



NYC Mesh



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Wi-Fi routers

Wi-Fi hardware -an antenna connected to a very small computer running wireless receiver transmitter (WRT) software.

WRT software is mostly based on Linux.

OpenWrt is an open-source WRT that can replace the factory software



OpenWrt

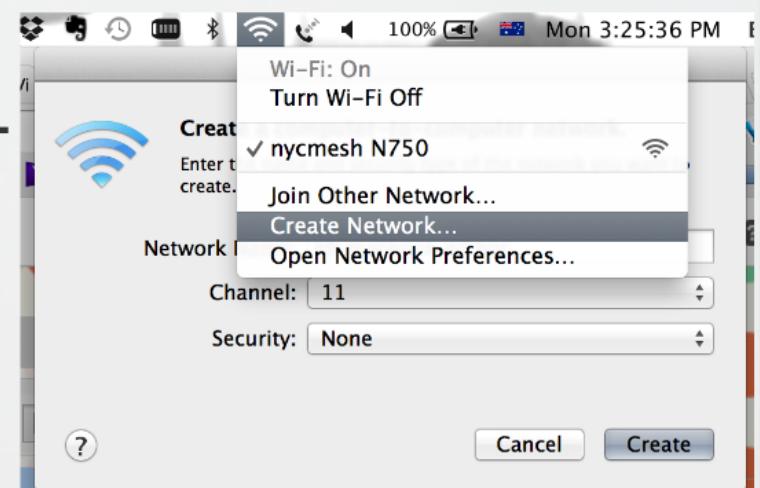
Linksys used Linux to build the WRT firmware for their WRT54G router. Because of open-source licensing they had to make the code publicly available.



Wi-Fi modes

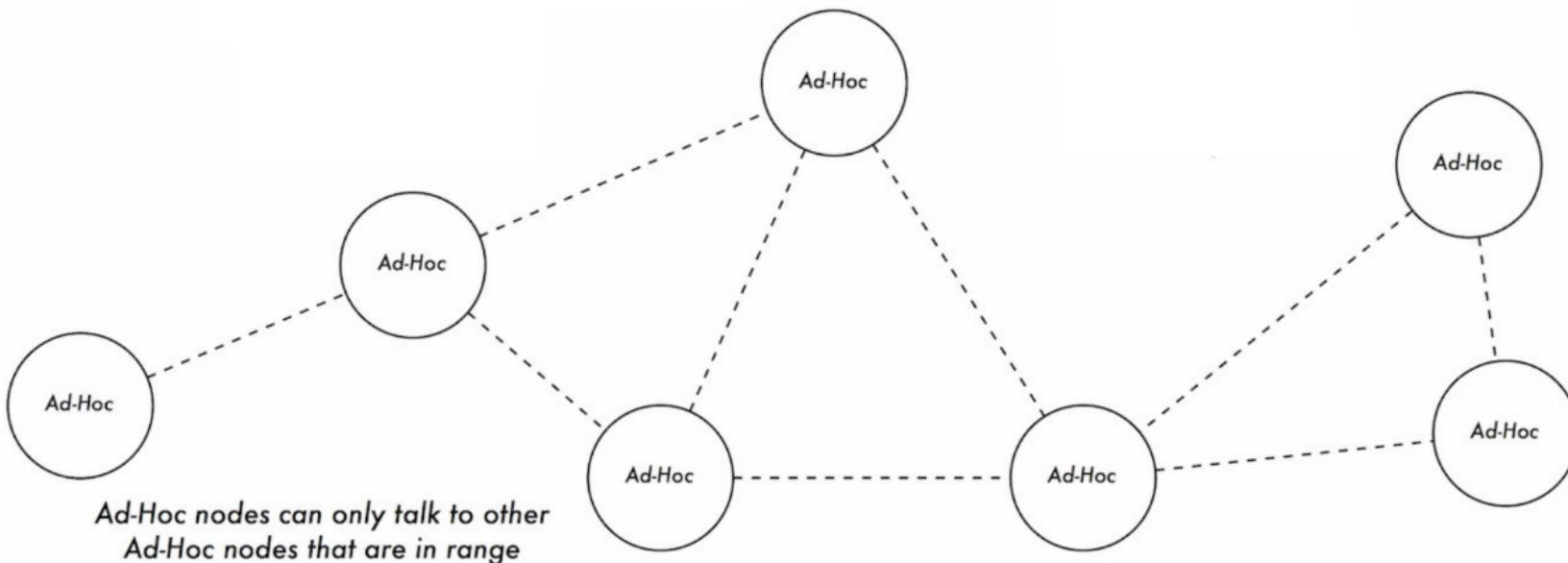
Two common Wi-Fi modes are-

- **Access Point** (infrastructure mode)
Hotspot AP and laptop client
- **Ad hoc**
Computer to computer-



