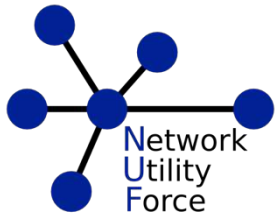
# Introduction




- Who is NUF?
- Project Background
- Deployment Overview
- Results

# Core Values and Beliefs

Network Utility Force believes that, above and beyond our experience, it's our values that drive our success in both business and life.  As such, NUF has adopted a system of Core Values & Beliefs that we live by:

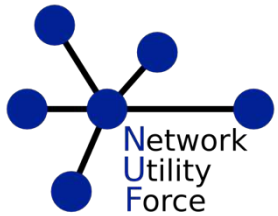
- We respect the individual, and believe that individuals who are treated with respect and given responsibility respond by giving their best.
- We require complete honesty and integrity in everything we do.
- We make commitments with care, and then live up to them. In all things, we do what we say we are going to do.
- Work is an important part of life, and it should be fun. Being a good business person does not mean being stuffy and boring.
- We are frugal. We guard and conserve the company's resources with at least the same vigilance that we would use to guard and conserve our own personal resources.
- We insist on giving our best effort in everything we undertake.
- Furthermore, we see a huge difference between "good mistakes" (best effort, bad result) and "bad mistakes" (sloppiness or lack of effort).
- Clarity in understanding our mission, our goals, and what we expect from each other is critical to our success.
- We are believers in the Golden Rule. In all our dealings we will strive to be friendly and courteous, as well as fair and compassionate.
- We feel a sense of urgency on any matters related to our customers. We own problems and we are always responsive. We are customer driven.

Permission to use these values granted by their creator, Charles Brewer of MindSpring.

# Who is NUF?

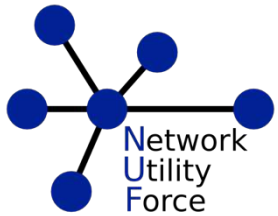
- Founded in December of 2011
- Projected 2015 revenues ~$1M
- 4 principal consultants/owners
- Numerous specialist contractors

# NUF Tenants




- Our reputation is EVERYTHING, without it, we are worthless
- We will ALWAYS advise our clients on what we believe is the right answer for them without exception
- Vendor neutral – The right tool for the right job
- Cisco, Juniper, Brocade, HP, Huawei, A10, Dell (Force10), Extreme, Vyatta, ADVA, Arista, Alcatel, etc., etc
- No hardware sales, 100% professional services
- No geographical boundaries, we go where we are needed

# NUF Core Skills




- IPv6
- Network Architecture and Design
- MPLS
- Peering
- IP address acquisition and management
- Network Security
- Wireless packet networks
- Network Automation
- DNS
- Network Monitoring
- Training

# Douglasville

- Founded in 1875 as the railroad arrived in the area
- 20 miles west of Atlanta
- 32,000 residents
- Downtown Douglasville is listed on the National Register of Historic Places

# Google Grant

- No outdoor WiFi
- Lack of hotspots
- Google reached out to Mayor Harvey Persons regarding their community outreach program and proposed offerings
- Google, Mayor Persons and the Douglasville IT department worked together with the Google team to find and hire a network engineering firm to build the municipal WiFi network
- Created the foundation for future WiFi expansion and wireless offerings for the city

# Deployment Overview

- Over 100 acres, across three separate locations (downtown, Hunter Memorial and Jessie Davis parks - approximately 50 APs)
- Both indoor and outdoor WiFi, as well as wireless backhaul
- Traffic is active, consistent and growing at sporting events, parades, and outdoor concerts, as well as within their community centers
- First municipal free access Wifi network to support IPv6 (?)

