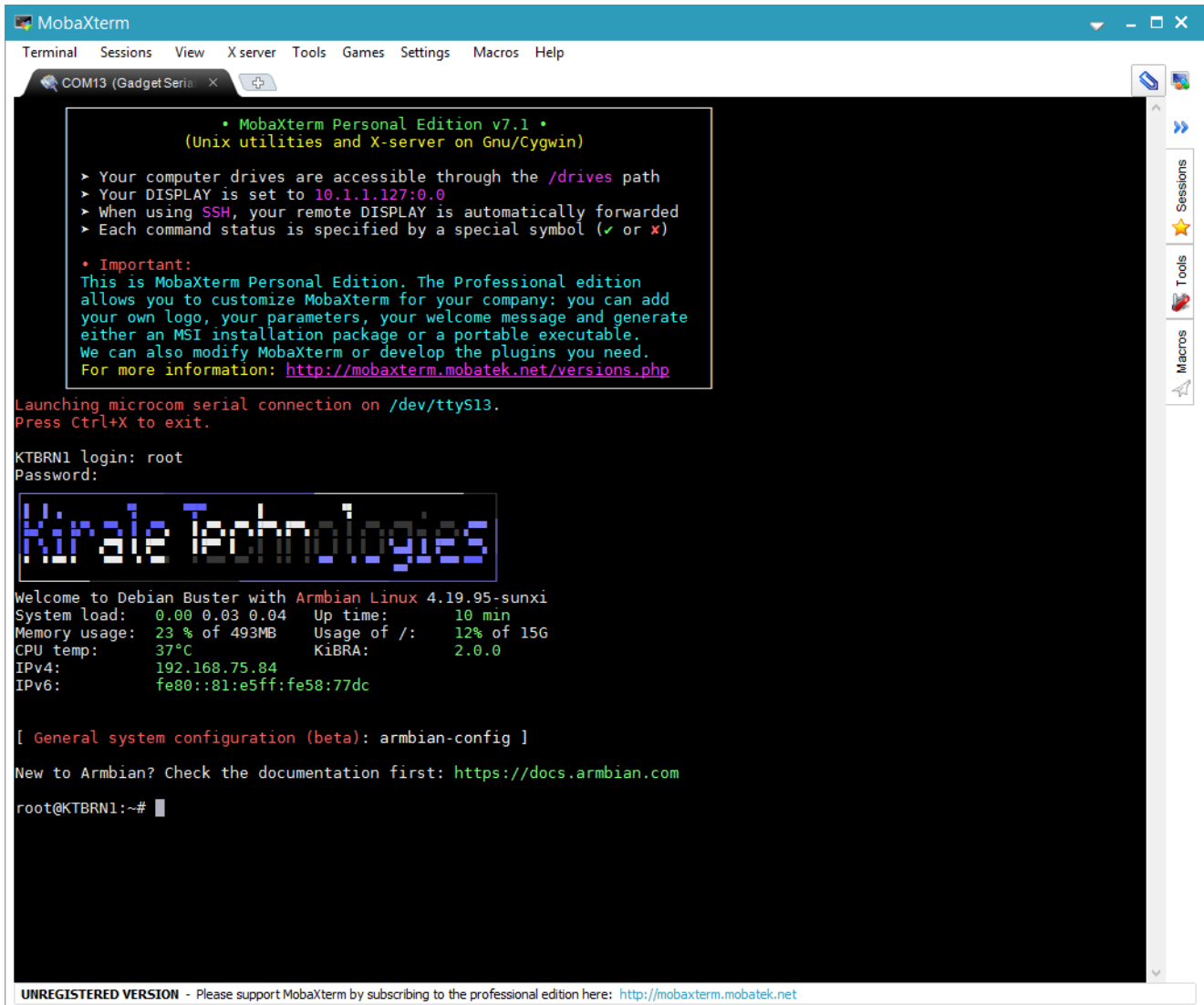
A new serial device should be listed (*Pi USB to Serial*) depending on your OS. It may be required to install the driver for the USB Serial port, so check if the device has been recognized by your PC.



If such is the case, install the driver by means of Zadig tool.



Once you have got access to KTBRN1 via USB serial, launch MobaXterm and open a new Serial session with the new listed port and speed 115200, then a login console should appear after clicking enter. Login with user `root`, password `kirale123`.



```
MobaXterm
Terminal Sessions View X server Tools Games Settings Macros Help
COM13 (Gadget Serial)
• MobaXterm Personal Edition v7.1 •
(Unix utilities and X-server on Gnu/Cygwin)
> Your computer drives are accessible through the /drives path
> Your DISPLAY is set to 10.1.1.127:0.0
> When using SSH, your remote DISPLAY is automatically forwarded
> Each command status is specified by a special symbol (✓ or ✗)
• Important:
This is MobaXterm Personal Edition. The Professional edition
allows you to customize MobaXterm for your company: you can add
your own logo, your parameters, your welcome message and generate
either an MSI installation package or a portable executable.
We can also modify MobaXterm or develop the plugins you need.
For more information: http://mobaxterm.mobatek.net/versions.php
Launching microcom serial connection on /dev/ttyS13.
Press Ctrl+X to exit.
KTBRN1 login: root
Password:
Kirale Technologies
Welcome to Debian Buster with Armbian Linux 4.19.95-sunxi
System load:  0.00 0.03 0.04  Up time:    10 min
Memory usage: 23 % of 493MB  Usage of /:  12% of 15G
CPU temp:    37°C           KiBRA:      2.0.0
IPv4:        192.168.75.84
IPv6:        fe80::81:e5ff:fe58:77dc
[ General system configuration (beta): armbian-config ]
New to Armbian? Check the documentation first: https://docs.armbian.com
root@KTBRN1:~#
```

UNREGISTERED VERSION - Please support MobaXterm by subscribing to the professional edition here: <http://mobaxterm.mobatek.net>

The welcome screen will show you information about IP addresses configured in KTBRN1 and what KiBRA version is running.

By default, the provided image comes configured with a static IPv4 address for Ethernet interface:

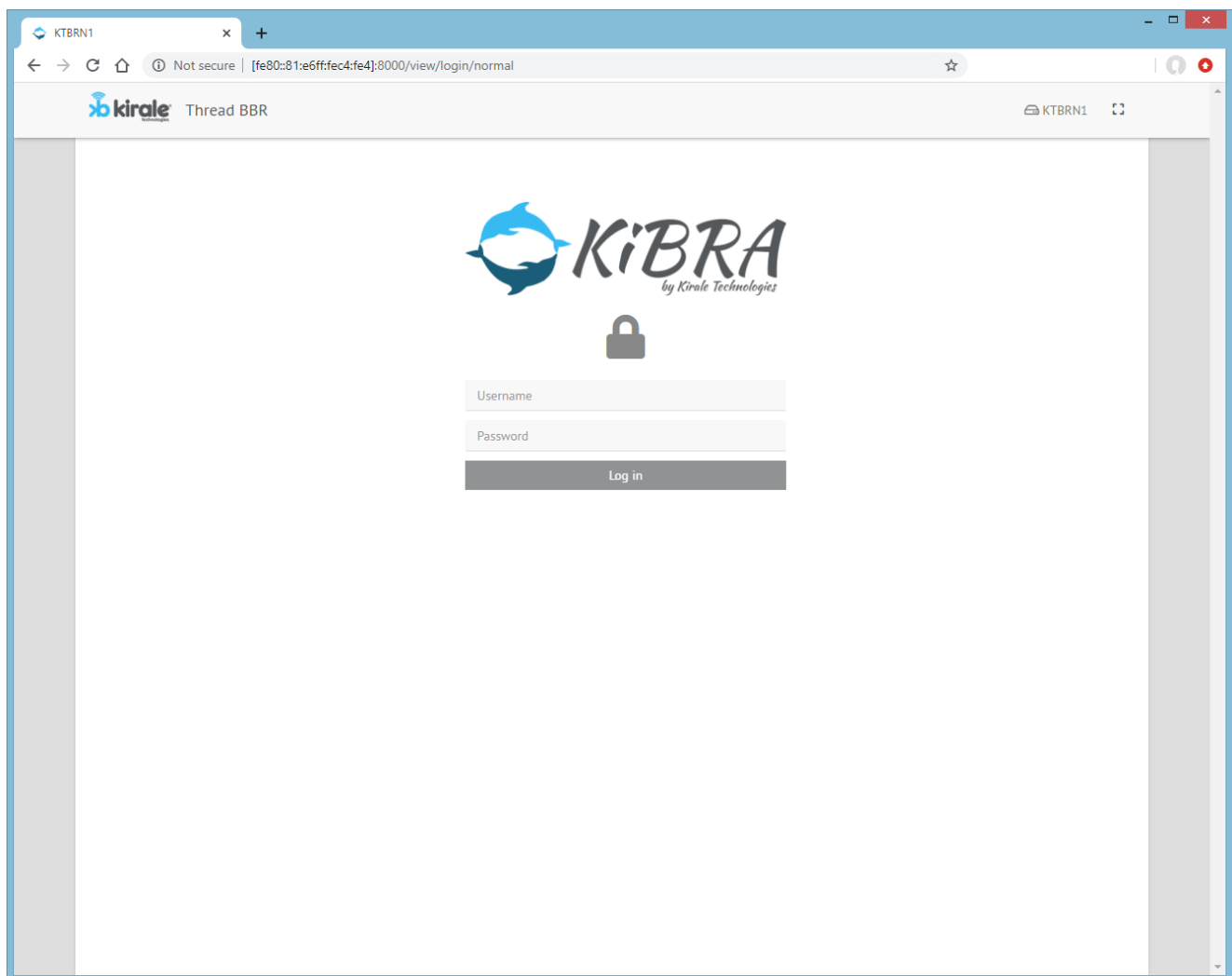
IPv4 address: 192.168.75.84/24

Furthermore, it comes with IPv6 protocol enabled for Ethernet interface so that it is possible to access Web Administration as well as SSH port by means of IPv4 and IPv6 (link-local) addressing.