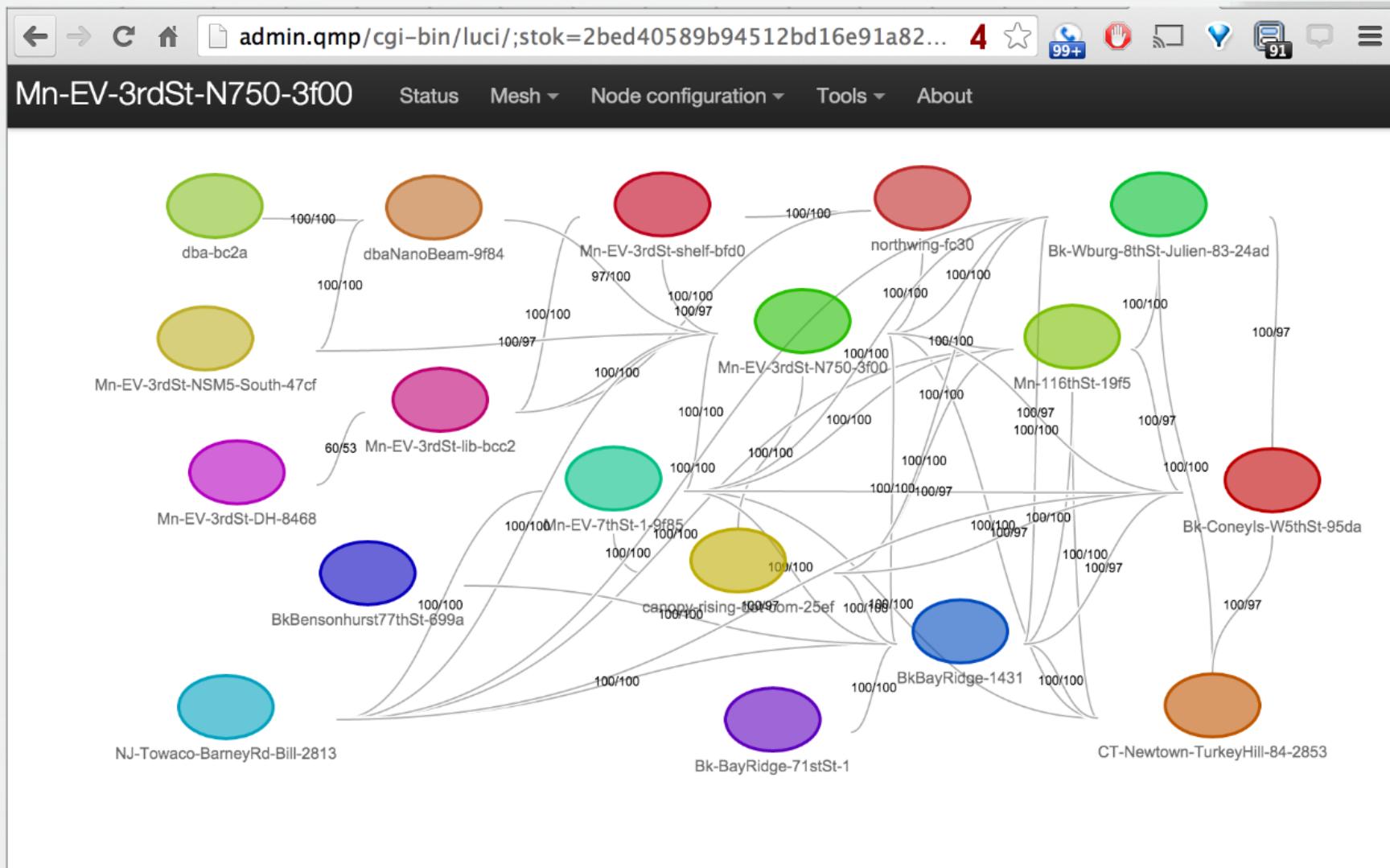
Ad hoc Wi-Fi:

a device can connect to another device that is in range- one "hop".



<http://wndw.net/>

Mesh protocols extend Ad hoc. Devices can connect to any device that is within the network (multiple hop), automatically find the fastest routes and reroute around outages.



