**NYC Mesh**
**A community owned network**

- Decentralized
- Resilient
- An infrastructure commons

**Our reasons for building 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
- 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.
- Self-sufficient network as alternative to internet
- Encryption?

# Mesh networks in USA are small <40 nodes
# Outside the U.S.- huge meshes!



+ many others in Europe,South America and Africa

# NYC Mesh is inspired by and collaborating with Guifi of Spain.

**NYC Mesh-**
**40+ active nodes**

**Guifi-**
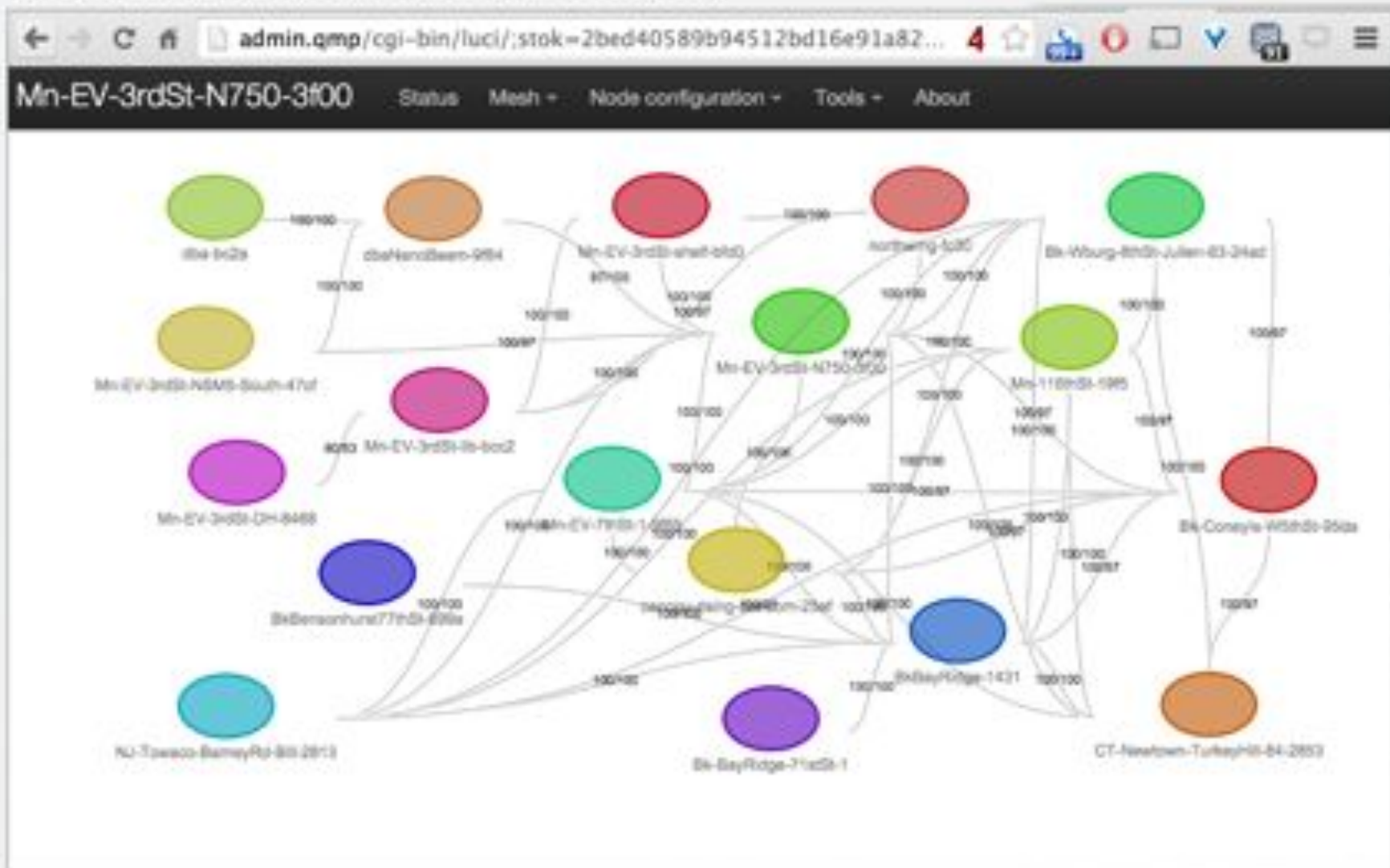**30,000 nodes in Spain**



NYC

Spain

# Wi-Fi routers

Off the shelf routers running OpenWRT packages

