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NYC Mesh Interim report June/2017

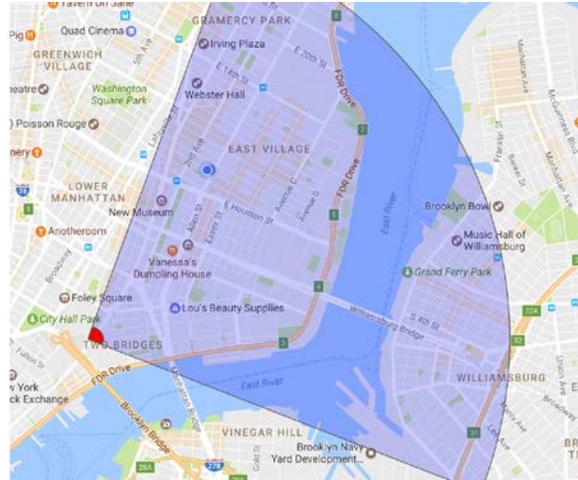
Activities undertaken-

Supernode 1

During January we finished our first large antenna install. This antenna is a 90' sector antenna on the roof of a data center at 375 Pearl St. in downtown Manhattan. We were inspired by Guifi's concept of a "supernode". A supernode serves as a prominent internet gateway to which many rooftops can wirelessly connect. This antenna is connected to backbone fiber and has donated bandwidth from DE-CIX (the largest internet exchange provider) and Packet.net.

Ubiquiti Prism
90° Sector antenna
5GHz
3 radios each capable
of 60 connections

Due to changes at datacenter we
have to renegotiate additional
antenna placements. Just one
antenna for now.



Area served by Supernode 1

Supernode 1 gives us our first reliable internet gateway and frees us from using members ISP connections. This is our major expense, and was made possible by the ISOC grant. Ongoing costs are \$850/month which we are working to cover using small donations from members.

Install team training

Organizing installs has been very time-consuming and usually only a couple of volunteers were available. To speed up installs, we began to have install team meetups in March and found many more volunteers, and also a contractor willing to help out. In these meetups we discuss the basics of networks and how to do an install. We have tools so members can learn how to crimp ethernet. We also have different routers so members can learn how to configure a router and how to align antennas for the best signal.

Installs

From April to June the install rate increased and we currently have 10 rooftops connected directly to Supernode 1. We standardised installs charging \$110 for equipment and \$50 directly paid to the contractor for labor for a rooftop install.

Our previous strategy of installing rooftop to rooftop had a serious problem in that people often moved out of their apartment, leaving an abandoned node. This is especially problematic in an urban setting and is a unique challenge with our mesh. To avoid this we decided to emphasise installing multiple apartments in the same building. We now have five apartments in the one building in Chinatown all on our network. One antenna on the roof feeds an ethernet switch and then ethernet cables go to each apartment. All installs from now will try to get multiple apartments on the network.

We are also trying to work with building co-ops so we can install an entire building. We have been working on a presentation for one cooperative with 200 apartments in downtown Manhattan.

Installing 10 antennas has given us a good experience in what works, and what kind of bandwidth we can provide. We have found that service is typically between 70 Mbps and 115 Mbps.

We now have access to 10 rooftops in the downtown area that can serve as reliable “second hop” connections for the immediate neighborhood. This will enable us to install on roofs that don’t have line-of-sight to Supernode 1.

Publicity and outreach

Outreach is a huge initiative. We started with targeting by community types: religious institutions, schools, and libraries. These are commonly the tallest buildings in the neighborhoods. We also followed the Guifi model of outreaching to churches with the impression that these institutions make a huge impact on their communities and more likely to be interested in the NYC Mesh project.

Our technique included scouring public information for contact information for religious institutions. Over the period of 2-3 months, we ran an email campaign, followed up with cold calls, and made visits. The result wasn’t in our favor and yielded very little interest. The most success we found was in communities where we had a NYC Mesh volunteer advocate for the project.

NEIGHBORHOOD PROGRESS

We identified the most success in neighborhoods where a volunteer (or two) championed the idea for their area. In Bedford Stuyvesant (a neighborhood in Brooklyn), a volunteer set up the network in his building of about six apartments. In East Williamsburg/Bushwick - a fast changing Brooklyn neighborhood - a local team set up a supernode on an old fire house. This node which is only established in May now connects three rooftops and also a large moored boat on the canal, which serves as a community center.

Chinatown is located at the base of the supernode. We identified the Chinatown Business Improvement District as our champion and are working closely to align local community associations and buildings with NYC Mesh.

The East Village neighborhood network is headed by a core member and is the longest established neighborhood network. The network was connected to Supernode 1 in January letting the members cancel their commercial ISP connections. Our oldest public access point is in the neighborhood bar “DBA”, which was also the location of many of the early meetups. Six rooftops in the area are connected to the supernode and provide a robust and stable mesh for the neighborhood, many nodes having uninterrupted service since February.