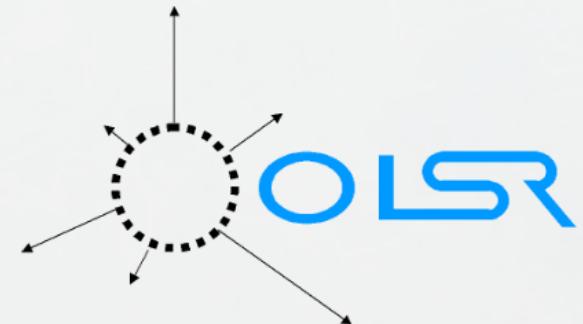
Mesh Packages!

Router software is now open-source. yay!

Let's add some mesh features to the ad hoc protocol-

Early popular mesh protocol-

OLSR (Optimized Link State Routing)



Next-

BATMAN (better approach to mobile ad-hoc networking)

-**BMX6**

-**Batman-adv** (layer 2 protocol)



NYC Mesh uses-



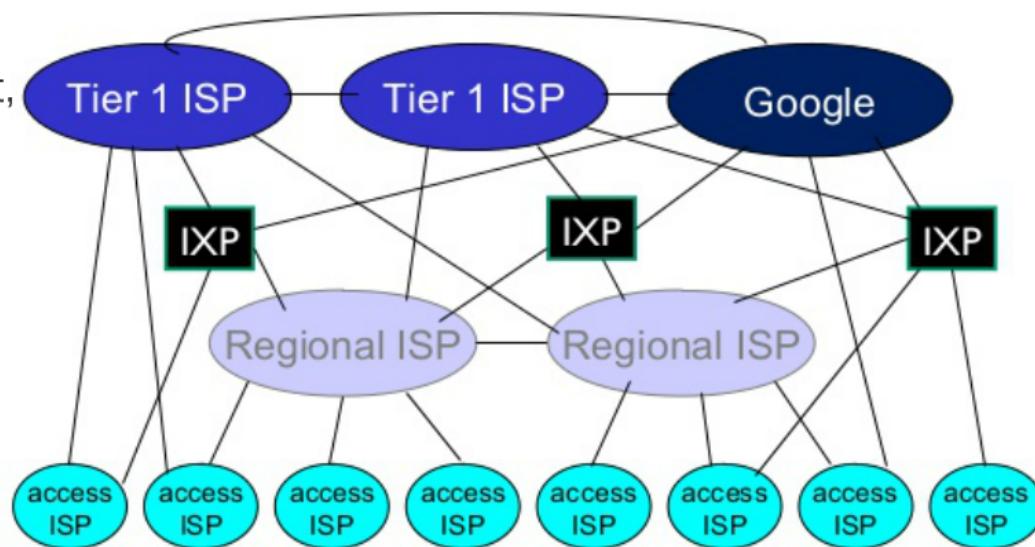
and we are also
experimenting with-



Mesh is an old idea. BGP is used to mesh tier 1 providers. New mesh protocols are bringing the old decentralized idea of the Internet to Wi-Fi routers.

Internet structure: network of networks

Tier 1 is AT&T, Cogent, Level 3, etc.



Internet Exchange Point (IXP)

- ❖ at center: small # of well-connected large networks
 - “tier-1” commercial ISPs (e.g., Level 3, Sprint, AT&T, NTT), national & international coverage
 - content provider network (e.g. Google): private network that connects its data centers to Internet, often bypassing tier-1, regional ISPs