# Key Hardware

**Aerohive AP170: 37**

**Aerohive AP330: 8**

**Ubiquiti AF24: 6**

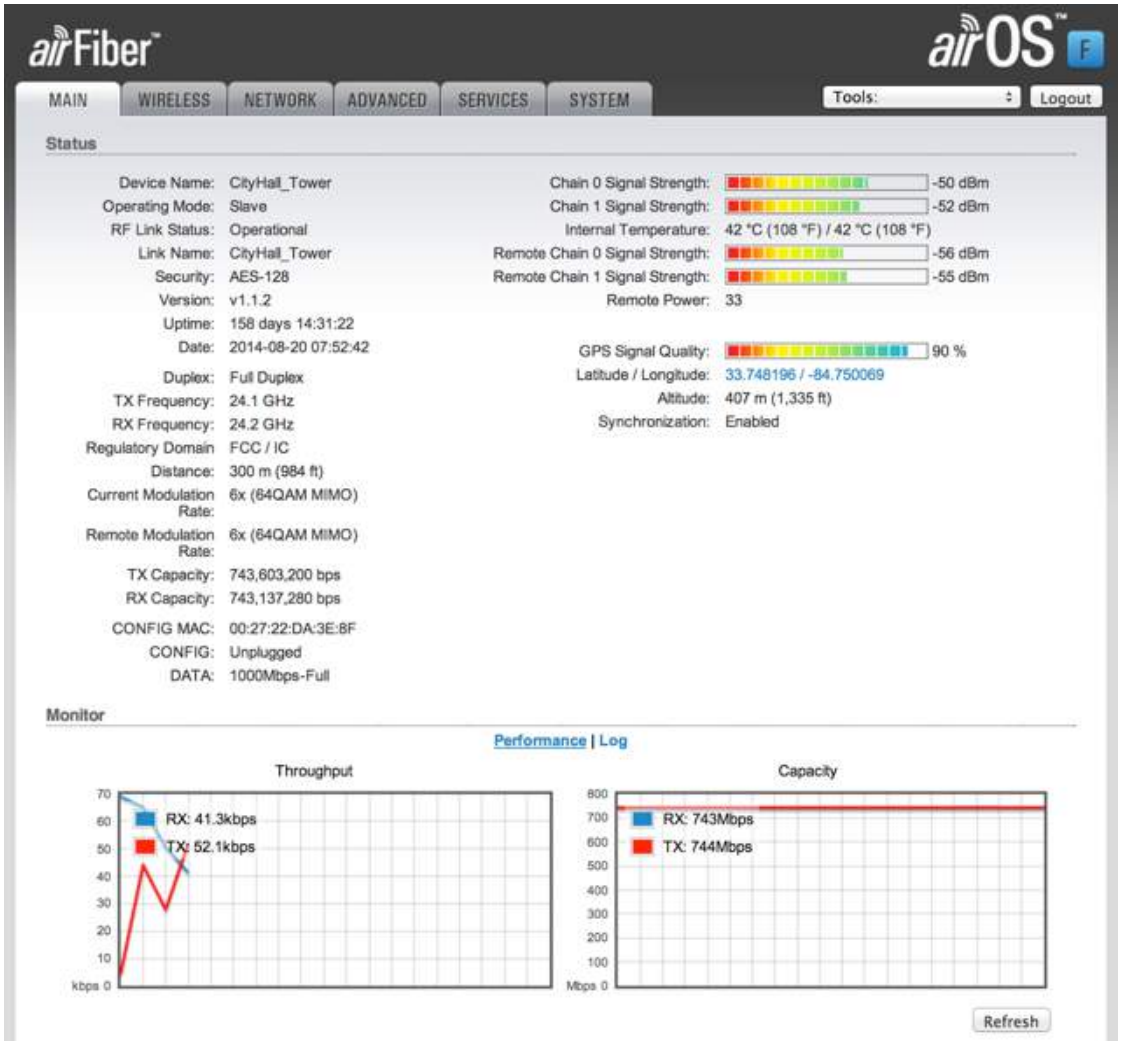
# Downtown

# Hunter Park

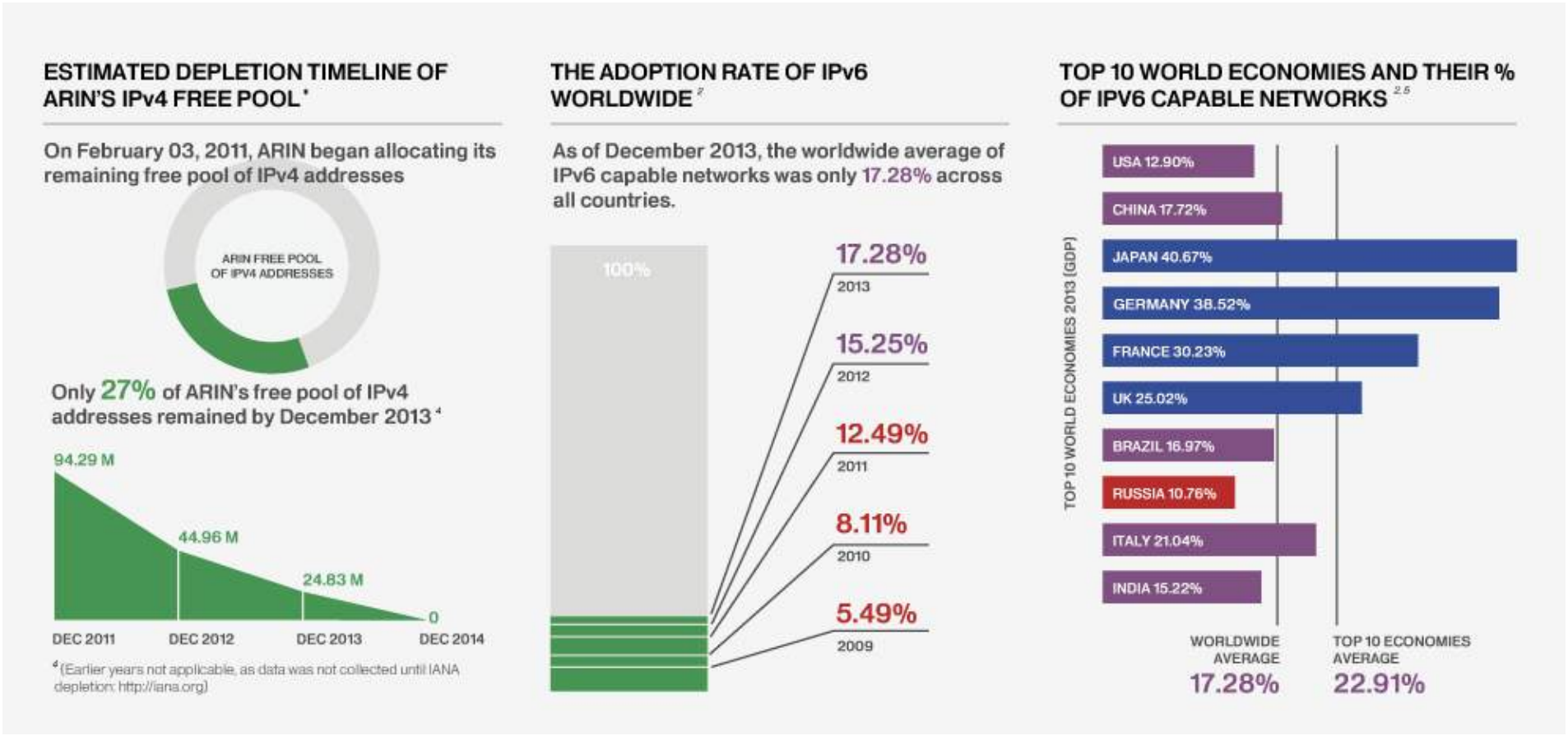
# Jessie Davis Park

# Deployment Pictures

# Backhaul Link Capacity

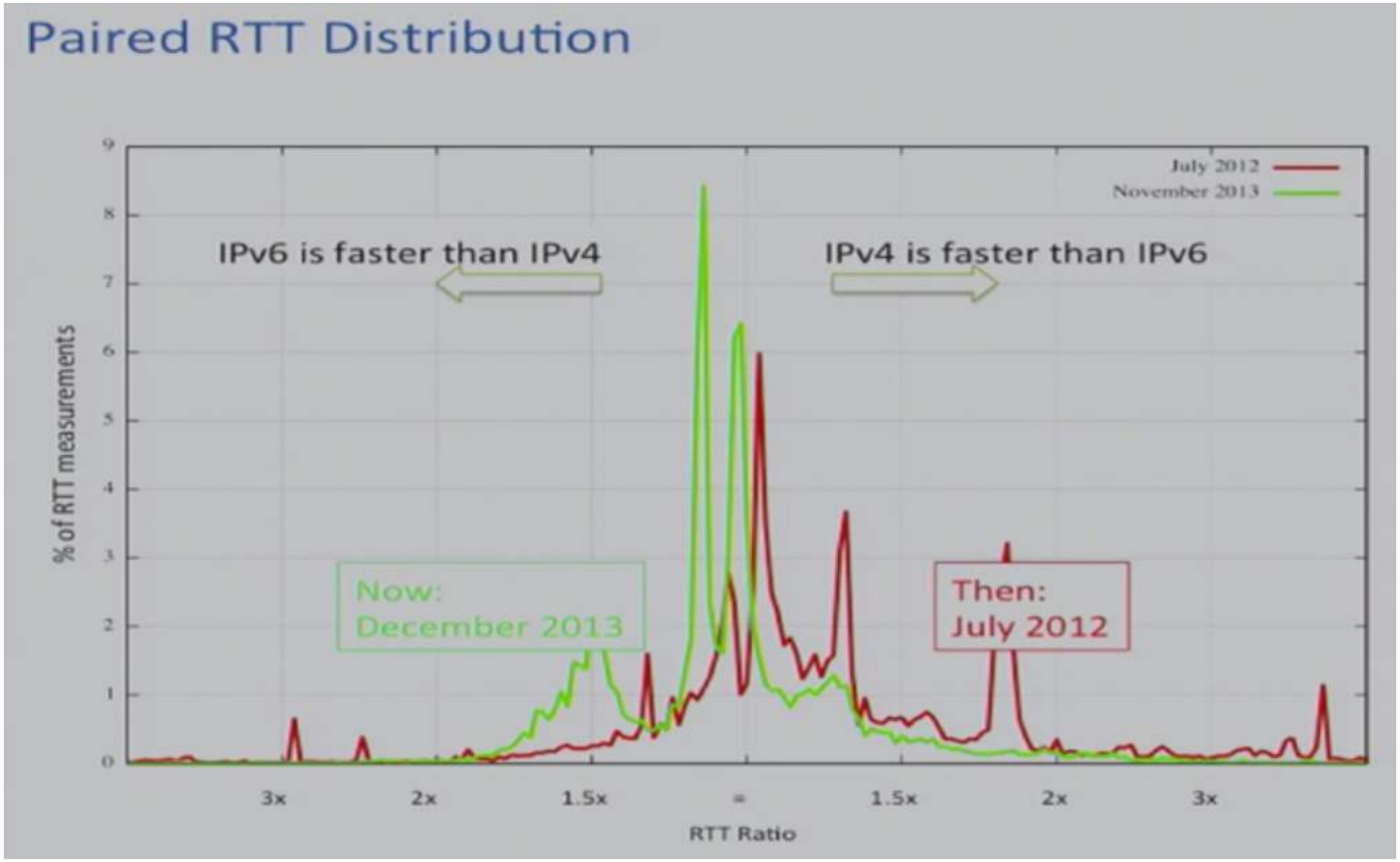