3. Web Administration Panel

The access to the Web Administration Panel is available in port 8000 of KTBRN1. Type <http://192.168.75.84:8000> or [http://\[IPv6\]:8000](http://[IPv6]:8000) in your browser (preferably Chrome or Firefox for compatibility reasons) and the login page should be shown.

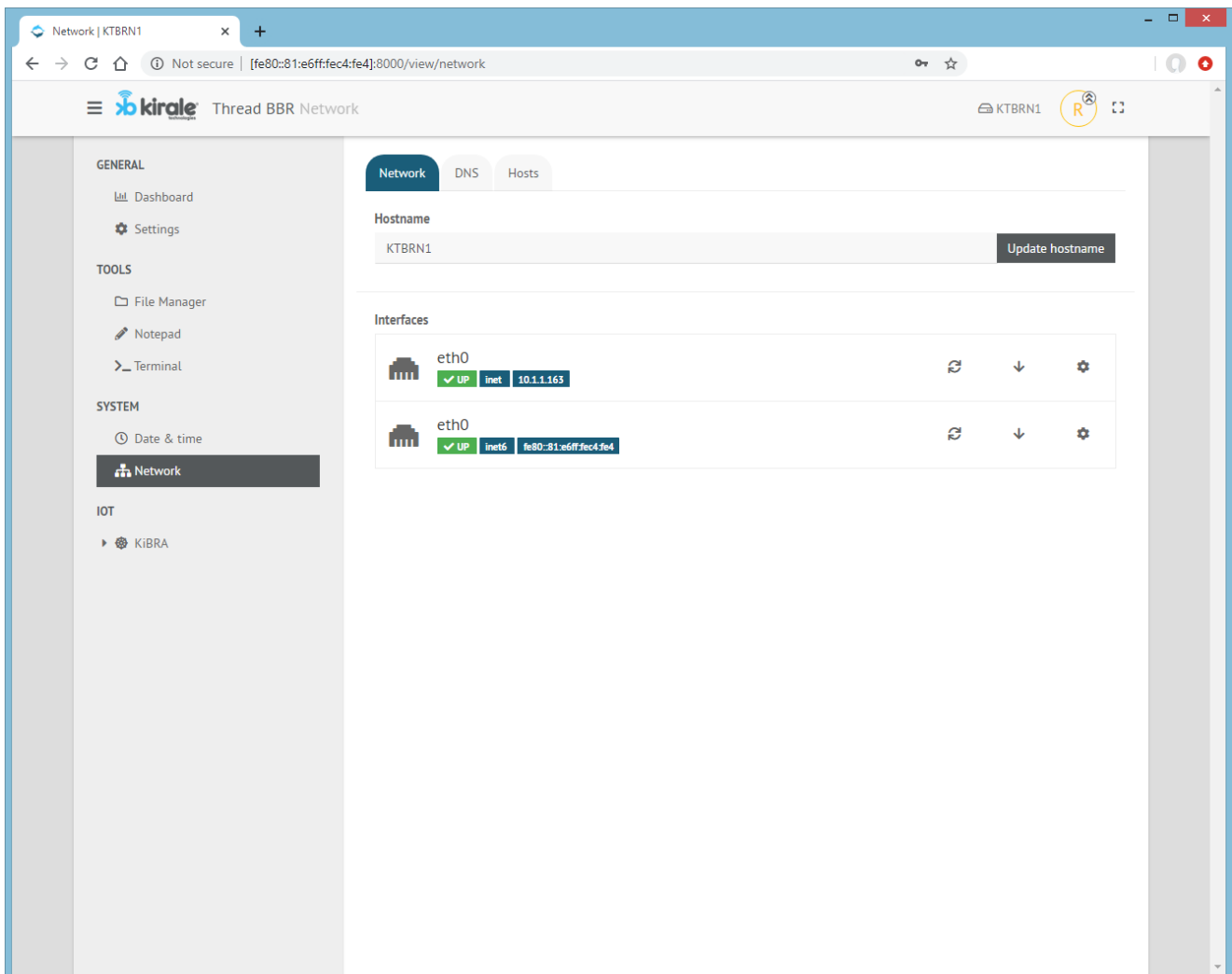
Note: Your PC must be connected to the same network as KTBRN1.



Credentials are the same as before. Login with user `root`, password `kirale123`.

3.1. Change network configuration

The administrator may want to allow DHCPv4 auto-configuration or change the default IPv4 address by other one. This can be done by accessing the “Network” menu in the Web Admin.

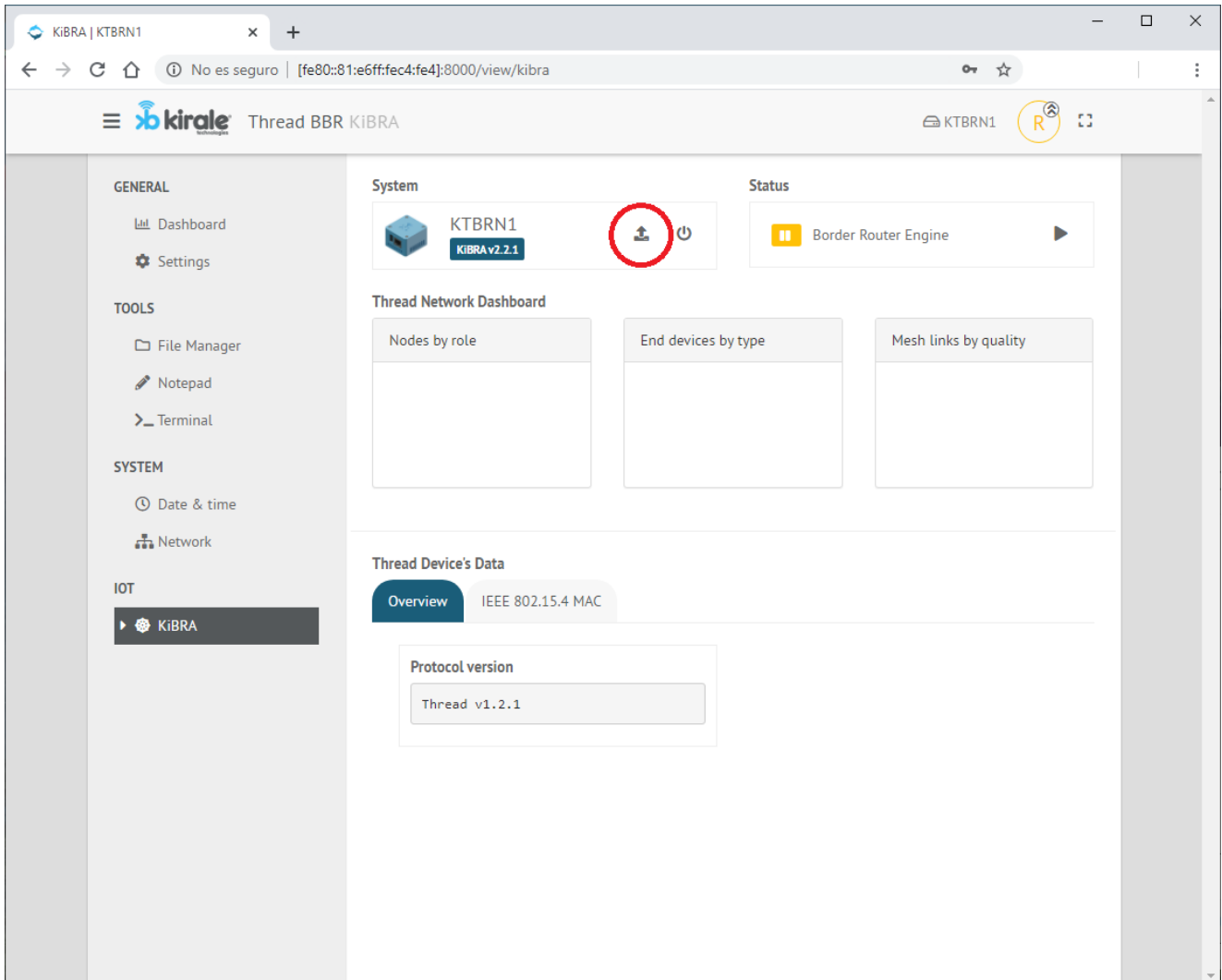


In the picture above, the new IPv4 address acquired by DHCP is 10.1.1.163. It is now possible to connect to KTBRN1 through SSH client to this IPv4 address or also to IPv6 link-local address if the PC is connected to the same network. Besides KiBRA will use this exterior IPv4 address for its NAT64 function.

Note: A reboot may be required to make sure that new settings are correctly applied.