Introduction 1-40

<http://goo.gl/PJQFjd>



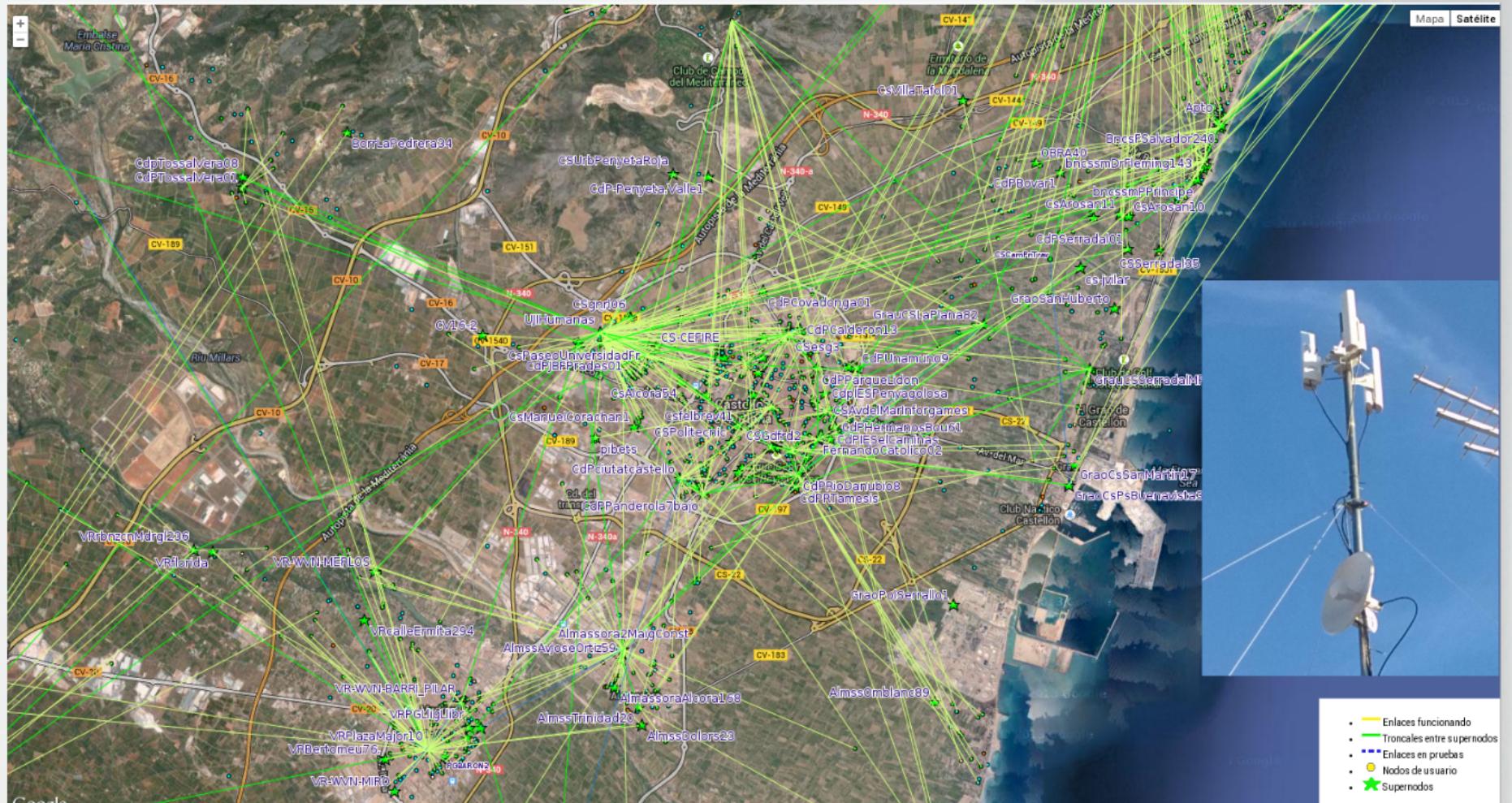
Prezi

Problem with multiple hop mesh over Wi-Fi

- each hop halves bandwidth
- each hop adds ~100 milliseconds latency.

Mesh networks need to reduce the number of hops to keep network usable.

- Use rooftop backbone to make "supernodes".
- Use multiple radio routers (MIMO)



USA community meshes

two well-known examples-



~25 nodes

Using Commotion/OLSR

seattlemesh.net

Active Nodes: 10 Hotspots: 0

Using cjdns

+ many small commercial WISPs running mesh



Prezi

Other community meshes



+ many others in Europe, South America and Africa



Why build a mesh network:

Before **Guifi** there was no internet in the farmlands. Telefónica was the only ISP. Spanish people hate Telefónica.

In Germany- very few Wi-Fi hotspots, as German law holds the operator of a public hotspot liable for everything its users do online.

Germany's "**Freifunk**" ("free wireless") clubs formed with the goal of creating open Internet access for all. They bypass legal problems by tunneling through VPNs based in Sweden.