We use qMp/OpenWRT with BMX6 mesh protocol

**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 needs a backbone network

Problems 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 and make "supernodes".
- Use multiple radio routers (MIMO)
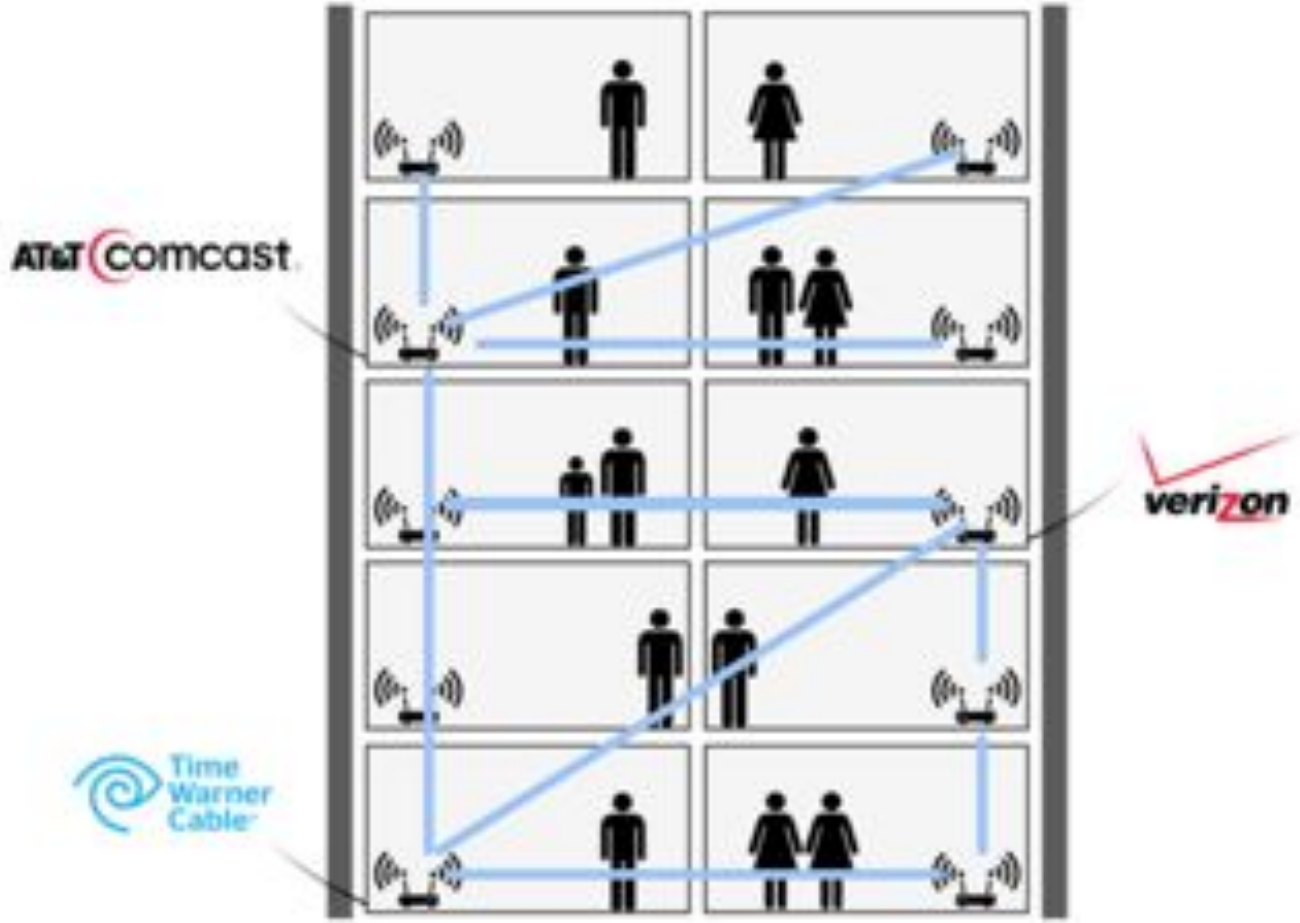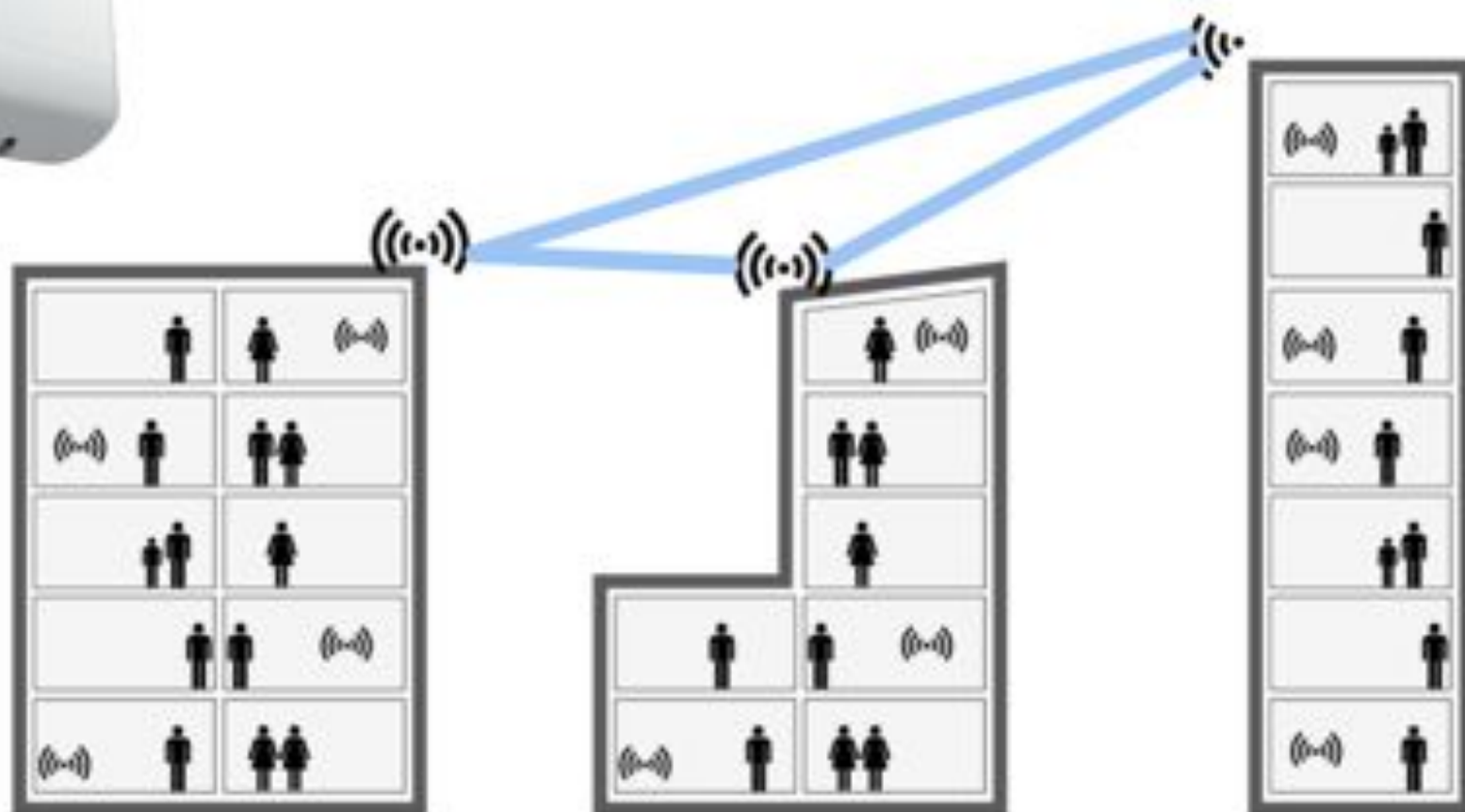- Use fiber or Ethernet where possible-