3.2. Update KiBRA

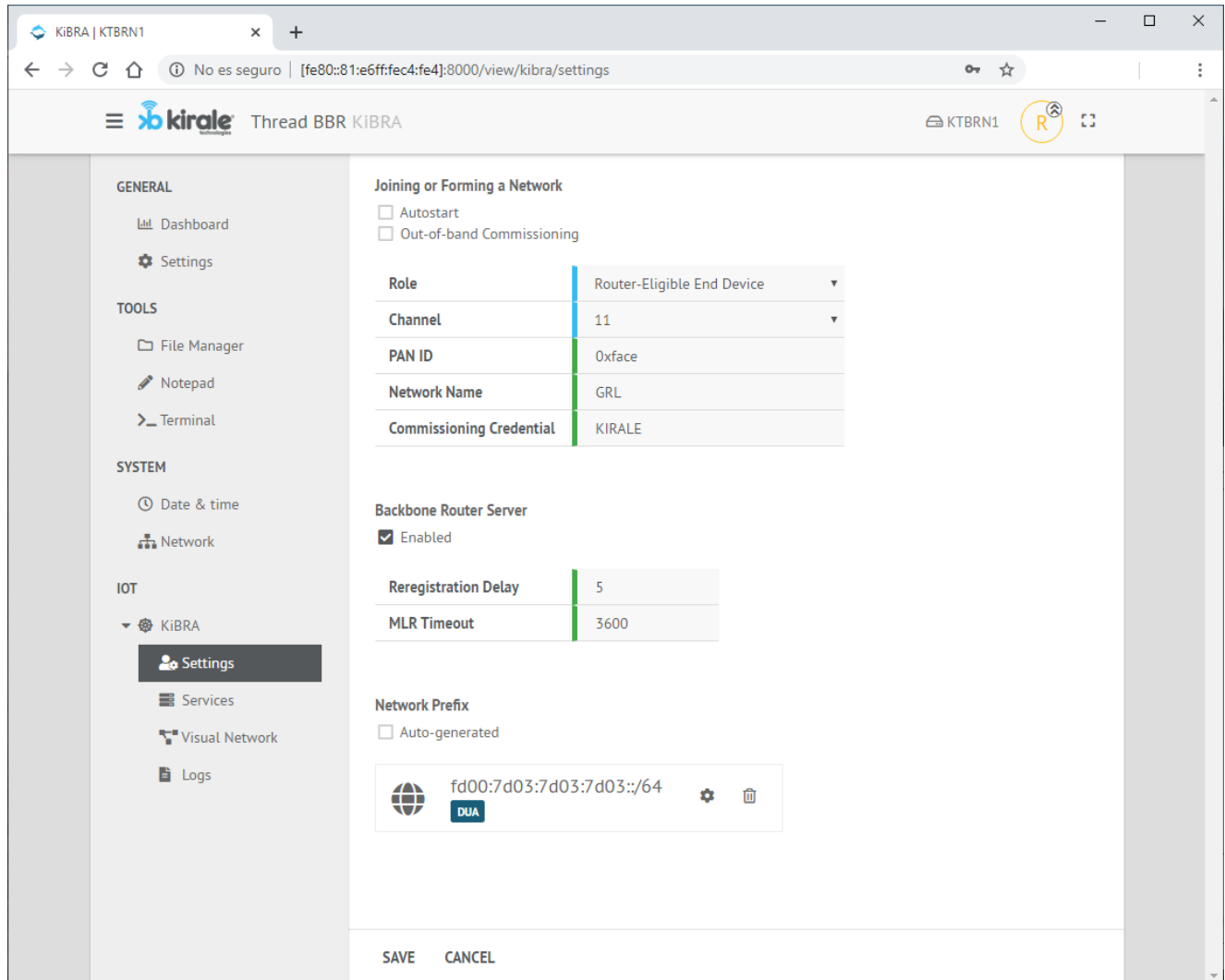
This can be done by going to “KiBRA” menu and clicking the “Upgrade” icon which is located next to the KTBRN1 picture in “System” section.



Then select the KiBRA-v2.x.x.zip file from the PC, click the “Install” button and follow the instructions that will appear on the screen.

3.3. Configure Border Router

Click the “Settings” sub-menu under the “KiBRA” menu to access the configuration page. If an input field is shown in red colour, a right value will be required to be set before saving changes.



KiBRA | KTBRN1

Thread BBR KIBRA

KTBRN1

GENERAL

- Dashboard
- Settings

TOOLS

- File Manager
- Notepad
- Terminal

SYSTEM

- Date & time
- Network

IOT

- KiBRA
 - Settings
 - Services
 - Visual Network
 - Logs

Joining or Forming a Network

☐ Autostart

☐ Out-of-band Commissioning

Role	Router-Eligible End Device
Channel	11
PAN ID	0xface
Network Name	GRL
Commissioning Credential	KIRALE




Backbone Router Server

☒ Enabled

Reregistration Delay	5
MLR Timeout	3600

Network Prefix

☐ Auto-generated

 fd00:7d03:7d03:7d03::/64  

DUA

SAVE CANCEL

3.3.1 Joining or Forming a Thread Network

This section outlines the configuration of how a device will join a network and the parameters which are needed during this process.

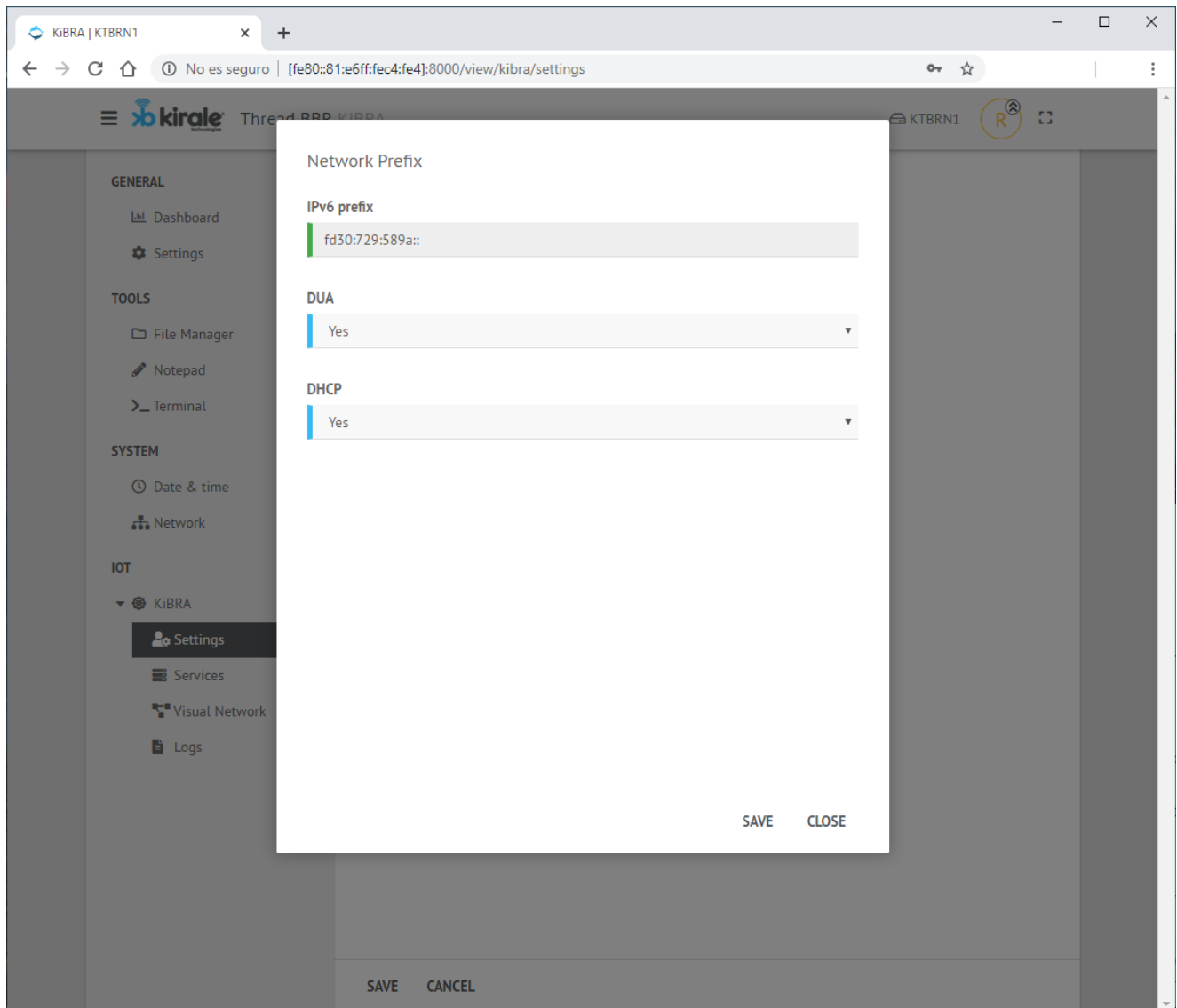
- Autostart: if this option is checked, Border Router will try to automatically join to Thread network after the next reboot.
- Out-of-band Commissioning: it allows selecting the kind of attaching that Border Router will make when it starts up.

3.3.2 Backbone Router Server

It gives the possibility of enabling or disabling the BBR function. Likewise, the administrator can set up specific parameters used by Border Router Server.

