



Infinity Controller

Guide

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Document overview

This guide provides information how to setup, configure and manage LigoWave Infinity Controller system.

Supported product types

LigoWave Infinity Controller system since NFT 7.54 Firmware version. Product list supporting management system is given below:

NFT 2ac outdoor – dual-band 2x2:2 802.11ac outdoor AP, 802.3 af/at PoE

NFT 1N – 2.4GHz 2x2 802.11n indoor AP, 24V PoE

NFT 1N af – 2.4GHz 2x2 802.11n indoor AP, 802.3af PoE

NFT 1Ni – 2.4GHz 2x2 802.11n indoor AP with PoE pass-through functionality, 24V PoE

NFT 2ac – dual-band 2x2:2 802.11ac outdoor AP, 802.3 af/at PoE

NFT 3ac – dual-band 3x3:2 802.11ac outdoor AP, 802.3 af/at PoE

Additionally, these LigoWave products can be upgraded with the NFT firmware, thus supported by the Infinity Controller system:

LigoDLB series products

LigoDLB PRO series products

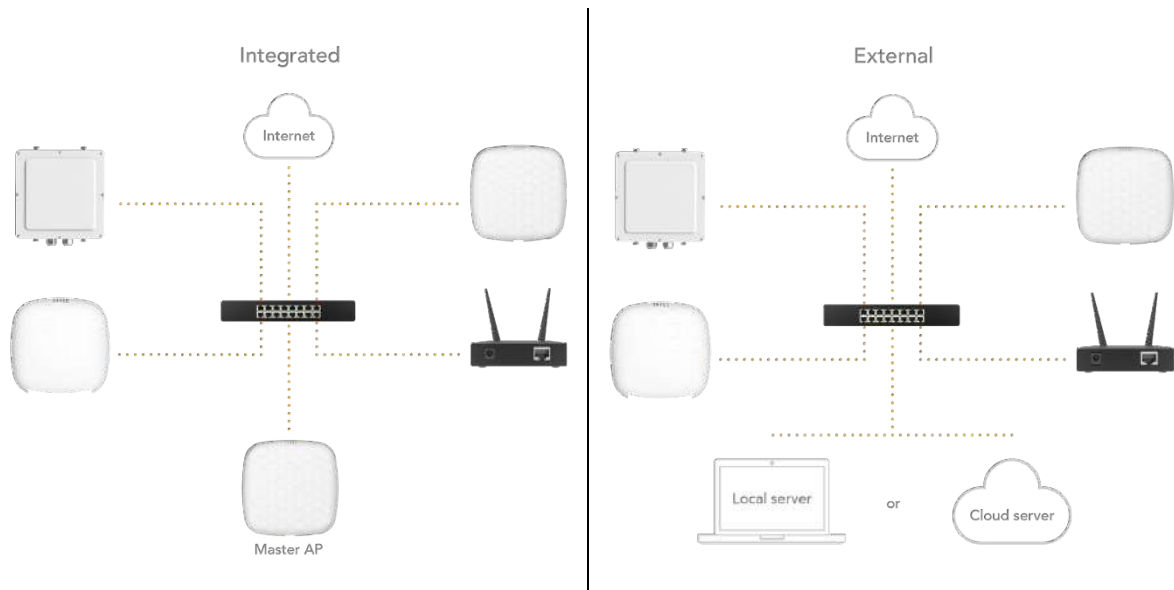
The proper firmware image must be uploaded on the LigoDLB series product in order to upgrade it to the NFT series product. Download the upgrade image with detailed instructions on LigoWave site: <https://www.ligowave.com/wiki/ligodlb-migration-to-nft>.

Infinity Controller

About Infinity Controller

The Infinity Controller allows easy, simple and fast network configuration, installation and troubleshooting. All management is done through a web browser and can be accessed from laptop, smartphone or any other device.

The Infinity Controller ecosystem is self-configuring system that allows to easy maintain or expand network. The system can be integrated, or external (network management system):



- **Integrated** – network is managed by a local device (NFT series product acting as Master AP). This option doesn't require any additional management hardware or software.
- **External** – network is managed by Infinity Controller software located on a server. The management software may be located in the cloud or installed on a client premises, that can be cloud based or installed locally.