MARKETING COLLATERAL

Currently available on nycmesh.net/leaflet are: one page flyers, simple brochures, a site survey template, and a landlord/building management template. The idea behind these materials are for the following types of outreach situations.

> APPROACHING NEIGHBORS

Once a building is connected to the mesh network, we want to notify all residents in a non-threatening method with simple language about benefits and change the mesh network brings to accessing the internet.

> COLD OUTREACH TO CAFES, RELIGIOUS INSTITUTIONS, LOCAL ESTABLISHMENTS

One page flyer concisely sharing the benefits of the network and what their involvement entails and how it impacts their community.

> APPROACHING BUILDING MANAGEMENT

A blank landlord/building template is available for neighborhood organizers who want to formally propose a solution for their building/community.

OUTREACH - UP NEXT

The team constantly generates great outreach ideas. Our goals are: to refresh outreach/marketing collateral; create a short video explaining the mesh network and its impact on the community; update the website; and continue to grow the neighborhood efforts.

CHALLENGES

- The team does not recommend prioritizing individual buildings given the fast-paced and constantly changing rental market.
- Given that technical people are more interested in such a project, it has been difficult to recruit graphic designing talents to help with producing marketing and outreach materials. Branding has also proven to be a hurdle.
- Although finding a champion and mapping key players in a community has broken ground in some neighborhoods, the team still encounters lack of trust and confusion about the project.
- It is difficult to explain/communicate mesh technology to less technical constituents.
- There is a general fear of lack of privacy with a community network compared to a purchased connection.

Hardware/firmware

Like many community networks we are having problems finding compatible hardware. The TP-Link brand indoor routers we previously supported are now locked down (so that we can't load custom firmware) or discontinued. We have purchased samples of several different routers that we will be experimenting with in the coming weeks. We have scheduled meetups to specifically work on supporting new hardware.

Monitoring

As the mesh network grew through 2015 and 2016, network stability became a large problem. Routers needed to be rebooted regularly (and even daily) and a misbehaving router could cause the entire network stability to suffer. To fix this we worked on a “watchdog” script that immediately restarts network services if there is a problem. This happens very quickly and without rebooting, leading to long periods of stability with problems being detected and solved immediately.

We installed the watchdog script on mesh routers in February and have not had to reboot a mesh router since, and our network is proving more stable than traditional NYC ISP connections. The watchdog is available for download on our website.

Additionally, we have deployed performance monitoring and statistics on our core network. Statistics that we collect are only of the “interface counters” level, amounting to traffic flow and link quality rather than destination, content, or user information. Among the statistics we collect are link bandwidth, packet rates, error count, wireless link signal levels, wireless noise floor, internet exchange route metrics, external connectivity ping time, and other metrics. This allows us to get long-term usage statistics to help understand if the network is being well utilized, if there are problems at odd-hours, and helps inform us of future decisions as we develop and grow the network. The statistics also helps increase transparency, which is a welcome change in the internet space.

Documentation

Our website has been updated over the last six months to include information on how to start a community network in your own city- nycmesh.net/how

This is currently four pages of notes and will be expanded over the year adding specific details. NYC Mesh has been getting emails from all over the world asking how to do build a network, so this is definitely helping people.

We now also provide a data policy which informs users that we do not collect their data, unlike a commercial ISP. This policy can be available at [nycmesh.net /data](http://nycmesh.net/data)

Our most asked question “why are you doing this” is at nycmesh.net/why

We have done many presentations on our network this year-

Building a community network- January.

How to Help -February

How it works -April

State of the Mesh- June

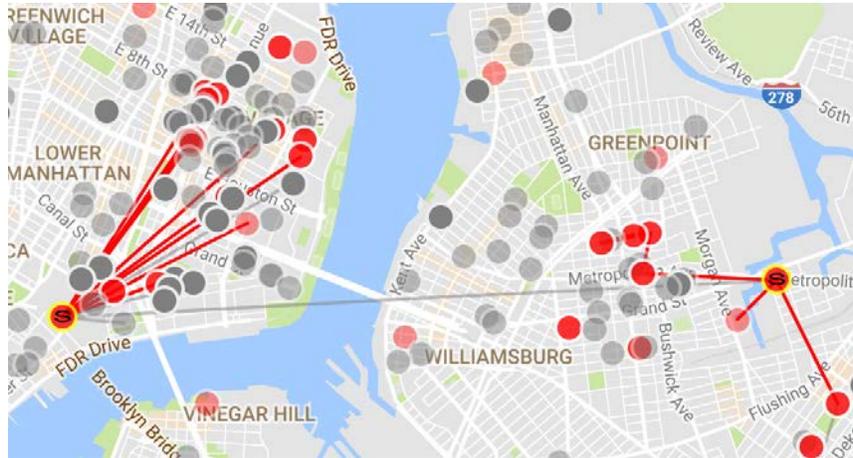
The videos and slideshows for these meetups are all freely available. Links to these are here nycmesh.net/blog/presentations/

We now have a [YouTube channel](#) that has the four videos from our meetups this year.