# 3 types of mesh nodes-

Type 1-
2.4GHz or dual-band routers connecting apartments
some with internet gateways-

Type 2-
5GHz directional routers connecting rooftops

and coming soon-

Type 3-
SuperNodes  sector antennas and point-to-point

# SuperNode 1

Sabey
375 Pearl St.

DE-CIX   bandwidth

We are planning antennas
facing Brooklyn and Manhattan
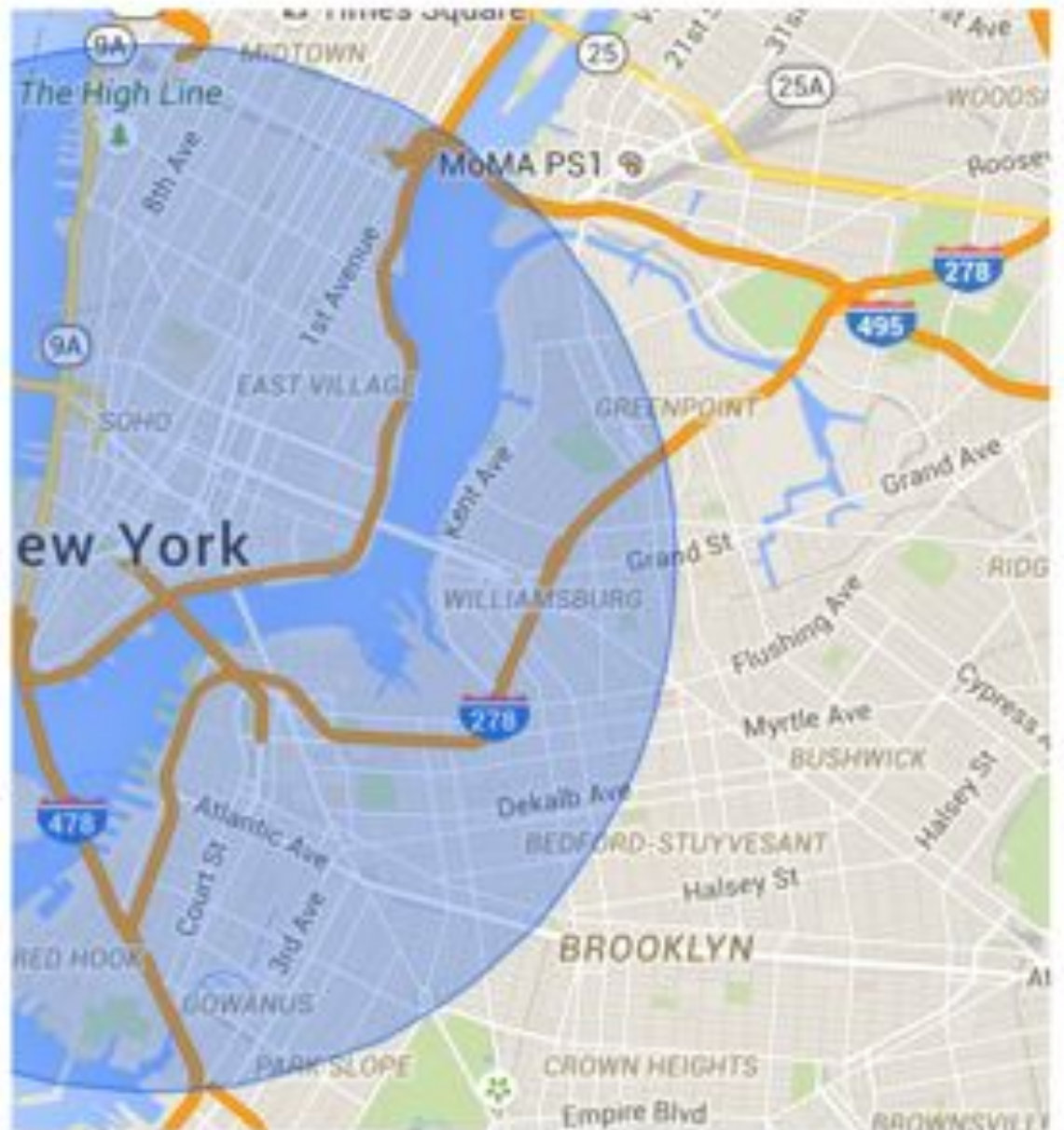from this IXP