Table below shows main differences between Internal and External controller options:

	Integrated	External
Network managed by	Master AP (local device)	Infinity Controller (server)
Feature set	Basic	Advanced
Network scale	Local	Global

Note: Infinity Controller may be located in the cloud or installed on a client's server.

“Plug & Play” functionality

“Plug & Play” feature allows easy and fast installation of new devices or replacement of the failed ones. For each local network only one device needs to be configured. All other devices will be configured with “Plug & Play” functionality:

- **Integrated version** – new devices will receive configuration information.
- **External version** – new devices will be redirected to the server for further configuration.

Network topology requirements

DHCP server must be running on the local network, so that devices could get an IP address.

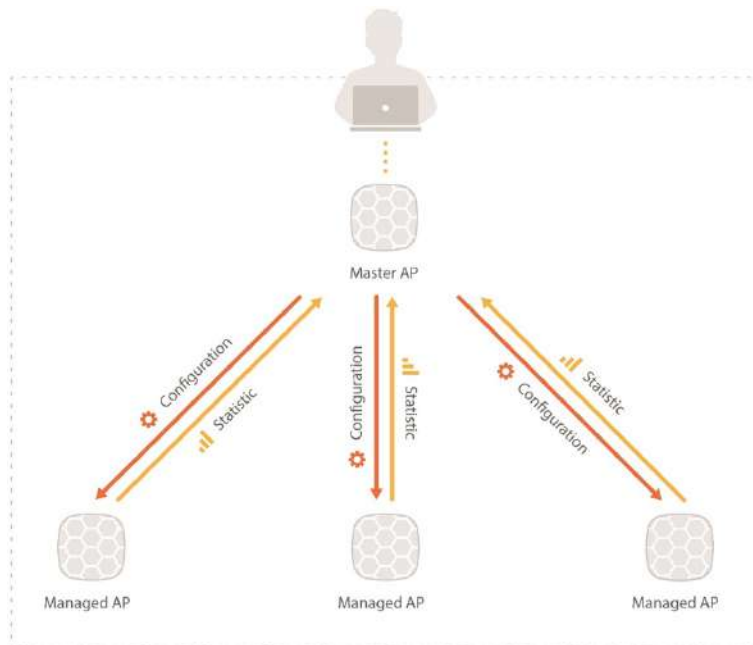
For “Plug & Play” feature to work all managed devices must be connected to the same Layer-2 network.

Integrated Infinity Controller

Introduction

Within this scenario, the first device will be designated to act as control unit called Master AP, which will automatically configure each new device, connected to the same network (subnet) thus creating the self-configuring Infinity Controller system. There is no need to install any management software - the configuration is done on Master AP only and then it is applied to all network devices.

Once a new, out of the box, device connects to the network, the Master AP will upload the same configuration for each Managed AP on the network. The setup of custom configuration is made on Master AP Web management and the same parameters will be assigned for each connected device on the same network automatically, thus creating a centralized configuration from a single device.



Integrated Infinity Controller system requirements:

- One device is operating as a Master AP, the others are operating as Managed APs.
- All devices are on the same network.
- DHCP server is running on network.

Setup new Master AP



For a proper Integrated Infinity Controller configuration, ensure that a DHCP server is running on the network.

In order to setup Integrated Infinity Controller system, at first configure the Master AP. All parameters that will be configured on Master AP, will be automatically applied on each Managed AP, connected to the same network.

Follow the steps for quick Master AP configuration, using initial setup wizard:

- Step 1.** Connect your PC to device via Ethernet.
- Step 2.** Start your Web browser.
- Step 3.** Enter the device IP address in the web browser's IP field and specify default login settings admin/admin01.



In case the device is unable to obtain IP address from a DHCP server, it will fallback to the default static IP 192.168.2.66.