Reasons to build a mesh network-

- Self configuring (simple!)
- Decentralized, no single point of failure
- Emergency community networking (for next hurricane)
- Freedom from Time Warner, Verizon and Comcast
- A neutral network that does not block or discriminate content
- Encryption to stop spying and censorship
- Public Wi-Fi access points
- Community building with highly localized websites
- Close the digital divide
- Symmetrical high bandwidth
- Creating an infrastructure commons. The community owns the network.
- Eventual self-sufficient network as alternative to internet

Our software

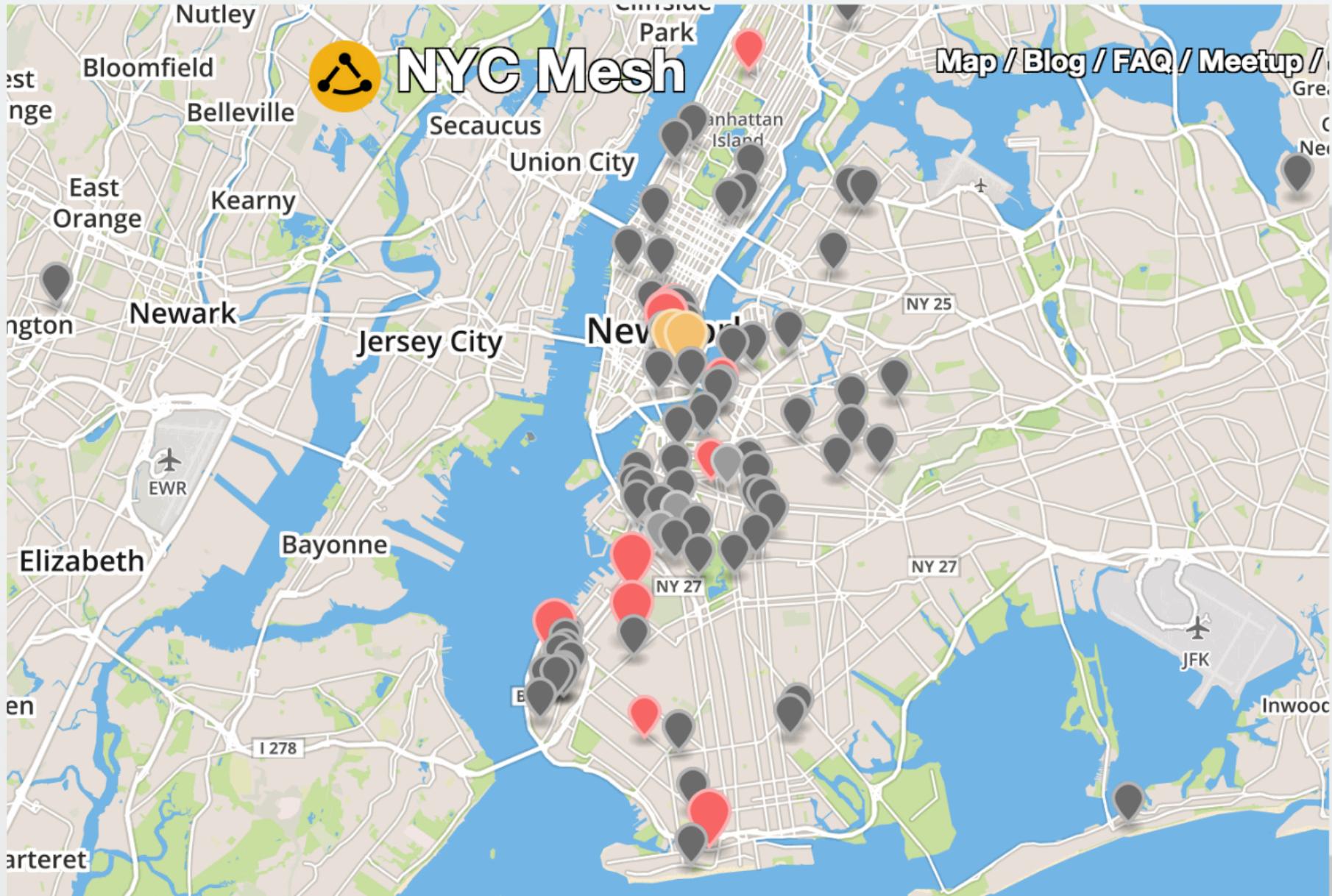
We chose a BMX6 package called qMp. qMp is used by Guifi and Freifunk. Well supported and scales.

Our images have tinc VPN added which allows the nodes to securely connect and mesh over the internet. Isolated nodes can be still be on the mesh.

Our download page has these images

<https://nycmesh.net/download/>





Red markers are active nodes, gray markers are node requests





Sunset Park



East Village



Greenwood



Prezi



PIX 11

5:14 78°

SPORTS

NIC REACH 4TH ROUND AT THE FRENCH OPEN

PIX11NEWS

ROGER FF

DBA bar, East Village- Ubiquiti Nanobeam router



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Coney Island



Panoramas for rooftop node requests:



Adding servers to the mesh

The mesh can work without servers

Servers add functions like-

- Local information
- Chat/IRC
- Wikis



We currently have servers in Harlem, Bay Ridge, Williamsburg and the East Village.