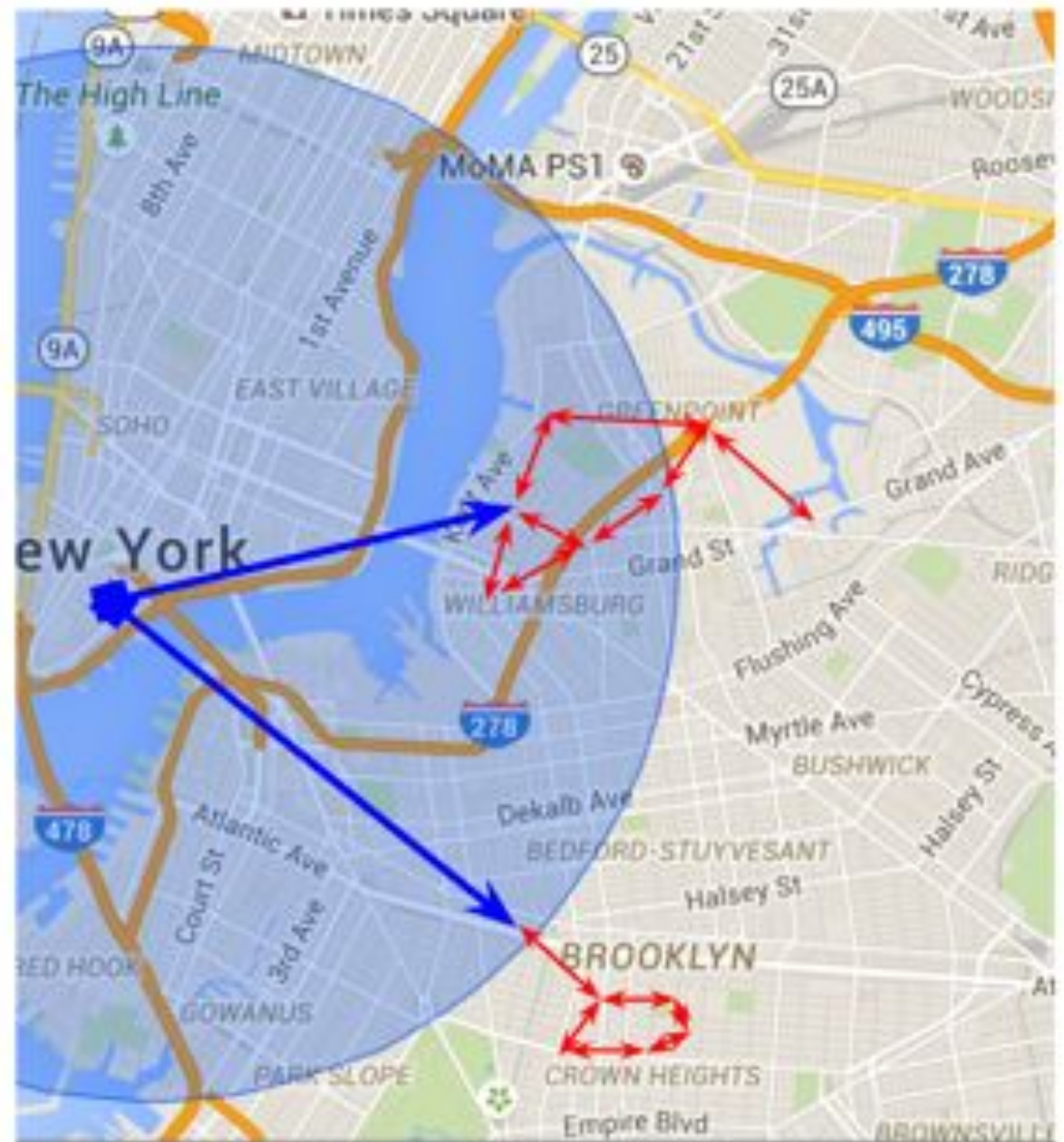# Brooklyn coverage-



# Downtown Manhattan coverage-

Using sector antennas
in P2M mode
(point-to-multipoint)

2 mile radius-

Use P2P for further distance

Extend into neighborhoods
using mesh M2M
(multipoint to multipoint)

# Modifications to qMp / OpenWRT

Let qMp do its setup first, then run our scripts

Created as an OpenWRT package

tinc VPN - Auto configure script (keys, conf)

HTTP POST script to upload public key

health scripts - check if tinc is running, bmx6 is using tap0, other bmx6 confs

Misc. NYC Mesh settings - SSID, Channel, Hostname, nodogsplash, firewall

# Networking

Each node has a /24 from 10.0.0.0/8 (also a /64 ipv6, not used at the moment)

bmx6 tunnels all traffic via ipv6

Wondershaper for bandwidth limiting

Nodogsplash captive portal which can also be used to limit bandwidth per client

# Hardware issues

Recent FCC ruling led to TP-Link lock down of 5GHz routers. We don't have replacement dual-band yet!