The initial screen with the user agreement looks as follows:

The screenshot shows the initial setup wizard interface. At the top, there is a progress bar with steps: START, SYSTEM SETUP, CONFIGURATION, SYSTEM ADMIN, and FINISH. Below the progress bar, the following information is displayed:

- Product name: NP1.3d2
- Serial number: 0427507000000000
- Firmware version: AP_GA v7.54.24176
- MAC address: 88:10:3B:0E:F3:E9

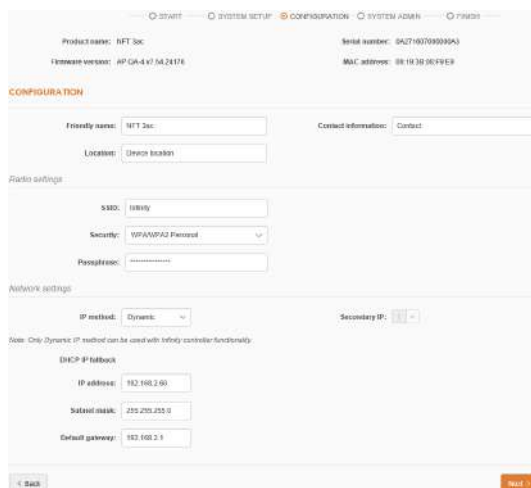
The main section is titled "START" and includes a "User agreement" section. The language is set to "English". The user agreement text states that the correct country code must be selected to meet regulatory requirements for authorized channels, channel width, output power, Dynamic Frequency Selection (DFS), and Automatic Transmit Power Control (ATPC). It also notes that the installer or equipment owner is responsible for proper product usage according to the regulatory rules. A checkbox labeled "I have read and agree" is checked. Below the agreement, there is a "Country" dropdown menu set to "United States". At the bottom, there are two input fields for power levels: "2.4 GHz Antenna gain, dB" and "5 GHz Antenna gain, dB", both set to "5". A "Next" button is located at the bottom right of the screen.

You are only allowed to select radio channels and RF output power values permitted for your country and regulatory domain.

Step 4. Choose the device operating mode **Master AP – Integrated** and click Next button:



Step 5. Setup your master AP with the following parameters:



Friendly device name – specify name of the device that will be used to identify the unit.

Contact information – specify the name of the contact person, such as a network administrator, for the device.

Device location – describe the location of the device.

SSID – specify the SSID of the wireless network.

Security – setup the security for the Integrated Infinity Controller’s system [WPA/WPA2 Personal, WPA/WPA2 Enterprise].

IP settings – leave **Dynamic IP** selection as Integrated Infinity Controller requires Dynamic IP assignment for all units.

Step 6. Setup the Administrator's username and password:



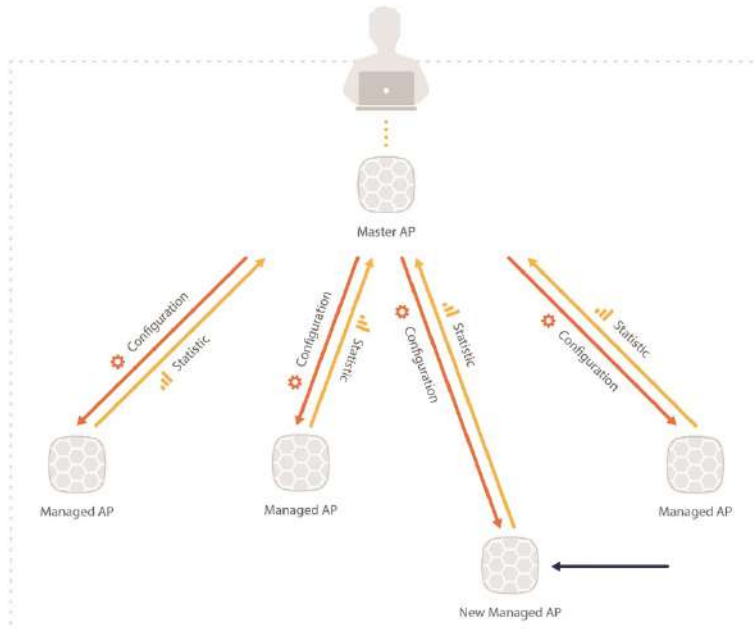
This password will be shared between Master AP and all managed devices. It must be the same on all devices in the same network otherwise device will not work.