3.3.3 Network Prefix

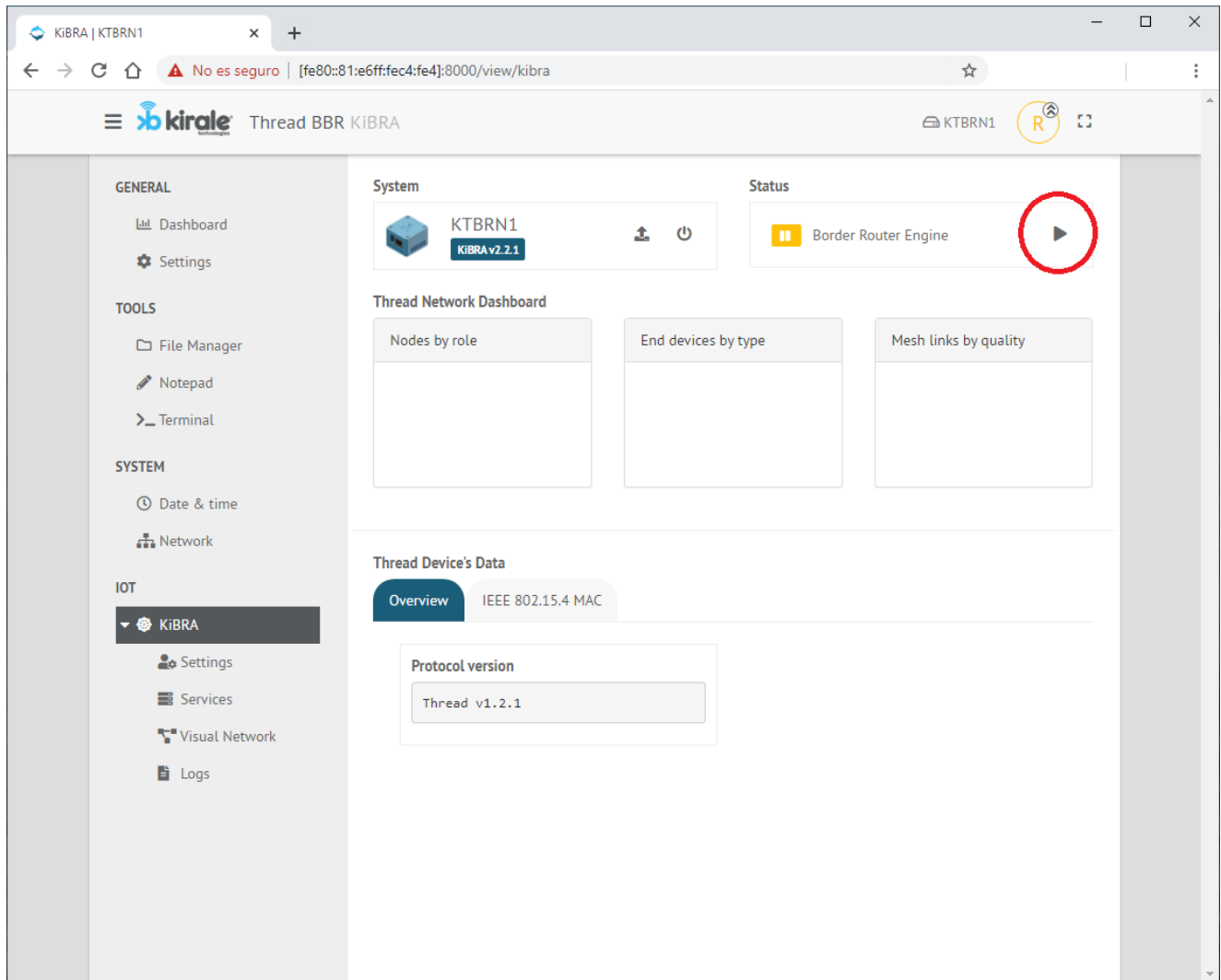
It enables manual configuration of the network prefix which will be used in Thread network. User can decide throughout different options how IPv6 addressing will be acquired by nodes within network, i.e. DHCP or SLAAC. If BBR function is turned on, then DUA prefix will be enabled.



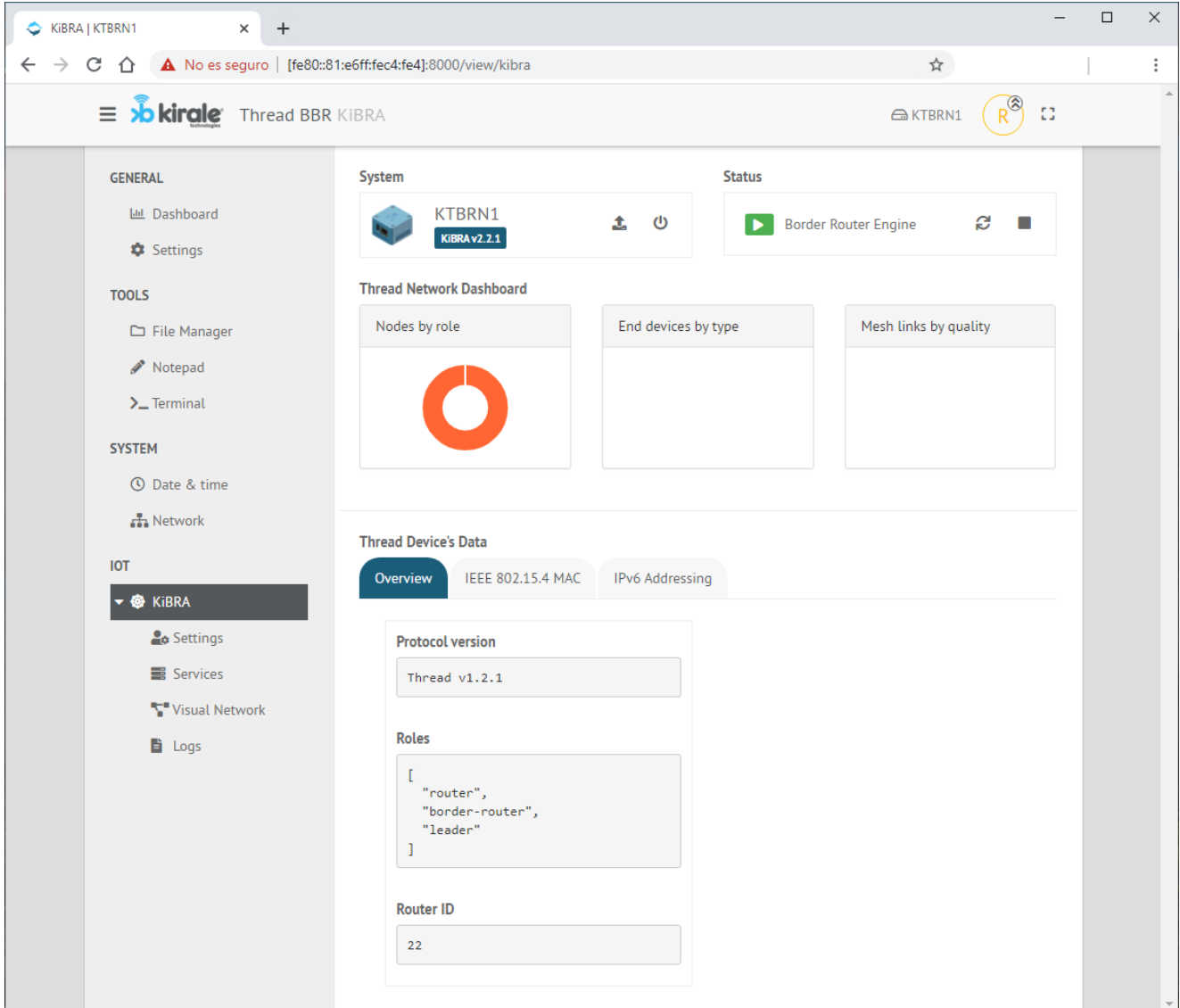
Once Border Router has been configured with desired parameters, save the changes.

3.4. Start-up Border Router

Go to “KiBRA” menu in order to start Border Router Engine.