OpenWRT slow to fix bugs- so it has been forked- **"LEDE"** is the new fork. We will use LEDE when there is stable release

Rooftop access difficult and people move

Line-of-sight difficult from one roof to another

# Organizing issues
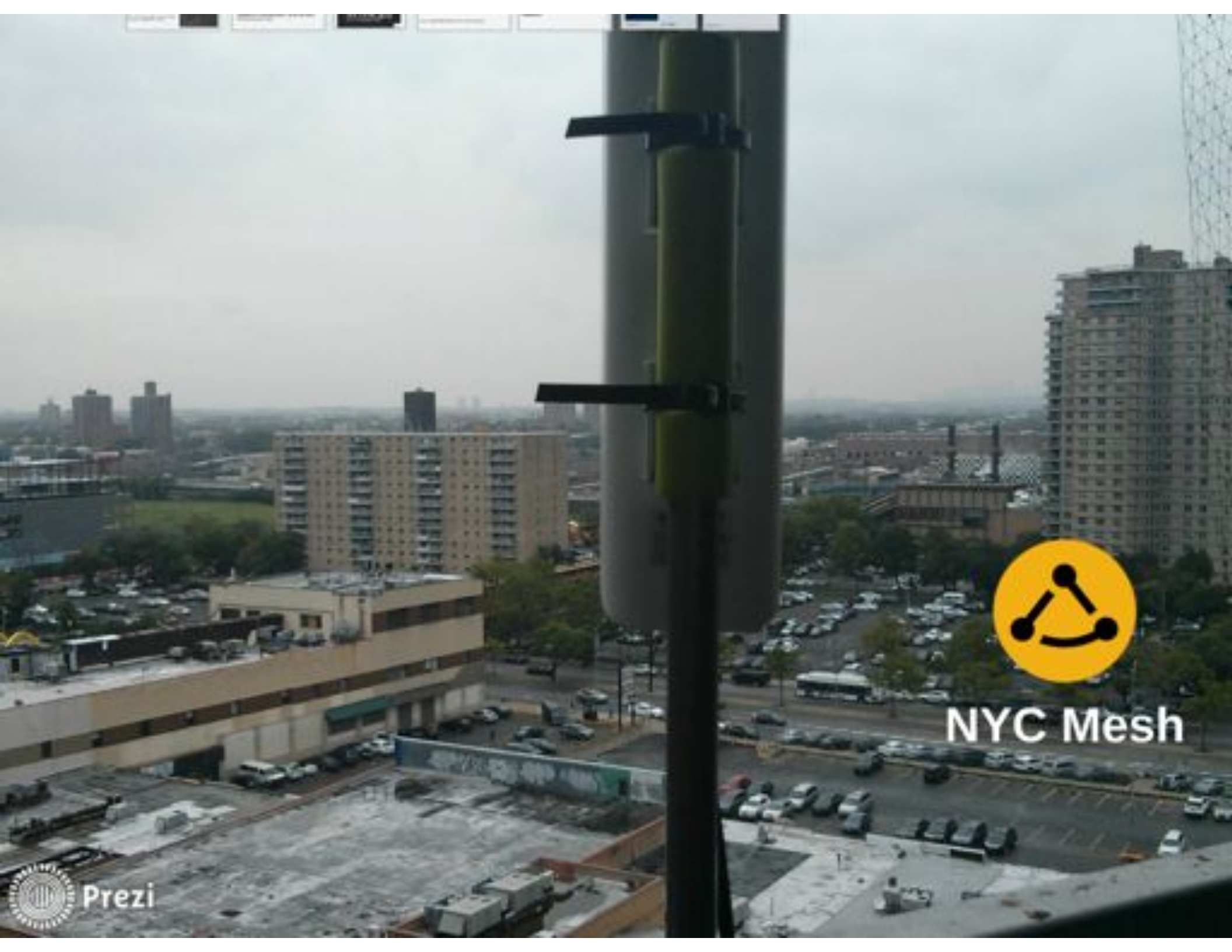
Volunteers with limited time

Money-
    Finally we are getting revenue stream-
    New donation page- https://nycmesh.net/donate/
    ISOC-NY our fiscal sponsor

Maintenance

NYC Mesh

Prezi