Step 7. Confirm the Master AP configuration thus finishing the setup process:

Step 8. In order to change other parameters not included in quick setup wizard, navigate through whole UI and change desired parameters. All settings changed on Master AP will be automatically uploaded on all Managed APs on this Infinity Controller's network.

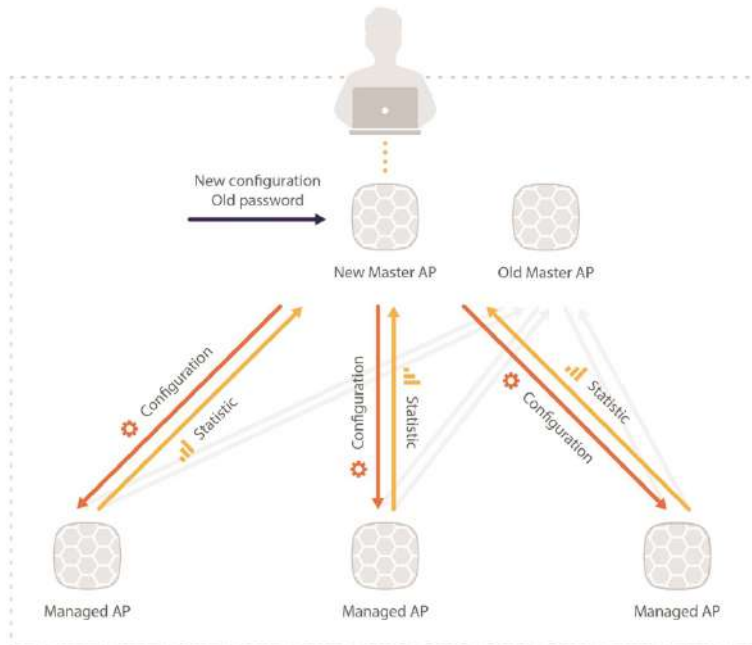
Adding a new Managed AP

In case you want to increase number of the devices in your network or replace the existing one, or swap a broken one, simply power up a new out-of-box device, connect to the network and it will be automatically added to the Integrated Infinity Controller's system with "Plug & Play" functionality.



Replacing Master AP

In case the Master AP goes down, all Managed APs remain working in the network independently, except there is no Master AP. In order to rebuild Infinity Controller system, the new out-of-box device should be configured as a Master AP.



How to replace Master AP:

1. Connect a new out-of-box device directly to your computer using UTP cable (default device IP is given by DHCP server with fallback IP 192.168.2.66).
2. Power up device.
3. Connect to the device Web management interface and setup Master AP.



Change the default login password of the new Master AP to the replaced Master AP's password, otherwise all Managed APs won't be able connect to the new Master AP.

4. Connect configured Master AP to the network.
5. All Managed APs will connect to the new Master AP automatically.

Control Managed APs

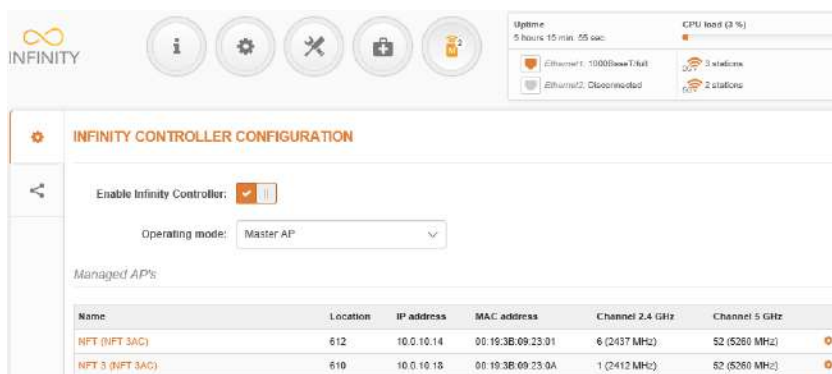
In order to view and manage Infinity Controller's devices, login to the Master AP's Web management interface and navigate to the Controller menu:



A number on the Controller's menu tab is the count of the Managed APs in the Infinity Controller system:



The Internal Infinity Controller settings on Master AP unit are as follows:



Enable Infinity Controller – enable or disable overall Infinity Controller's functionality.