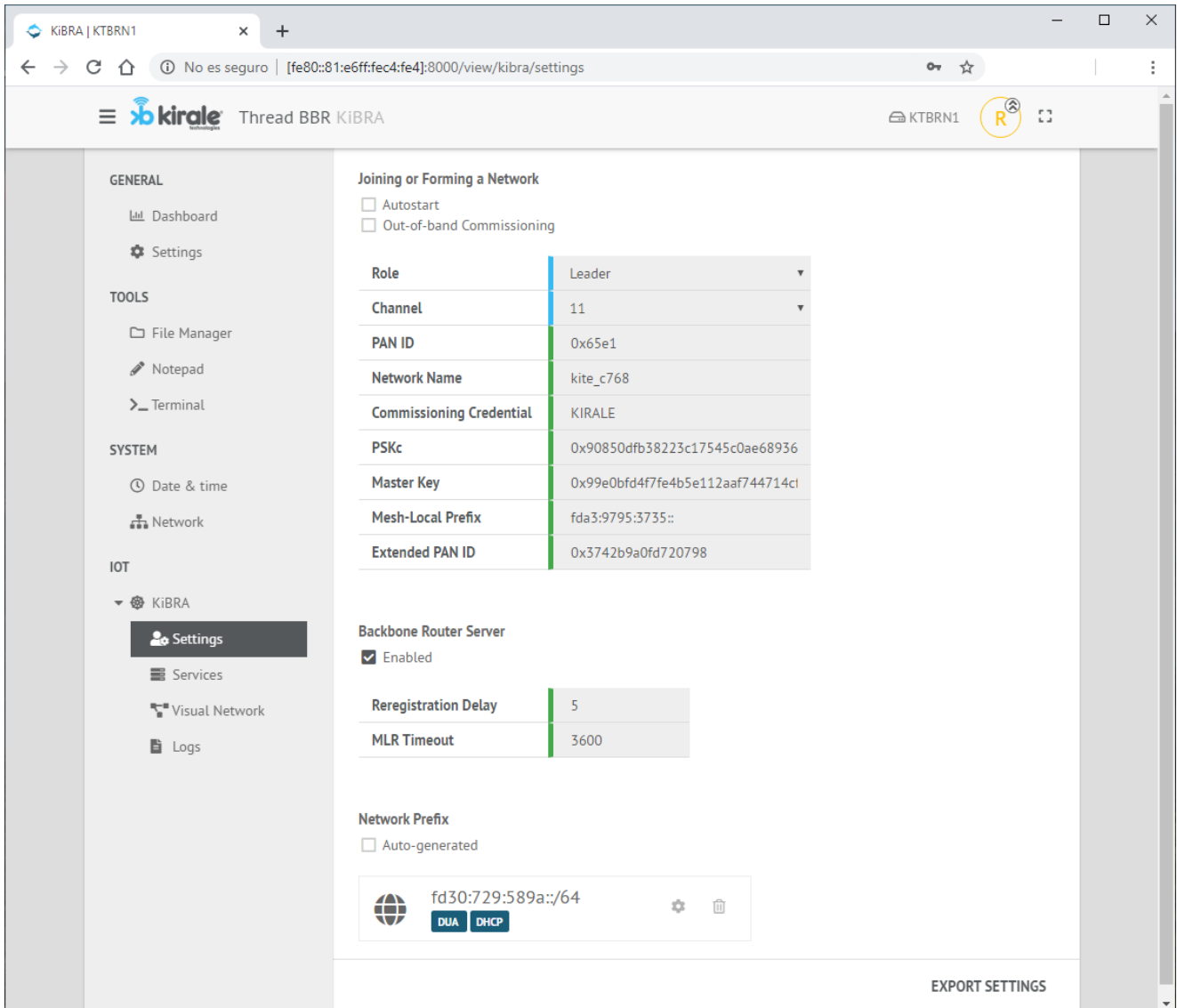


After clicking the start button, the device either will join the selected network or form a new one, depending on settings configured by the administrator.



The screenshot displays the KIBRA web interface for KTBRN1. The browser address bar shows the URL `[fe80::81:e6ff:fec4:fe4]:8000/view/kibra`. The interface includes a sidebar with navigation options: GENERAL (Dashboard, Settings), TOOLS (File Manager, Notepad, Terminal), SYSTEM (Date & time, Network), and IOT (KiBRA, Settings, Services, Visual Network, Logs). The main content area is titled "Thread BBR KIBRA" and features a "System" section with a "KTBRN1 KIBRA v2.2.1" status box and a "Status" section with a "Border Router Engine" status box. Below these is the "Thread Network Dashboard" with three charts: "Nodes by role" (a donut chart), "End devices by type", and "Mesh links by quality". At the bottom is the "Thread Device's Data" section, which includes tabs for "Overview", "IEEE 802.15.4 MAC", and "IPv6 Addressing". The "Overview" tab is active, showing the "Protocol version" as "Thread v1.2.1", the "Roles" as an array containing "router", "border-router", and "leader", and the "Router ID" as "22".

If you go back to the “Settings” sub-menu, it is possible to see the rest of Thread network configuration parameters that have been configured either by the administrator or by the system itself on startup.



The screenshot shows the KIBRA | KTBRN1 settings page in a web browser. The page is titled "Thread BBR KIBRA" and has a sidebar with navigation options: GENERAL (Dashboard, Settings), TOOLS (File Manager, Notepad, Terminal), SYSTEM (Date & time, Network), and IOT (KiBRA, Settings, Services, Visual Network, Logs). The main content area is divided into several sections:

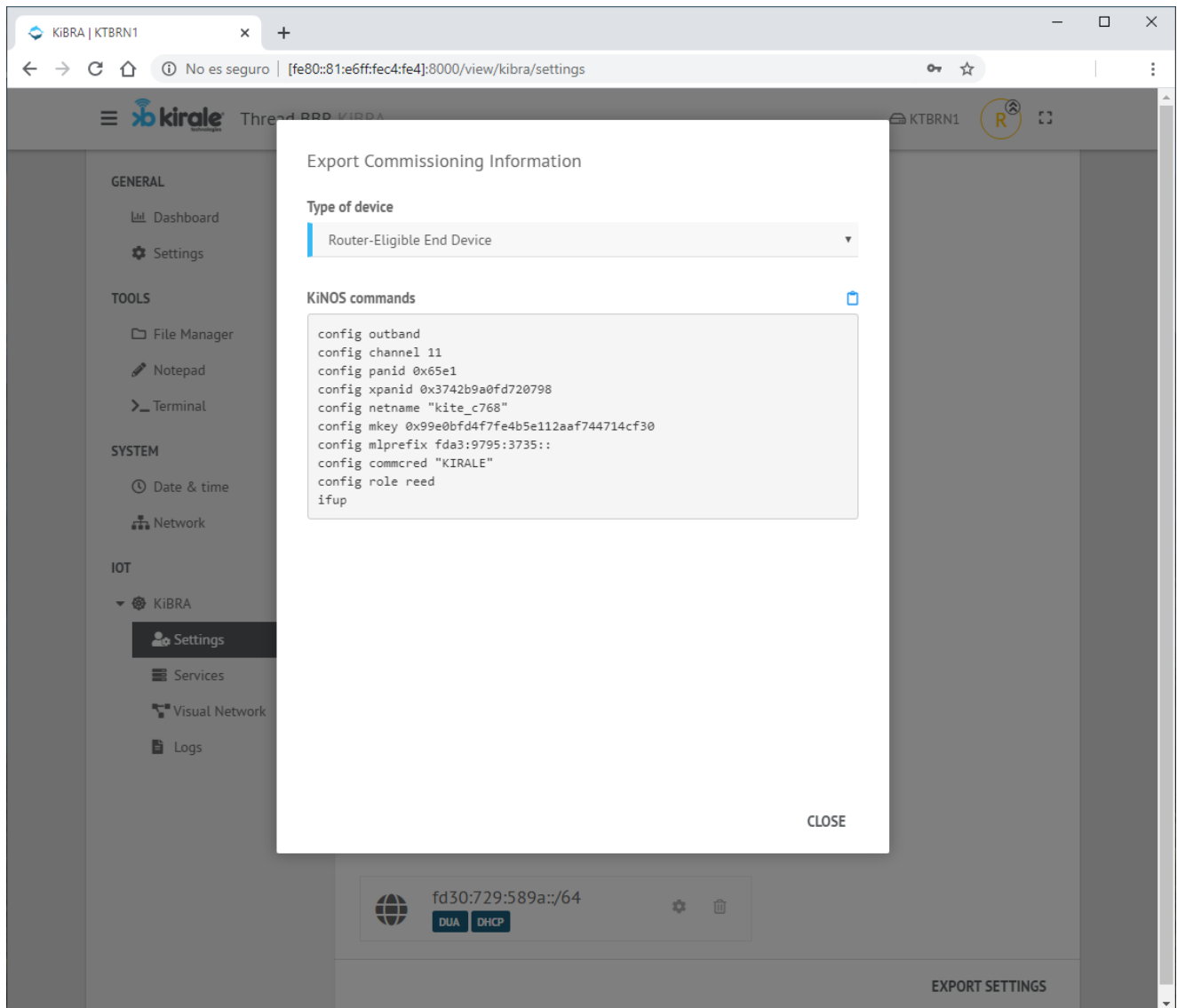
- Joining or Forming a Network:** Includes checkboxes for "Autostart" and "Out-of-band Commissioning". Below this is a table of network parameters:

Role	Leader
Channel	11
PAN ID	0x65e1
Network Name	kite_c768
Commissioning Credential	KIRALE
PSKc	0x90850dfb38223c17545c0ae68936
Master Key	0x99e0bfd4f7fe4b5e112aaf744714c1
Mesh-Local Prefix	fda3:9795:3735::
Extended PAN ID	0x3742b9a0fd720798
- Backbone Router Server:** Includes a checkbox for "Enabled" (checked) and a table of parameters:

Reregistration Delay	5
MLR Timeout	3600
- Network Prefix:** Includes a checkbox for "Auto-generated" (unchecked) and a text input field showing "fd30:729:589a::/64" with "DUA" and "DHCP" buttons.

An "EXPORT SETTINGS" button is located at the bottom right of the settings area.

Here you can gather the information needed to attach other devices to the same network. There is a button below called “Export Settings” which allows copying commissioning information, required to provision a new device into the network, by means of KiNOS commands.