# Why Did We Deploy IPv6

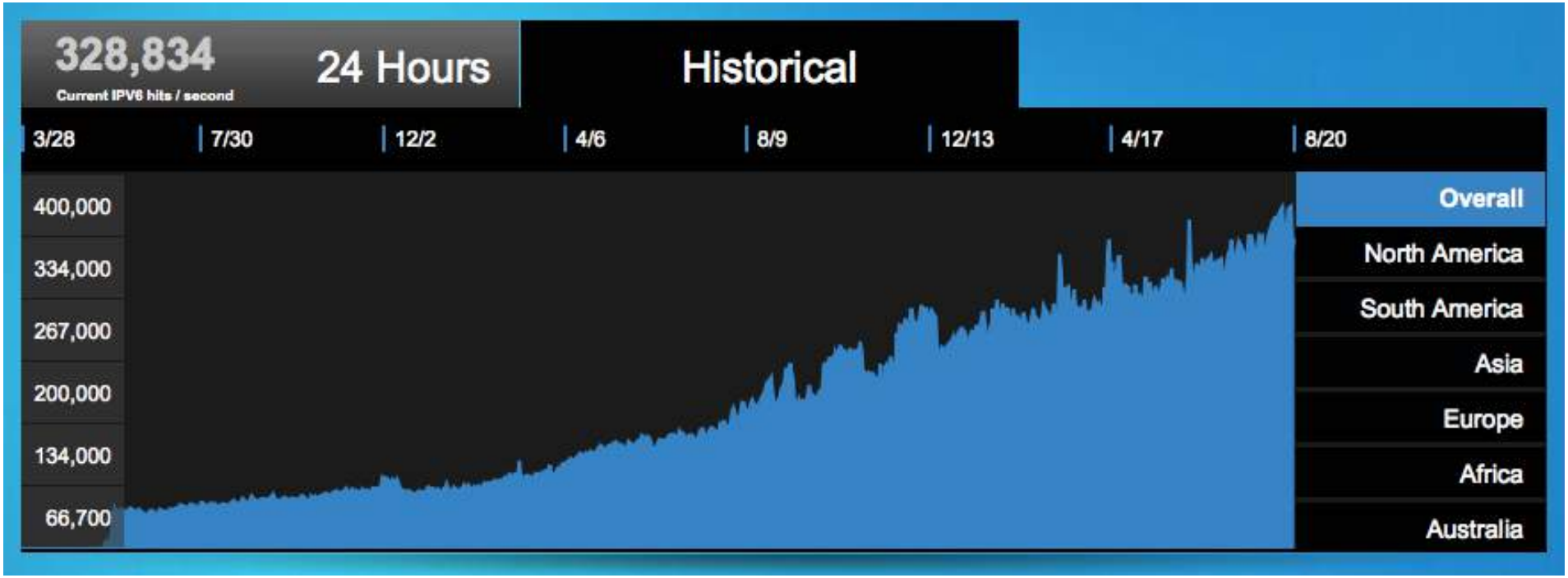


# IPv6 is Faster

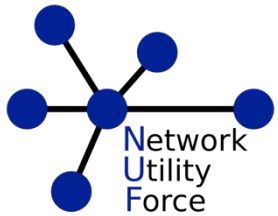
Lee Howard, IPv6 Performance Bonus: https://www.youtube.com/watch?v=Ftoy2tp4kDM



# IPv6 Traffic Volume (Akamai)



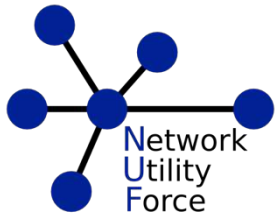
# RFC 6540




## - IPv6 Support Required for All IP-Capable Nodes -

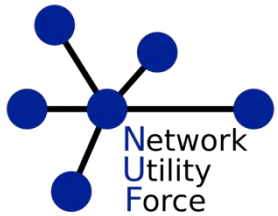
*Given the global lack of available IPv4 space, and limitations in IPv4 extension and transition technologies, this document advises that IPv6 support is no longer considered optional. It also cautions that there are places in existing IETF documents where the term "IP" is used in a way that could be misunderstood by implementers as the term "IP" becomes a generic that can mean IPv4 + IPv6, IPv6-only, or IPv4-only, depending on context and application*.