Operating mode – displays the operating mode of the unit:

Master AP – current operating mode. The Master AP controls all Managed APs running on the same network.

Managed AP – if enabled, unit will wait for automatic configuration upload from the Master AP running on this network.

Cloud AP – if enabled, unit will wait for automatic configuration upload from the registered External Infinity Controller.


Managed AP table – displays all managed APs connected on current Integrated Infinity Controller's network.

Managed AP table

This table displays all Managed APs on the network: active units are colored in orange, while inactive Managed AP are displayed in grey:

Managed AP's

Name	Location	IP address	MAC address	Channel 2.4 GHz	Channel 5 GHz
NFT (NFT 3AC)	612	10.0.10.14	00:19:3B:09:23:01	6 (2437 MHz)	52 (5260 MHz)
NFT 3 (NFT 3AC)	610	10.0.10.18	00:19:3B:09:23:0A	1 (2412 MHz)	52 (5260 MHz)

There is possibility to change some parameters for each Managed AP individually. Just click on the configuration icon  to load individual settings:

MANAGED AP 10.0.10.18 (NFT 3) SETTINGS

Friendly name:

Location:

2.4 GHz Channel:

5 GHz Channel:

2.4 GHz Tx power, dBm:

5 GHz Tx power, dBm:

LED status:

Flash all LEDs, min:

Product name: NFT.3AC

Firmware version: AP_QA-4 v7.54.24579

MAC address: 00:19:3B:09:23:0A

Connected clients: 1

Troubleshooting file:

Backup configuration:

Restore configuration:

Reset to factory defaults:

Friendly name – a friendly name for identification.

Location – describe physical location of the unit.

Channel – indicates which channel the AP is operating on or that an autochannel function is used. Click on the button for channel configuration.

Tx power, dBm – control unit's radio transmitting power.

LED status – enable or disable all LEDs. If disabled, no LEDs will light up on the unit.

Flash LEDs – use this function for particular unit identification. Once enabled, all LEDs of the unit will flash for 5 minutes (changeable parameter) thus helping identify the location of the unit in the area.

Connected clients – displays the number of connected client to this particular Managed AP.

Troubleshooting file – generate and download a troubleshoot file with device's status information which may help in resolving support issues.

Backup configuration – click to download current configuration file. The configuration file is useful to restore a configuration in case of a device misconfiguration or to upload a standard configuration to multiple devices without the need to manually configure each device through the web interface.

Restore configuration – click to upload an existing configuration file to the device.

Reset to factory defaults – click to restore unit's factory configuration.



Resetting the device is an irreversible process. Current configuration and the administrator password will be set back to the factory default.

Wireless clients table

Use **Controller | Client Information** menu to view wireless clients connected to each Master AP and Managed APs:

CLIENT INFORMATION

<input type="checkbox"/>	Client MAC	AP name	IP address	Signal, dBm	Tx/Rx rate, Mbps	Tx/Rx CQI, %	Link uptime
<input type="checkbox"/>	8G2DAA33AB31	NFT 3	192.168.100.124	-56 / -56 / -52	216 / 216	48 / 48	1 hour 17 min. 34 sec.
<input type="checkbox"/>	3C15C2E425EA	NFT 3	192.168.100.130	-82 / -64 / -68	975 / 702	75 / 54	3 min. 8 sec.
<input type="checkbox"/>	28E14C95C289	NFT 3	192.168.100.33	-51 / -53 / -57	72 / 24	100 / 33	1 hour 41 min. 42 sec.
<input type="checkbox"/>	E0B52D41BA8E	NFT 3	192.168.52.94	-72 / -69 / -79	72 / 26	100 / 36	1 hour 7 min. 26 sec.
<input type="checkbox"/>	3052CB E8 04 63	NFT 3	192.168.100.140	-56 / -55 / -55	760 / 868	90 / 67	3 hours 24 min. 6 sec.
<input type="checkbox"/>	3C15C2E425EA	NFT 3	192.168.100.130	-95 / -95 / -94	15 / 5	7 / 2	4 hours 16 min. 1 sec.
<input type="checkbox"/>	683E341EA572	NFT	192.168.100.215	-51 / -55 / -50	71 / 57	98 / 79	21 min. 38 sec.
<input type="checkbox"/>	F8165403C78A	NFT	192.168.100.120	-50 / -48 / -48	144 / 18	100 / 13	1 hour 13 min. 37 sec.
<input type="checkbox"/>	F8D111C0FD89	NFT	192.168.100.93	-56 / -65 / -61	300 / 300	67 / 67	3 hours 22 min. 28 sec.
<input type="checkbox"/>	8C3AE914FE05	NFT	192.168.100.49	-46 / -52 / -48	433 / 433	33 / 33	2 hours 33 min. 16 sec.

External Infinity Controller

Introduction

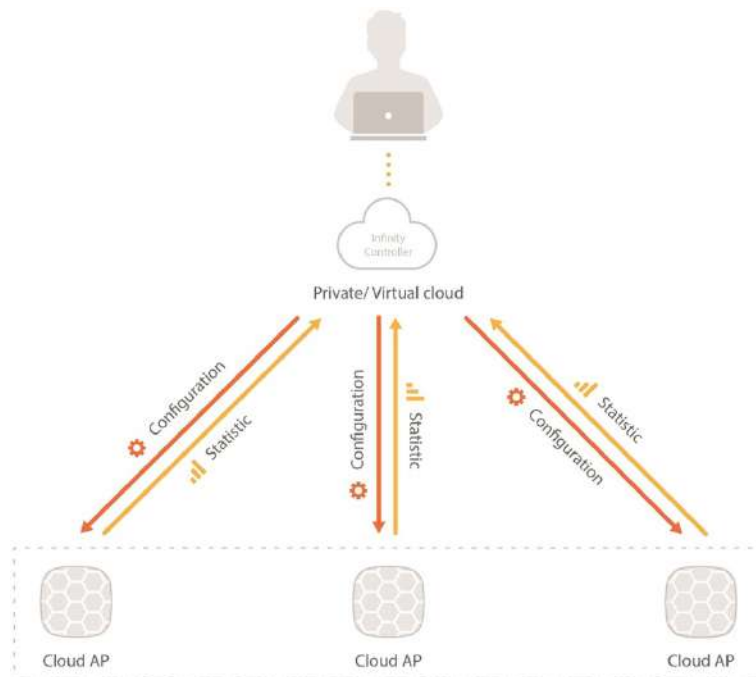
Within this scenario devices are maintained by an External Infinity Controller (network management system) that can be a cloud based or installed in client's server.



Ensure that External Infinity Controller is accessible to all network devices.

The concept is similar to Integrated Infinity Controller scenario: the first device must be assigned to operate as Cloud AP with a correct Organization ID and server IP address.

The other new out-of-box devices connected to the network will be redirected to External Infinity Controller by the Cloud AP with "Plug & Play" functionality. Further devices monitoring, configuration and provisioning is done in the External Infinity Controller.



External Infinity Controller system requirements:

- At least one device must be configured as Cloud AP.
- All devices are on the same network.
- DHCP server running on network.

Setup Cloud AP



Ensure that a DHCP server is running on the network.

In the External Infinity Controller system only the first device must be configured to operate as a Cloud AP with the specific parameters – Organization ID and Controller URL. Once this Cloud AP device is connected to the network, it will download the network specific configuration from an External Infinity Controller. Other out-of-box devices will not require any manual configuration and will be managed by this Cloud AP.