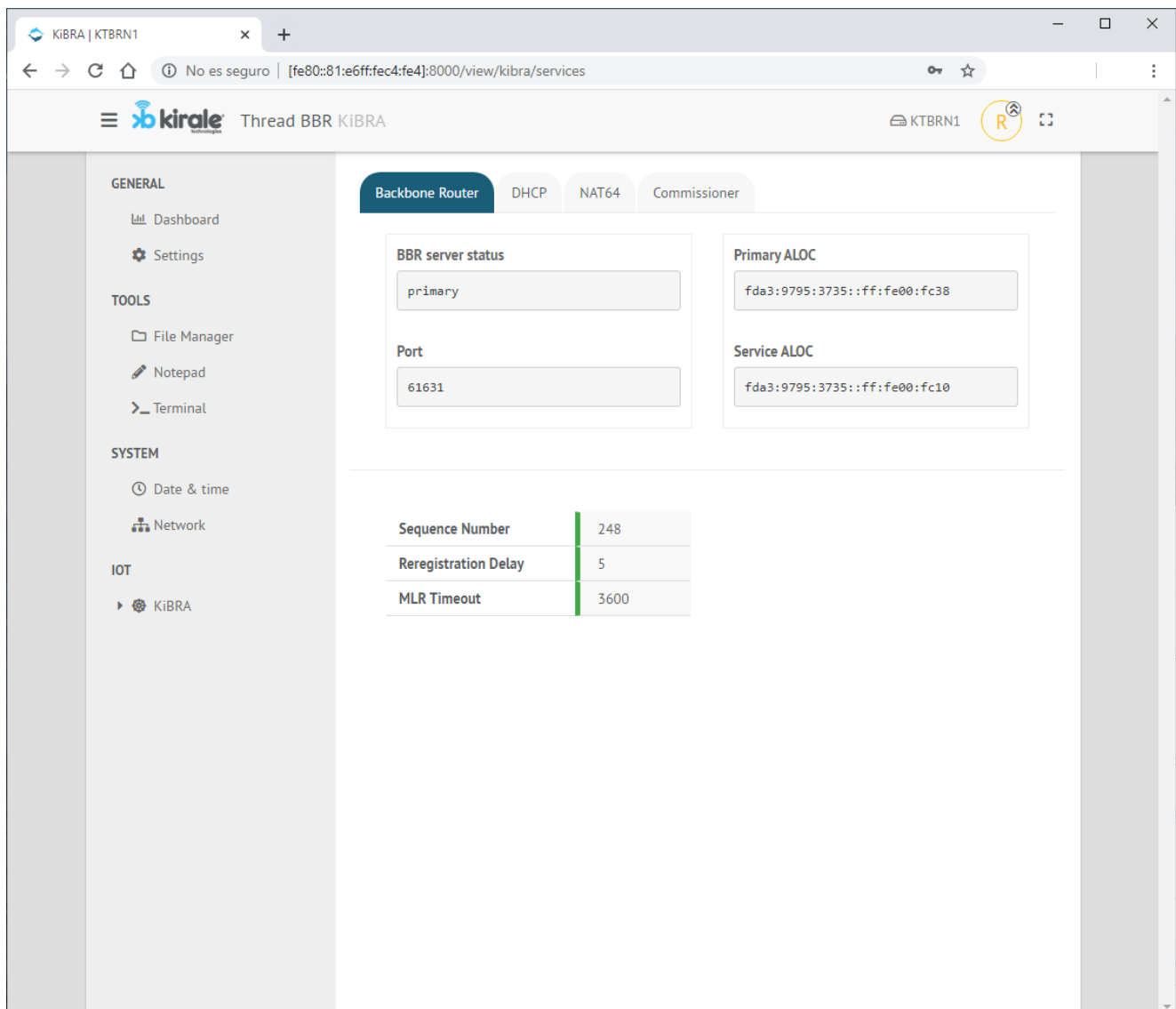


3.5. Services

The administrator can see what services are being provided by Border Router right now and their current state in “Services” sub-menu under the “KiBRA” menu. There are four sections which show different services that Border Router is able to provide to.

3.5.1 Backbone Router Server

Whether the “Backbone Router Server” option has been enabled in the “Settings” sub-menu, data related to this service will be shown in this page.

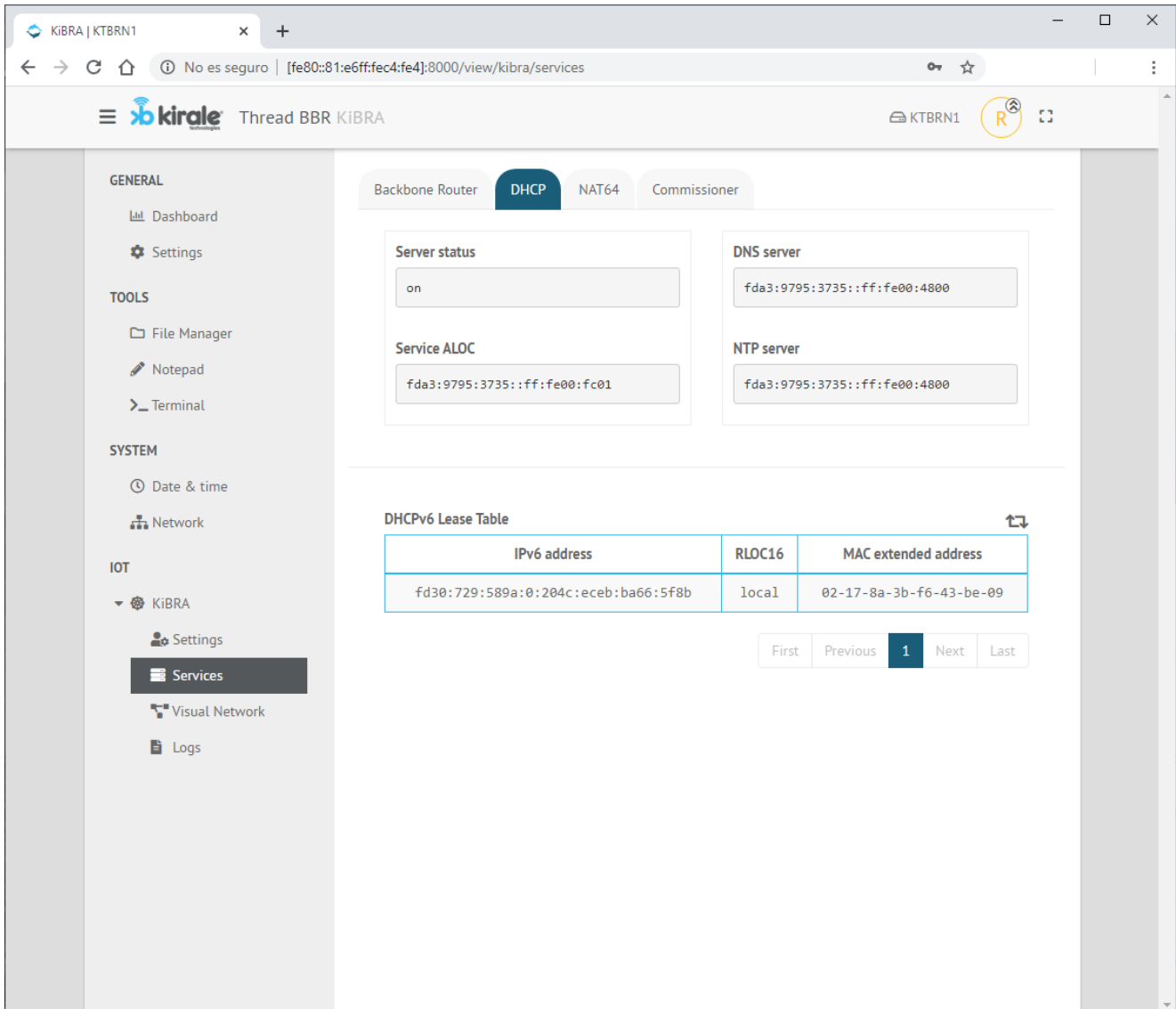


The screenshot shows the KIBRA web interface for KTBRN1. The left sidebar contains a menu with sections: GENERAL (Dashboard, Settings), TOOLS (File Manager, Notepad, Terminal), SYSTEM (Date & time, Network), and IOT (KiBRA). The main content area is titled "Thread BBR KIBRA" and has tabs for "Backbone Router", "DHCP", "NAT64", and "Commissioner". The "Backbone Router" tab is active, displaying the "BBR server status" section with a dropdown menu set to "primary" and a "Port" field set to "61631". To the right, the "Primary ALOC" field is set to "fda3:9795:3735::ff:fe00:fc38" and the "Service ALOC" field is set to "fda3:9795:3735::ff:fe00:fc10". Below these fields is a table showing system parameters:

Sequence Number	248
Reregistration Delay	5
MLR Timeout	3600

3.5.2 DHCP

If DHCP option was selected at the time of configuring the network prefix, this page will show the list of nodes which have acquired its IPv6 address via DHCP and what it is.



