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Overview

[NYC Mesh](#) is a community network. This means that city residents take it upon themselves to maintain and grow the network. A massive amount of cooperation between many different people with many different skills is required to accomplish this, and this website is here to make sure that individuals who want to improve the network can get the knowledge and skills they need to do so.

- **Website**: https://www.nycmesh.net/
- **Slack**: https://slack.nycmesh.net/

If you have any questions, please read see our FAQ page at nycmesh.net/faq or reach out on slack.

About NYC Mesh

We are a community network offering fast, affordable, and fair access to the Internet for all New Yorkers. By joining NYC Mesh, you can access the Internet while simultaneously helping your neighbors get better, safer Internet access, too. Adding an NYC Mesh connection to your apartment or building can serve as a backup Internet connection in case your commercial Internet service goes down.

As a community network, city residents such as yourself take it upon themselves to maintain and grow the network. This means that in addition to accessing the Internet, you can also make friends, meet neighbors, and learn valuable technical and computer skills by participating in our active community, either in-person or online. We regularly host face-to-face meetups, and you can join our Slack chat. Both are great places to ask questions and otherwise connect with our active community.

About this Wiki

The NYC Mesh Wiki is the central clearinghouse for technical information about our network. Here, we describe the implementation of specific nodes, document installation procedures, and more. This website is not a networking tutorial, so readers are expected to have some basic familiarity with computer internetworking concepts to take full advantage of the material we present here, but we do strive to provide links to good educational resources for newcomers where it makes sense to do so.

There are a couple of different ways that you can make use of this website.

- **Like a book:** You can read the entire website "front to back." Use the navigation menu to proceed from one section to the next, in order. This will give you a good idea of how our network works and how you can help us improve and maintain it.
- **Like a reference:** You can skip directly to a section that interests you, or use this website to look up answers to specific questions that you have. This comes in particularly handy during an install or when troubleshooting issues.

Moreover, this website itself is part of the community network and is maintained by volunteers. That means you can help us improve it by adding missing information, clarifying confusing points, or even just fixing typos you notice while you're reading. To learn more about how you can contribute to and edit this website, see our `docs` README file.

Who should read this wiki

This wiki contains information about the *technical* implementation of the NYC Mesh network itself, along with ancillary information about the standard operating procedures (SOPs) of various NYC Mesh volunteer teams. **Before reading this website, please read our FAQ.** Many common questions are answered there, and this documentation is mostly written with the assumption that readers are already familiar with the answers to our most frequently asked questions.

Once you have already read our FAQ, then you should consider reading or referring to this website if:

- you want to help expand the network by physically installing new nodes,
- you have computer networking experience and want to help improve the network's performance or security,
- you plan to volunteer to monitor or otherwise maintain the network and have questions regarding the configuration of various hardware and software components, or
- you are interested in knowing details about how NYC Mesh functions that are not already covered by the FAQ.

You should *not* read this wiki if:

- you want us to connect your apartment, house, or building to the mesh. Instead, please go to our Get Connected (join request) form where you will be put in contact with one of our install teams.
- there is a problem with your connection and you need assistance from an NYC Mesh volunteer technician. Please use our Request Support form to open a trouble ticket to get help with problems you cannot fix on your own.

- you are a member of the press seeking the latest news about NYC Mesh. We publish press releases specifically for journalists on our main website's Press page.
- you are a member of the general public and are simply curious about our work. For this information, please read the Frequently Asked Questions (FAQ) page on our main website, returning here only if the FAQ does not satiate your curiosity. :)

We are always excited to welcome new volunteers who want to help us continue providing affordable, fair, and fast Internet connectivity to our fair city and so we hope you find this guidebook useful.

Volunteer Slack Channels

A list of possible volunteer roles is available on the [website volunteer page](#).

Our Slack has a number of channels with volunteer opportunities:

- #volunteer
  - Volunteer opportunities
  - random discussions etc
- #install-team - **list**
  - list of new installs
  - private channel (due to members personal information being present) - fill out the form bookmarked in #volunteer or talk to an existing volunteer in person to be added to the channel.
  - *no general discussion besides specific installs*
- #maintenance-team
  - Discussion of maintenance related topics
  - Follow this channel to join on weekend/weekday hub maintenance
- #maintenance-tasks - **list**
  - list of maintenance tasks
  - *no general discussion besides specific maintenance tasks*
- #meshathon
  - Discussion of large volunteer events
  - Planning for large building installs (ex running fiber at Grand St Guild)
- #outreach
  - Discussion and planning for outreach events and co-operative events with other organizations
- #design
  - Opportunities to assign with graphic design and creating new marketing materials

There are also neighborhood specific channels (#n-parkslope, #n-greenpoint, #n-harlem, etc.) which host discussions and planning for specific areas of the city. Please join the channels for where you live (or make a new one if it doesn't exist yet) to collaborate with other members in your area.