All components of our system are available in the open at our Github site, including, including the website, documentation, mapping scripts, firmware components. Our Github site is available at github.com/nycmeshnet

Supernode 2

In May, a separate team began building our second supernode in Bushwick. It is on top of a converted fire house and has extended views and line-of-sight to Supernode 1



Supernode 1 on the left, Supernode 2 on the right

Building a resilient network in Brooklyn proved difficult in 2015 and 2016. With a centralized location, similar to downtown Manhattan, it will be much easier and more stable. Three rooftops are already connected to this new supernode. There is a planned connection between the two supernodes (see gray line) using donated high-bandwidth AirFiber antennas.

Computer networking training

We have begun classes in computer networking. These are conducted in a community maker space. The first class was well received. As such, we intend to develop a series of classes, which will also be available online for general education about mesh networks and networking in general.

Topics to be covered include networking technology from the most basic level with no experience at all, up to building small networks, campus networks including mesh networks, and explanatory information about the Internet in general and supernode connectivity to the internet. Additional classes will be taught around installation techniques and proper procedure for rooftop work.

Through teaching classes we hope to educate and empower the community to grow in their knowledge and understanding, and to be able to develop and teach these classes to each other independently without need for specific mentors or teachers.

Performance to date against the goals of the project

There has been growing interest in the NYC Mesh project and we have been steadily increasing the number of installations. We have been holding regular general meetups to describe and gain interest in what we are doing. These quickly became too big for the first venue, causing us to find larger venues such as university classrooms, and also create break-out meetups for particular topics.

With ten rooftops now connected to Supernode 1, we now have a solid base to extend deep into those neighborhoods with “second hop” installs. To do this we will need brochures, mailouts, and hopefully some more mainstream publicity.

One of our important aims is to remove the digital divide by bringing high-bandwidth connections to poorly serviced and low-income areas. While we have helped some people who previously had no connection, we need to work much harder on this, and at a larger scale. We have begun working with the Chinatown Business Improvement District which has some insight on this topic, and there are numerous neighborhood housing groups we have begun reaching out to.

Outcomes & achievements

Supernode 1 Manhattan, active in January

Connecting 10 rooftops to Supernode 1 by June

Regular and larger meetups divided into general, technical, educational, and social

Supernode 2 Brooklyn, active in May

Beginning educational courses on computer networking and installation

Documenting how to start a community network nycmesh.net/how

Stabilizing the network through monitoring and “watchdogs”.

Lessons learned and disappointments

Our largest ongoing disappointment is that we do not have any relationship with the city or mayor’s office. We would be thrilled to add the NYC Housing Authority (NYCHA) buildings to our network. This is something we will continue to work towards. Most of the other community network projects in the city received a large amount of funding from the city’s “Rise:NYC” grants

a few years ago and these projects are all still ongoing. Silicon Harlem is one of the Rise:NYC grant recipients and we have had discussions about collaborating.

Early in the year we had conflicts with the grant application writer. He left in January after many arguments. This conflict made it obvious that we need conflict resolution mechanisms.

Our relationship with the Sabey data center (Site of Supernode 1) has changed as the people left that company. Unfortunately some challenges have arisen with flexibility on antenna placement. For the moment we are limited to a north-east facing direction. With increased monthly fees we could be allocated additional sides of the rooftop platform. There is significant competition amongst data centers for clients, thus we should be able to negotiate a solution. Given the potential for conflict and ever-shifting commercial landscape, we will need more supernodes so that we are not so reliant on a single relationship.

Any changes in the design of the project and implications for future work

Our supernode uses a sector antenna that can connect to well over one hundred rooftop antennas. This gives us a new point to multi-point (P2MP) architecture at the core of our network. Previously we were using only multipoint to multipoint mesh routers and ethernet. This hybrid of P2P and MP2MP allows us to scale quickly and also gives us a reliable internet gateway and an interconnection point between diverse neighborhoods. While we have this stable and high speed connection, it is important for us to ensure we maintain a mesh topology so that we do not become too reliant on one location or commercial entity. Thus far this ideology has sustained us well and we hope to continue on this hybrid path for some time, as it provides a unique solution to the last-mile problem.

Additional information useful to ISOC community

ISOC has a mission to provide open development and use of the internet to benefit all people of the world. While NYC Mesh is in an urban setting, full of opportunities for internet connectivity, the opportunities here are over-commercialized, are of poor quality, and lack an openness and understanding of how the internet truly functions. NYC Mesh brings the realization of ISOC's mission to New York City in an actionable way that also meets the needs of people right now. In addition to meeting the physical needs of people who lack or desire better internet access, the meetings and education portion of our work has sparked a desire in communities to learn and grow their knowledge of all things internet-related. Many of our members have sought involvement with their building management to help bring the network to their building and beyond, further educating their neighbors and landlords. We consider this involvement and spread of ideas a success of the mission which should help grow the project and people simultaneously.