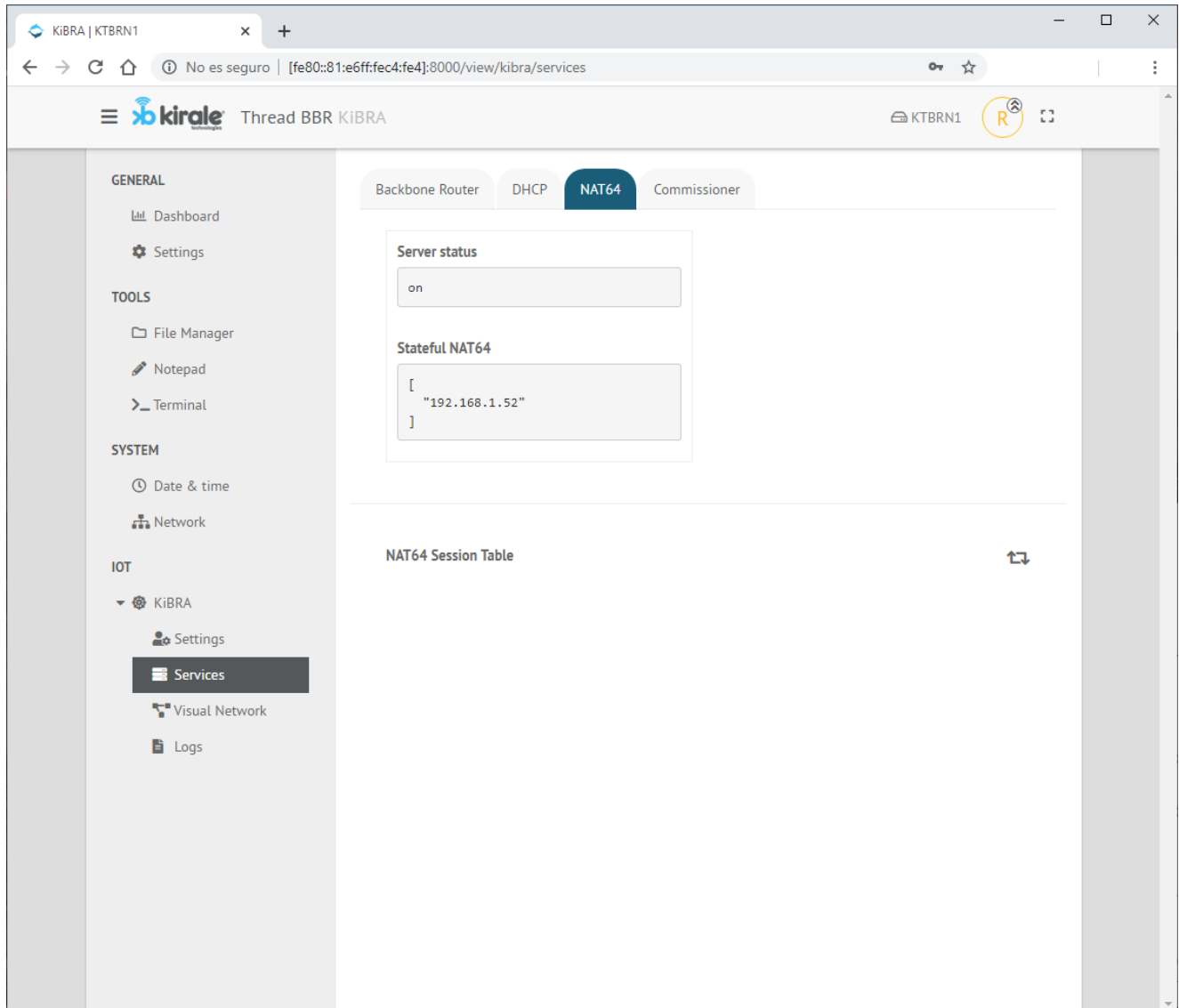
The screenshot shows the KIBRA web interface for Thread BBR KIBRA. The left sidebar contains navigation menus for GENERAL (Dashboard, Settings), TOOLS (File Manager, Notepad, Terminal), SYSTEM (Date & time, Network), and IOT (KiBRA, Settings, Services, Visual Network, Logs). The main content area has tabs for Backbone Router, DHCP, NAT64, and Commissioner. The DHCP tab is active, showing configuration fields for Server status (on), Service ALOC (fda3:9795:3735::ff:fe00:fc01), DNS server (fda3:9795:3735::ff:fe00:4800), and NTP server (fda3:9795:3735::ff:fe00:4800). Below these fields is a DHCPv6 Lease Table with the following data:

IPv6 address	RLOC16	MAC extended address
fd30:729:589a:0:204c:eceb:ba66:5f8b	local	02-17-8a-3b-f6-43-be-09

Navigation buttons (First, Previous, 1, Next, Last) are located below the table.

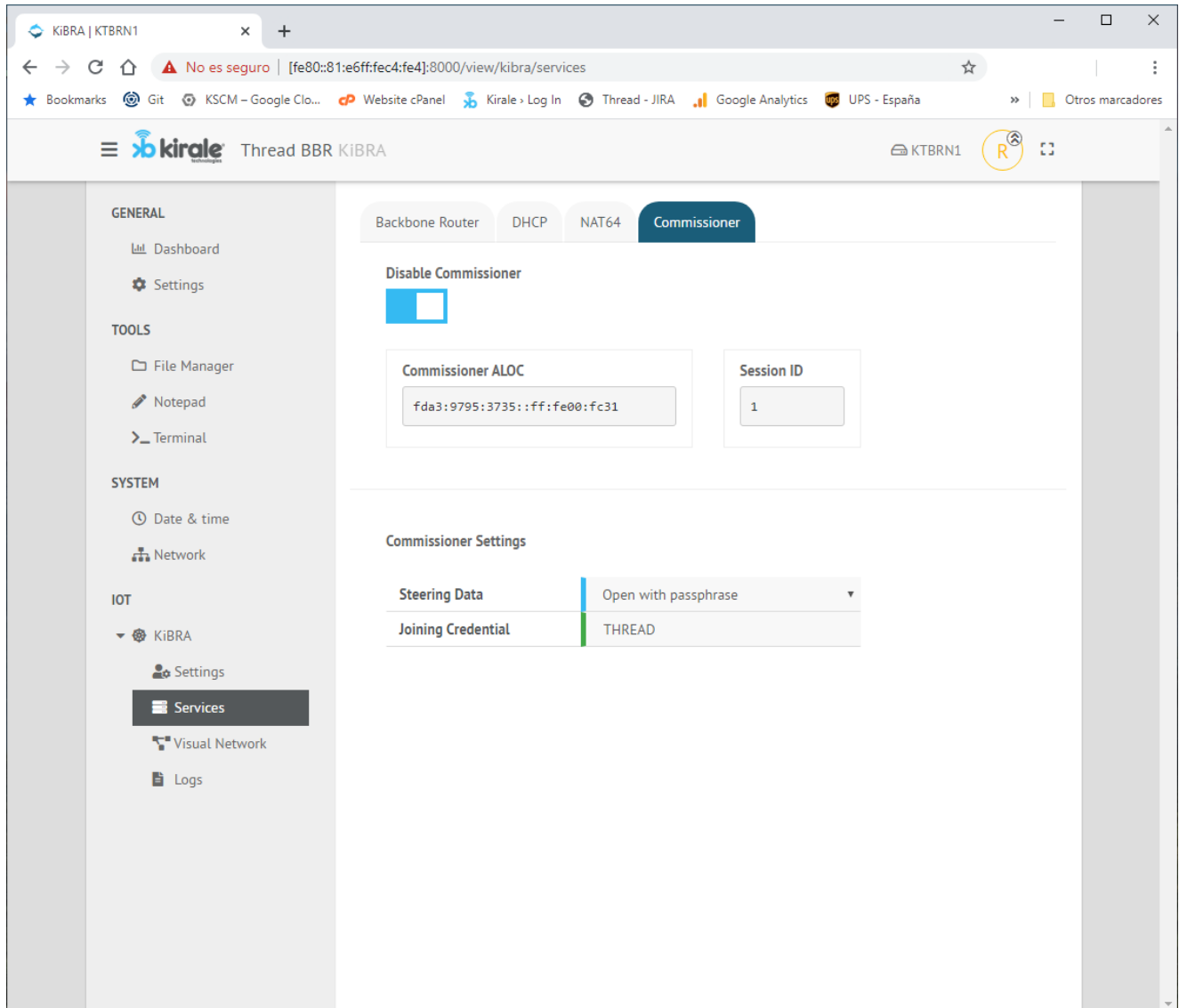
3.5.3 NAT64

If there is an IPv4 address configured in the external interface, this one will be used to perform NAT64 function in the Border Router. The current NAT session table is displayed here.



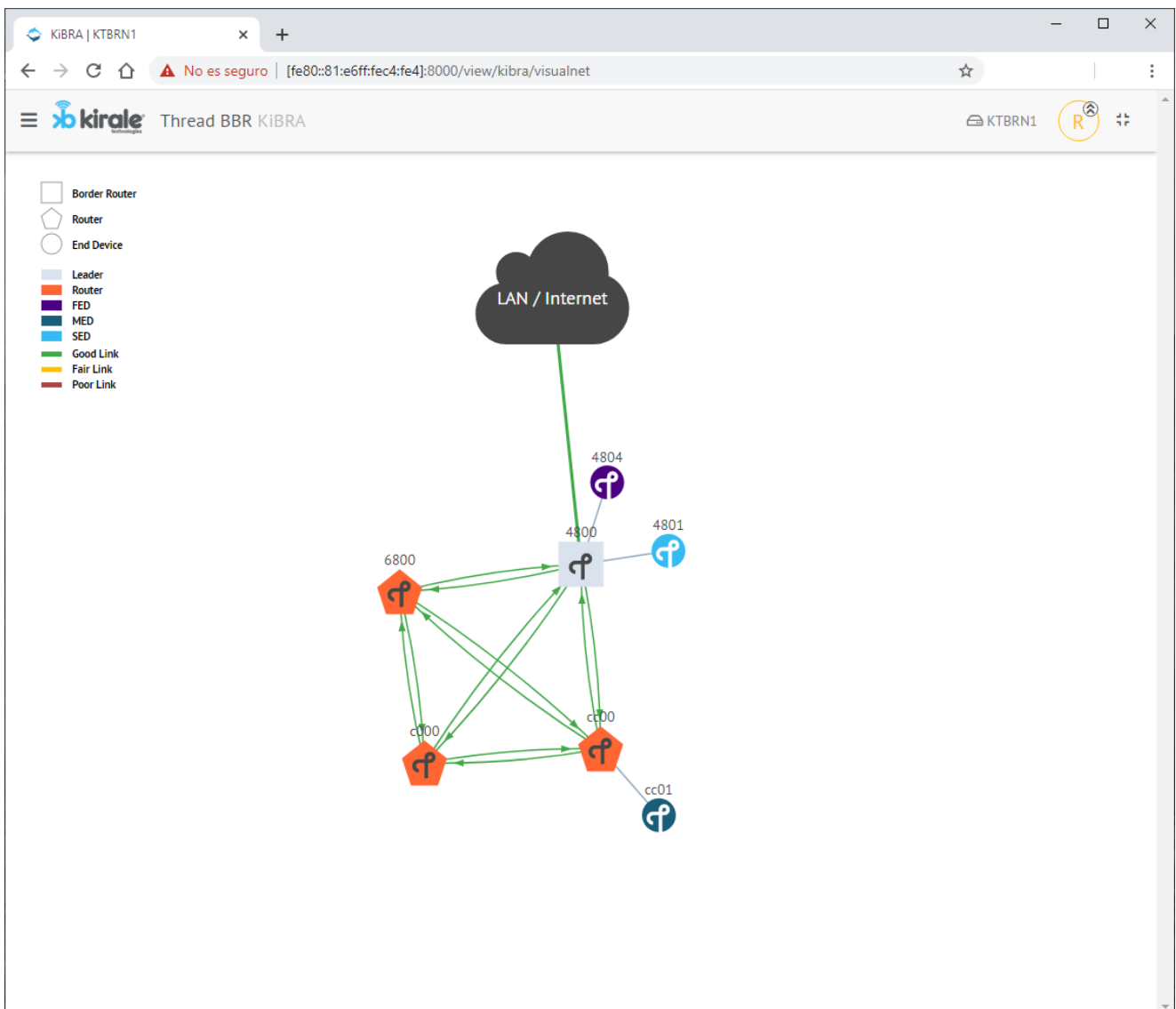
3.5.4 Commissioner

The Border Router can also act as Commissioner within the Thread network. Once this function is enabled, the administrator can set up the steering data in order to allow new devices to attach to the network.