Mesh Glossary

Telecommunications, computing, and internetworking technologies often have an enormous amount of jargon associated with them. This jargon makes it possible to speak precisely and quickly to others who are in-the-know, but can also drastically increase the learning curve for newcomers. We offer this page as a quick reference guide for common terms, acronyms, and other abbreviations that NYC Mesh technical teams use on a regular basis.

A

Antenna : Antenna, router and radio are often confused- see our FAQ

AP : a wifi Access Point

ARIN : American Registry for Internet Numbers- where you get your ASN

ASN : Autonomous System Number that identifies your network on BGP for peering. Our number is AS395853

B

Backhaul : very high bandwidth connections, usually point to point.

BGP : This is the routing protocol of the Internet. We use it to connect at an IXP

BMX6 : An ad-hoc mesh protocol we use. (BatMan eXperimental 6)

BuB : "Bottom up Broadband" The beneficiaries of the networks actively participate in the planning, deployment and maintenance tasks.

C

Captive portal : a web page that is shown before connecting to the Internet normally

Cjdns : Caleb James DeLisle's Network Suite. Encrypted IPv6 mesh protocol.

Clearnet : the regular internet as opposed to the hidden web (Tor, I2P, Freenet)

Commons : The commons include public libraries, the Internet, parks and roads and some mesh networks. Guifi has a "Wireless Commons License".

CPE : Customer premises equipment (e.g. a LiteBeam, NanoStation, home router). ISP jargon

D

Dark fiber : fiber cable that is not connected.

DHCP : or "Automatic" setting will automatically try to get you an IP address and subnet mask

E

Ethernet cable :The cable we use that has 8 wires for carrying data and power

F

FFTF : Fiber From The Farms Broadband Initiative -- Guifi term for BuB

FNF : Free Network Foundation

FTTH : Fiber to the home. For example our Grand Street Hub

G

Guifi : The largest community owned network, based in Catalonia, Spain

GPON : Gigabit Ethernet Passive Optical Network. Fiber network that doesn't need power

H

HNA : Host and Network Association information used by mesh protocols

I

IPv4 : the most common version of the Internet Protocol (IP), An IPv4 address consists of four octets e.g. 192.168.1.20

IPv6 : 6th version of Internet Protocol. Designed to replace IPv4. e.g. 2001:db8:0:1:1:1:1:1

ISP : Internet Service Provider

IXP : Internet Exchange Point, where internet networks come together to peer or exchange traffic between their networks. (An IXP is a network and not really a "point" or a building)

J

K

L

LIR : local Internet registry, an organization that has been allocated a block of IP addresses by a regional Internet registry (RIR)

LuCI : (pronounced Lucy) Lua Unified Configuration Interface, the web interface in OpenWRT

M

MANET : Mobile Ad-hoc NETwork

N

NAT : Network address translation- a method of remapping one IP address space into another

node : WiFi router or other routing devices in a particular location on a network

O

OLSR : Optimized Link State Routing Protocol (popular mesh protocol)

OLT : Optical Line Terminal. This expensive device powers a fiber GPON network

ONT : Optical Network Terminal. Small cheap device that converts fiber to ethernet in apartment

OpenWRT : Open source Wireless Receiver/Transmitter (WRT) software

OSPF : a popular dynamic routing protocol

P

Peering : An agreement between two networks to connect and exchange traffic without charge

P2P : Point-to-point connection between two antennas

P2MP : Point-to-multipoint connection, e.g. between one sector antenna and multiple smaller antennas

POE : Power over ethernet (how Ubiquiti routers get 24 volt power)

Q

R

Radio : The wireless receiver/transmitter part of a router

Router : Antenna, router and radio are often confused- see our FAQ

RIR : Regional Internet registry

S

Sector antenna : a directional antenna designed to connect to many other antennas. Typical "sectors" are 90 degrees or 120 degrees

SSID : Service set identification- the Wi-Fi access point name

Supernode : This is a large install, typically with a fiber connection and many sector and point-to-point antennas

Site survey : Normally refers to checking the suitability of a building for an install, for example taking panoramic photos of the view to see what other buildings are reachable, as well as checking how cables will be run. Also used for the process of scanning for wireless networks in some wireless products, for example a Ubiquiti LiteBeam refers to a network scan as a "Site Survey" in the web interface.

T

U

V

W

WAP : Wireless Access Point

WDS : Wireless Distribution System, A mesh protocol we use

WISP : Wireless ISP

WNDW : Wireless Networking in the Developing World -- essential book

WRT : Wireless Receiver/Transmitter software (WRT)

X

Y

Z

Getting Started

Please read our FAQ if you haven't already.

Join the mesh

First you need to enter a new node request. This will add your address to our list of requests and put your location on our map. If you have multiple locations enter them separately. If you are within range of a (blue) supernode or hub node, and have line-of-sight, we may be able to connect you.