These servers are only available on the mesh and do not need an Internet connection.

The screenshot shows a web browser window with the following details:

- Address Bar:** wiki.mesh/doku.php
- User Information:** Logged in as: brian (bhny) | Update Profile | Logout
- Page Title:** wiki.mesh
- Page Content:**
 - Welcome to wiki.mesh**
 - Hoping to keep track of valuable data regarding the [nyc.mesh](#).
 - As any wiki, it's open to contributions. So don't hesitate to create pages. Add info, etc.
 - Services**
 - [http://harlem.mesh](#)
 - [http://bayridge.mesh](#)
 - [http://ev.mesh](#)
 - [http://nyc.mesh](#)
 - [http://chat.mesh](#)
 - irc.mesh IRC chat on port 6667, or SSL 6697 (needs IRC client)
 - Events**
 - [2015-07-29 Meetup at Hardware Hacklab](#)
- Bottom Right:** A vertical toolbar with icons for edit, clock, link, and up/down arrows.
- Page Footer:** start.txt · Last modified: 2015/07/26 16:21 by bhny
- Page Bottom:** Except where otherwise noted, content on this wiki is licensed under the following license: [CC Attribution-Share Alike 3.0 Unported](#)

IRC chat

(brian_) #mesh mesh channel

```
12:01 You have joined the channel
12:01 brian_ has joined (~brian@d2774717.irc.mesh)
12:01 Topic: mesh channel
12:01 -Server- set the topic at: Jul 28, 2015, 11:26 AM
12:01 Mode: +P
12:01 Created at: Jul 28, 2015, 11:26 AM
```

```
10:57 <mesh_> 3 channels formed
10:57 <mesh_> I have 3 users, 0 services and 0 servers
10:57 <mesh_> 3 4 Current local users: 3, Max: 4
10:57 <mesh_> 3 6 Current global users: 3, Max: 6
10:57 <mesh_> Highest connection count: 6 (31 connections received)
10:57 <mesh_> - irc.mesh message of the day
10:57 <mesh_> - ****
10:57 <mesh_> - * H E L L O *
10:57 <mesh_> - *
10:57 <mesh_> - *
10:57 <mesh_> - * Welcome to the nycmesh irc server *
10:57 <mesh_> - *
10:57 <mesh_> - *
10:57 <mesh_> - ****
10:57 <mesh_> End of MOTD command
10:57 <mesh_> Reply(396): d2774717.irc.mesh is your displayed hostname now
11:44 <hackint> (Global) [Network Notice] major - We need to relink some ircd
servers, which will result in temporary netsplits. Sorry.
```

brian_

▼ hackint
#nycmeshnet

#irc://irc.hack.
#gluon

▼ EFnet_
#nycmeshnet

#irc://irc.hack.

▼ mesh
#mesh

▼ mesh_
#mesh

chat.mesh

The screenshot shows a web-based chat application titled "chat.mesh". The interface has a header bar with a "NYC Mesh" tab, a user "Brian", and various icons. Below the header is a navigation bar with "Server" (9 messages) and the current channel "#meshchat". The main area displays a conversation between a user "guest" and the bot "mesh". The bot has greeted the user with "Hello NYC Mesh!". A message from "guest" is shown as "→ guest has joined". On the right side, there's a sidebar showing "1 Users" and the name "guest". At the bottom, there's a footer with "guest" and a "Send message..." input field.

→ guest has joined

»

1 Users

guest

guest Hello NYC Mesh!

guest Send message...

ev.mesh

The screenshot shows a web browser window with the URL "ev.mesh/" in the address bar. The page title is "ev.mesh". The main content area displays a "User login" form with fields for "Username *" and "Password *". Below the password field are two links: "Create new account" and "Request new password". A "Log in" button is located below the password field. Below the login form, there is a section titled "NYC Mesh" with the following text:
This is the mesh. This is not the internet. This website is running on a small server in the East Village.
Here is a list of all the servers running on the mesh-
[wiki.mesh](#)
NYC Mesh is a community-owned network. We aim to create a free, resilient, stand-alone system that serves both for daily use and also for emergencies. Please visit [nycmesh.net](#) and help us extend the network.
[Read more about NYC Mesh](#)
Powered by [Drupal](#)

ev.mesh



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