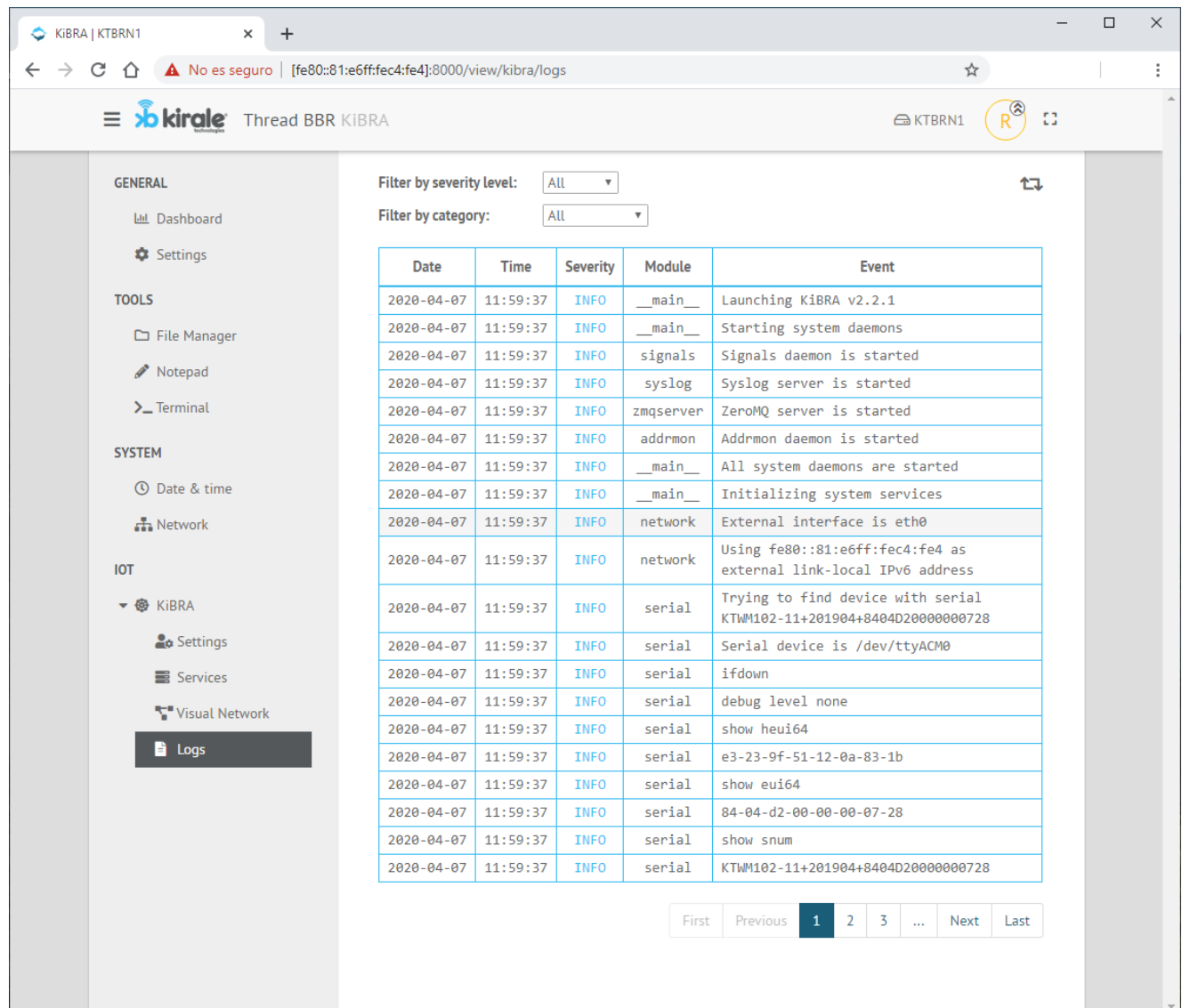
3.6. Visual Network

The network topology map is a map that allows an administrator to see the physical layout of connected devices. Having the map of a network's topology on hand is very useful for understanding how devices connect to each other and the best techniques for troubleshooting.



3.7. Logs

The administrator can look into system logs through the “Logs” sub-menu under the “KiBRA” menu. It allows filtering logs by severity level and category.



The screenshot shows the KIBRA web interface for KTBRN1. The browser address bar shows the URL [fe80::81:e6ff:fec4:fe4]:8000/view/kibra/logs. The interface has a sidebar with navigation menus and a main content area with filters and a log table.

Filter by severity level: All

Filter by category: All

Date	Time	Severity	Module	Event
2020-04-07	11:59:37	INFO	__main__	Launching KIBRA v2.2.1
2020-04-07	11:59:37	INFO	__main__	Starting system daemons
2020-04-07	11:59:37	INFO	signals	Signals daemon is started
2020-04-07	11:59:37	INFO	syslog	Syslog server is started
2020-04-07	11:59:37	INFO	zmqserver	ZeroMQ server is started
2020-04-07	11:59:37	INFO	addrmon	Addrmon daemon is started
2020-04-07	11:59:37	INFO	__main__	All system daemons are started
2020-04-07	11:59:37	INFO	__main__	Initializing system services
2020-04-07	11:59:37	INFO	network	External interface is eth0
2020-04-07	11:59:37	INFO	network	Using fe80::81:e6ff:fec4:fe4 as external link-local IPv6 address
2020-04-07	11:59:37	INFO	serial	Trying to find device with serial KTWM102-11+201904+8404D20000000728
2020-04-07	11:59:37	INFO	serial	Serial device is /dev/ttyACM0
2020-04-07	11:59:37	INFO	serial	ifdown
2020-04-07	11:59:37	INFO	serial	debug level none
2020-04-07	11:59:37	INFO	serial	show heui64
2020-04-07	11:59:37	INFO	serial	e3-23-9f-51-12-0a-83-1b
2020-04-07	11:59:37	INFO	serial	show eui64
2020-04-07	11:59:37	INFO	serial	84-04-d2-00-00-07-28
2020-04-07	11:59:37	INFO	serial	show snum
2020-04-07	11:59:37	INFO	serial	KTWM102-11+201904+8404D20000000728

First Previous 1 2 3 ... Next Last

4. A brief insight

In order to gather a deeper knowledge of how KTBRN1 works, a detailed description of the system, what tools are available and a few tips for troubleshooting are provided.

4.1. Advanced filesystem

KTBRN1 device is a Linux-based system which has the peculiarity that its filesystem is running from a SD card. It involves a big challenge to sufficiently ensure the reliability and performance of the system.

SD cards are prone to corruption or damage, leading to loss of stored files and other data. Also, as memory cards have a limited lifespan, after a certain period of usage they can get corrupt or damaged.

Kirale Technologies has designed an advanced filesystem to overcome those inconveniences in an effective way. Basically, our design mounts the partition read only and all files that are written are not really written to disk but kept in RAM. This way the filesystem would not corrupt because on a reboot, you get the old image again. On the other hand, a synchronization software writes to the system those files that must be kept updated, to reflect changes to the actual disk after a reboot.

4.2. Critical services

There are two critical services running on KTBRN1. On the one hand “kibra” service which takes care of all Border Router functions, and on the other hand “ajenti” service which manages the Web Administration Panel. Both Python applications are installed in virtual environment.

Using common Linux commands, the administrator can know the status of those services and restart them if necessary.

```
root@KTBRN1:~# service kibra (status | start | stop | restart)
root@KTBRN1:~# service ajenti (status | start | stop | restart)
```

The administrator can manually start up “kibra” application by means of following commands:

```
root@KTBRN1:~# service kibra stop
root@KTBRN1:~# source /opt/kirale/py3env/bin/activate
(py3env) root@KTBRN1:~# python -m kibra --log debug
```

In the case of “ajenti” application, the administrator should use the following commands:

```
root@KTBRN1:~# service ajenti stop
root@KTBRN1:~# source /opt/kirale/py2env/bin/activate
(py2env) root@KTBRN1:~# ajenti-panel --dev
```

4.3. Inter-process communication

The Web Administration Panel and KiBRA are constantly communicating with each other through a local TCP port.

END OF THIS DOCUMENT