The easiest option is for our install team to come out and do the install. After you submit the new node request we will check whether a connection is possible. If so we'll send a link so you can schedule an install. This suggested donation of $290 covers everything needed.

If you want to DIY it is best to join our Slack group and ask questions in the #install channel

Member Connection Troubleshooting

First step:

Make sure all the devices are powered on and connected properly.

You may have two power supplies: one to power your home WiFi router and a second to power the POE (Power Over Ethernet) which in turn powers the device(s) on the roof. If you do, be sure the right power supply powers the right device. The POE and router power supplies are not interchangeable. They may be different voltages, and if plugged in to the wrong device they may damage that device.

The POE is a device that powers the devices on the roof through the Ethernet cable. If you have a POE, make sure its LED is lit and that it is connected to the rooftop cable.

Make sure the router is powered and connected to the POE, if you have one, or if not, to the Ethernet cable coming from the roof.

Second step:

Test the connection, eliminating the router and WiFi.

To test without WiFi, connect your computer directly to the router using an ethernet patch cable. Turn WiFi off on your computer to make sure you are using the cable and not WiFi.

To check if the router is the issue, connect directly to the POE, bypassing the router altogether.

If possible, connect your devices with ethernet cables to your router. An Ethernet connection will be faster and more reliable than a WiFi connection.

Third step:

Try power-cycling the equipment.

Start with the router: unplug it from wall power and a wait few seconds for all the lights to go out. Then plug it back in.

If you have a POE you can also try unplugging the POE and replugging after a few seconds. Note that this will distrupt anyone connected to the same equipment.

Other things to try:

Keeping your router's firmware up to date ensures that you benefit from bugfixes or security enhancements.

Your Internet and WiFi Speeds

How much speed do you need?

Several factors can affect your internet performance: WiFi router location, number of users, the hardware and age of your device(s), the device software (called firmware), and any applications running in the background of your computer.

There is a perception that Internet services require a lot of bandwidth (speed). Recommended internet speeds for use of third-party products and services depend on the number of devices you're using. See the following speeds required for these common third-party products and services:

-- Streaming HD 10 Mbps

-- Skype Call HD 1.5 Mbps

-- Video Gaming 3.5 Mpbs

-- Twitch Gaming 4.5-6 Mbps

-- Netflix 5 Mbps

-- Amazon Prime HD 15 Mbps

For more information please refer to each service's website, or consult the FCC's Broadband Speed Guide.

WiFi Router Location

If you're connecting to the Internet via WiFi, make sure your router is placed as close to the middle of your home as possible, away from obstructions (such as cabinets), away from other electronic devices, and off the floor. Walls, metal (ductwork or decking), refrigerators, and microwave ovens, reduce signal if not block it totally. Electronic devices (microwaves, TVs, baby monitors, cordless phones, etc.) can create interference. Wi-Fi doesn't do well around lots of water, either, so stay away from aquariums and domaestic water heaters.

Wifi band

WiFi routers operate in different frequencies. The 5 GHz wireless frequency provides faster data rates at shorter distances and is typically much less "busy" than the 2.4 GHz wireless frequency. If wireless range is your priority, 2.4 GHz performs better than 5 GHz, but 2.4 Ghz is more susceptible to interference. The 5 GHz wireless frequency doesn't penetrate solid objects nearly as well as the 2.4 GHz. A dual-band router (2.4/5 Ghz) usually performs better than a mono-band 2.4Ghz router, as your device (smartphone, laptop) will choose the better signal, 2.4 or 5 Ghz.

Make sure your old or slow devices, e.g., printers, use the 2.4Ghz to free up the 5Ghz.

- Note 1: WiFi 6 and 6 Ghz
  WiFi 6 referes to the new standard 802.11ax (or AX WiFi). It works on 2.4, 5, or the newly open band 6 Ghz. WiFi 6 ≠ 6 Ghz The WiFi 6 improvement will not only affect 5GHz networks, which the industry has largely shifted to, and which provide faster data on shorter distances; it will also make 2.4GHz networks faster, which are typically slower but better at penetrating solid objects like walls.
- Note 2: the 5GHz band has nothing to do with 5G cellular service - two differents things. 5G refers to the 5th generation mobile network for cellular phones.

Wifi channels

Wifi operates on different channels (like cars driving on different lanes of a highway). Your neighbor's router may operate on the same channel as your router, creating congestion. Try to change your router's WiFi channel. There are apps that can scan the airwaves and tell you which channels are the least occupied. Channel occupation, just like road traffic, depends on time of day and may change from one day to another, as your neighbors may just do the same, change channel.

Test the performance

It is a good idea to always use the same tool to test to be able to compare. We use speedtest.net against Pilot Fiber, New York, NY as the server.

In video by Bright Side

https://www.youtube.com/embed/iBm55SPMS2k