Follow the steps for quick Cloud AP configuration, using device initial setup wizard:

- Step 1.** Connect your PC directly to the device via Ethernet.
- Step 2.** Start your Web browser.
- Step 3.** Enter the device IP address in the web browser’s IP field and specify default login settings **admin/admin01**.



If LigoWave NFT device is unable to obtain an IP address from the DHCP server, it will fallback to the default static IP 192.168.2.66.

The initial screen with the user agreement looks as follows:

The screenshot shows the initial setup wizard interface. At the top, there are navigation tabs: START, SYSTEM SETUP, CONFIGURATION, SYSTEM ADMIN, and FINISH. Below the tabs, the product name is 'NFT 34c' and the serial number is '0427160700000363'. The firmware version is 'AP (A.4.7) 54.24176' and the MAC address is '88:10:3D:68:F9:E9'. The language is set to 'English'. A 'User agreement' section is visible, with a checkbox for 'I have read and agree'. Below this, there is a 'Country' dropdown menu set to 'United States'. At the bottom, there are input fields for '2.4 GHz Antenna gain, dB' and '5 GHz Antenna gain, dB', both set to '5'. A 'Next' button is located at the bottom right.

You are only allowed to select radio channels and RF output power values permitted for your country and regulatory domain

Step 4. Choose the device operating mode **Cloud AP – External** and click Next button:



Step 5. The correct URL and the Organization ID of the External Infinity Controller must be specified. This is where the Cloud AP will be registered and managed.



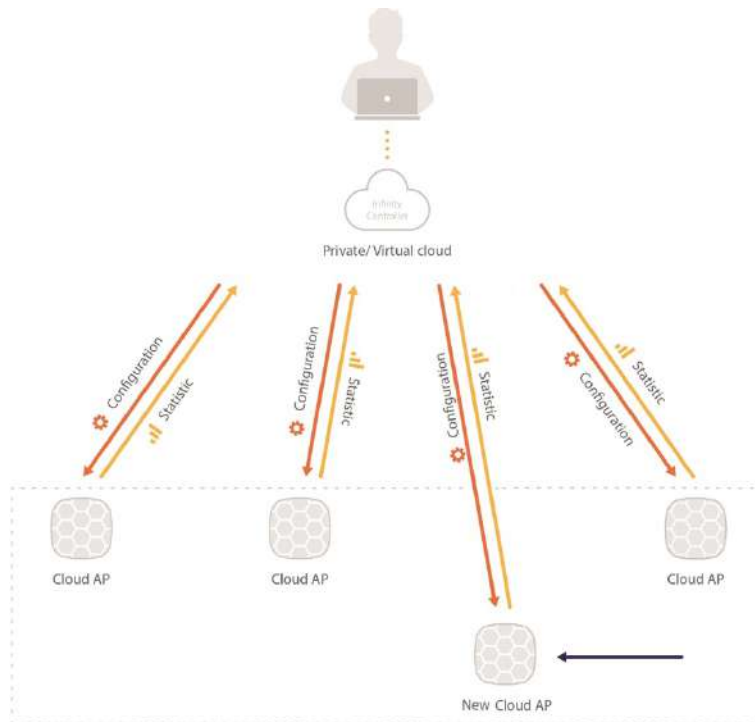
The External Infinity Controller must be configured properly to register and manage particular Cloud AP.

Step 6. Click **Finish** button to finalize configuration. Device is now operating in Cloud AP mode, thus all configuration settings will be overwritten by the management system – External Infinity Controller.

Step 7. Other new out-of-box devices will be automatically directed to the External Infinity Controller by this Cloud AP for further management, thus creating a self-configuring system.

Adding a new Cloud AP

If you want to increase the number of devices in your network, replace an existing one or swap a broken one, connect a new out-of-box device to the network, power it up and it will automatically communicate with the existing Cloud AP. Cloud AP will redirect new devices to the External Infinity Controller for further management.



How to add a new device to a network:

- Connect device with UTP cable to the network (default device IP is given by DHCP server with fallback IP 192.168.2.66).
- Power up the device.
- New device will be redirected directly by existing Cloud AP to the External Infinity Controller for further managing.

Server requirements

Hardware: 2.5 GHz quad core CPU, 10 GB RAM, 40 GB SSD drive

OS: Debian stable 8.4, CentOS 7, Ubuntu 16.04 server, Ubuntu 14.04 server, Ubuntu 14.04 desktop, Ubuntu 12.04 desktop

Web Browser: Mozilla Firefox, Google Chrome, or Microsoft Internet Explorer 8 (or above)

Install External Infinity Controller on Linux

Follow the steps to install External Infinity Controller on Linux OS.

Step 1. Get External Infinity Controller's package from ligowave.com:

- US mirror <https://www.ligowave.com/public/NFT/nftcontroller.latest.tar.gz>
- EU mirror <http://eu.ligowave.com/NFT/nftcontroller.latest.tar.gz>

Step 2. Install docker:

```
curl -fsSL https://get.docker.com/ | sh
```



For more information, refer to Docker install guide on https://docs.docker.com/linux/step_one/

Step 3. Extract External Infinity Controller (note that file name can differ for each new release):

```
tar -xvzf nftcontroller-latest.tar.gz
```

Step 4. Install External Infinity Controller

```
sudo ./install.sh install
```

Step 5. Select HTTPS security mode:

1) HTTP only, No SSL/TLS certificates

Insecure, unencrypted connection. For private networks only.

2) HTTPS with self-signed SSL/TLS certificates

Insecure, encrypted connection. Web browsers will display certificate error.

3) HTTPS with free certificates from Letsencrypt service

Secure, requires a valid domain and open default TCP ports (80,443) (by using this option you agree to Letsencrypt terms and conditions (<https://letsencrypt.org/repository/>)).

Step 6. Enter TCP port number for web interface.

Step 7. Enter domain or IP address of the server.



Note, only this domain can be used by devices to connect to the server.

Step 8. Start External Infinity Controller:

```
sudo nftcontroller start
```

Step 9. In a couple of minutes, the controller will start.

Step 10. Access External Infinity Controller via Web interface:



Make sure you are using correct TCP port. Also use **HTTPS://** then using https connection.



Run External Infinity Controller virtual machine on Windows with VirtualBox

Follow the steps:

Step 1. Download latest NFT-Controller VM image from LigoWave web site:

- US mirror <https://www.ligowave.com/public/NFT/NFT-Controller-latest.ova>
- EU mirror <http://eu.ligowave.com/NFT/NFT-Controller-latest.ova>

Step 2. Download and install the latest VirtualBox software from:

<https://www.virtualbox.org>

Step 3. Launch VirtualBox. Use Import Appliance dialog (File→Import Appliance) to import NFT-Controller virtual machine (VM)

Step 4. Start NFT Controller virtual machine. Virtual machine's network is set in Bridge mode. VM will get an IP address from the local DHCP server.

Step 5. Login to Virtual machine. Default username is **nft**, and password **admin01**

Step 6. Install External Infinity Controller

```
sudo ./install.sh install
```

Step 7. Select HTTPS security mode

1) HTTP only, No SSL/TLS certificates

Insecure, unencrypted connection. For private networks only.

2) HTTPS with self-signed SSL/TLS certificates. This is the default mode.

Insecure, encrypted connection. Web browsers will display certificate error.

3) HTTPS with free certificates from Letsencrypt service

Secure, requires a valid domain and open default TCP ports (80,443) (by using this option you agree to Letsencrypt terms and conditions

(<https://letsencrypt.org/repository/>))

Step 8. Enter TCP port number for web interface

Step 9. Enter domain or IP address of the server.



Note, only this domain can be used by devices to connect to the server.

Step 10. Start External Infinity Controller:

```
sudo nftcontroller start
```

Step 11. In a couple of minutes, the controller will start.

Step 12. Access the External Infinity Controller via Web interface to complete the setup.



Make sure you are using correct TCP port. Also use **HTTPS://** then using https connection.