# Additional Considerations



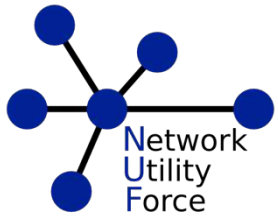

- Maintainability
- Scalability
- Performance
- Flexibility

# What were the steps



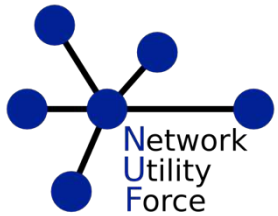

- Identify needs and resources
  - IPv6 addresses
  - Capable Suppliers
  - Systems support
  - Staff training
- Create deployment plan
- Test it all in a lab
- Follow up with continuous monitoring and improvements

# Setup - Bootstrapping



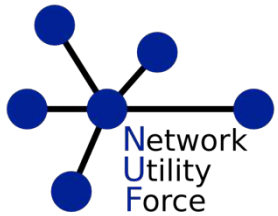

- Using RA/ND process
- RA's set both managed flag and other flag
  - Some debate about using DHCPv6
  - Ultimately enough devices support it now
- On-site DHCPv6 server handles requests (also doubles as DNS server)
- All devices get GUA

# Setup - Security



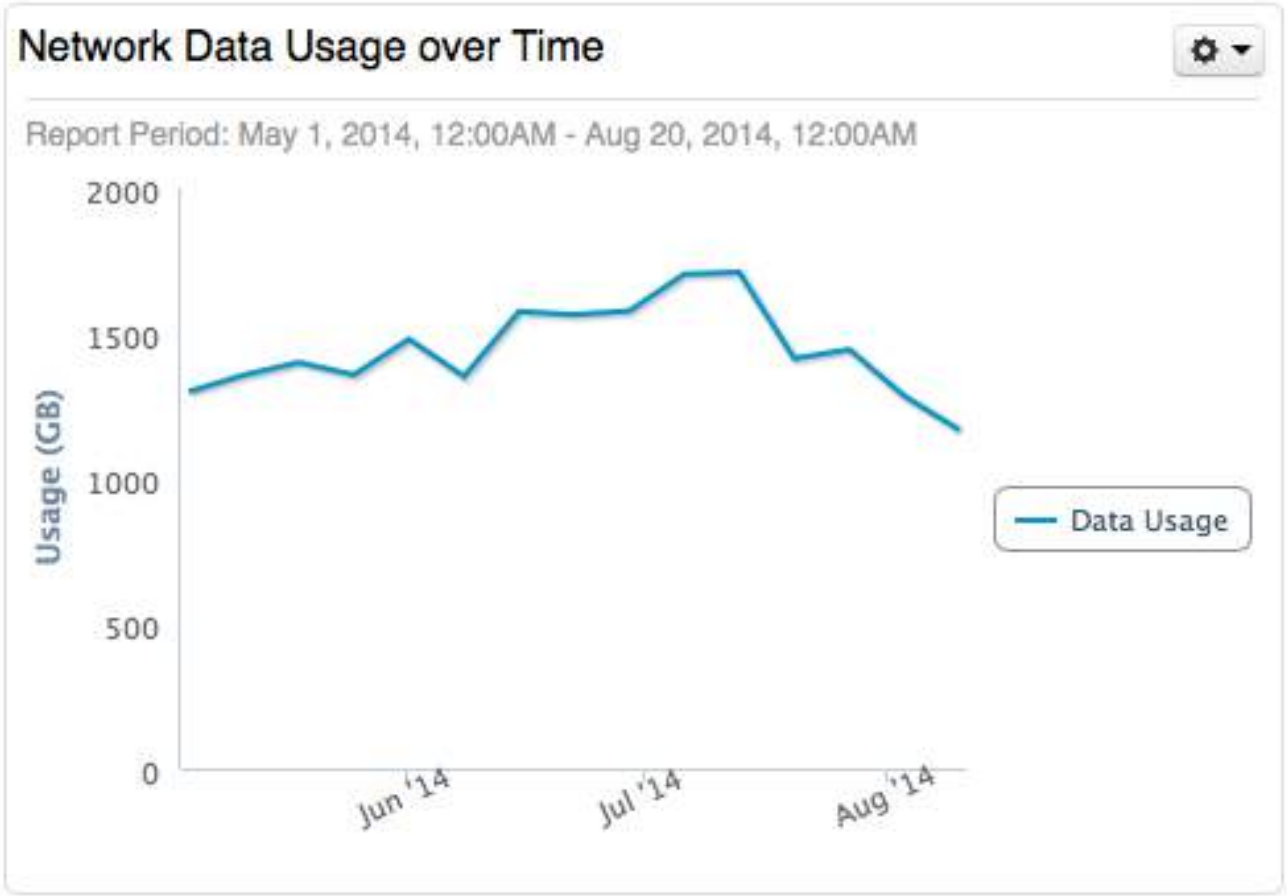

- No firewalling or content filtering – Thanks Google!
- Transparent redirect for splash page is v4 only
  - ➢v6-only devices can bypass splash page
  - ➢Not a big deal since the network is open anyway
- RA-Guard not available
- DHCPv6-Shield not available
- Vulnerable to MITM attacks

# Results

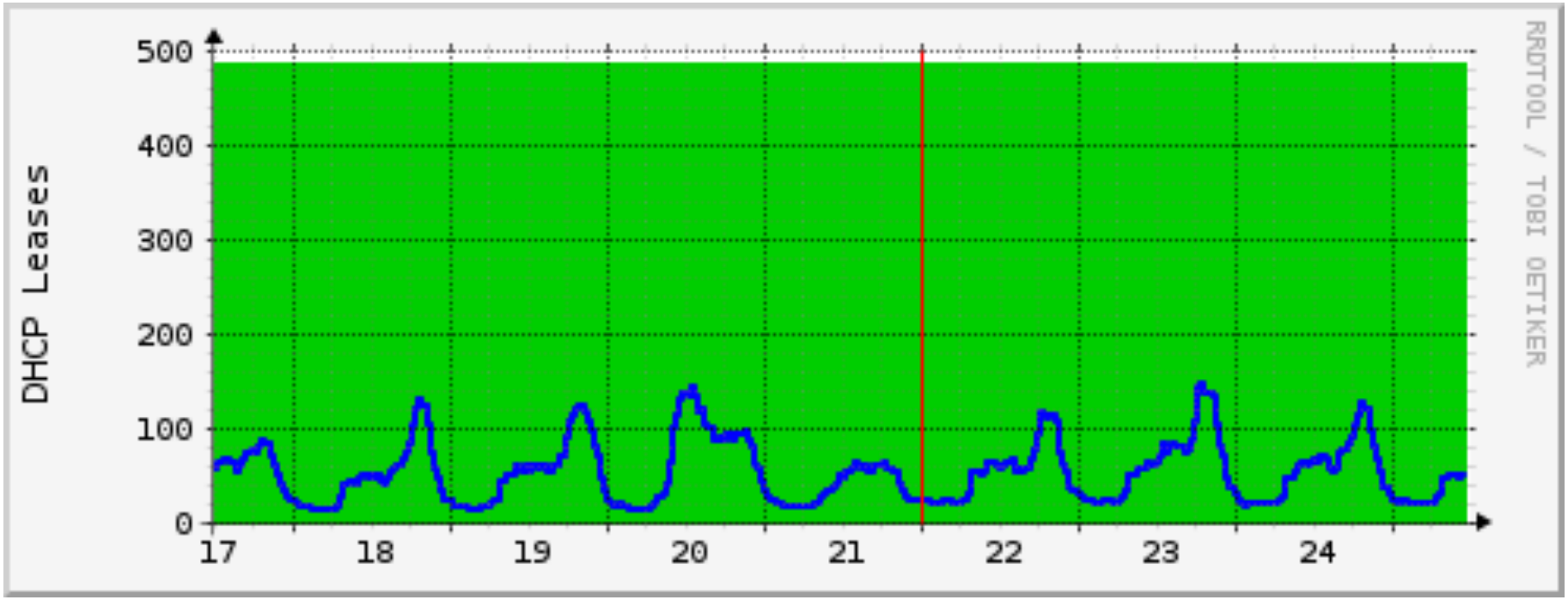



- Regularly see more than 100 users
- During events 200+ users common
- Most devices Android or IOS
- No user complaints
- No tech support (for v6) requested
- New devices log on all the time, use v6
- Some abuse complaints, mostly DMCA

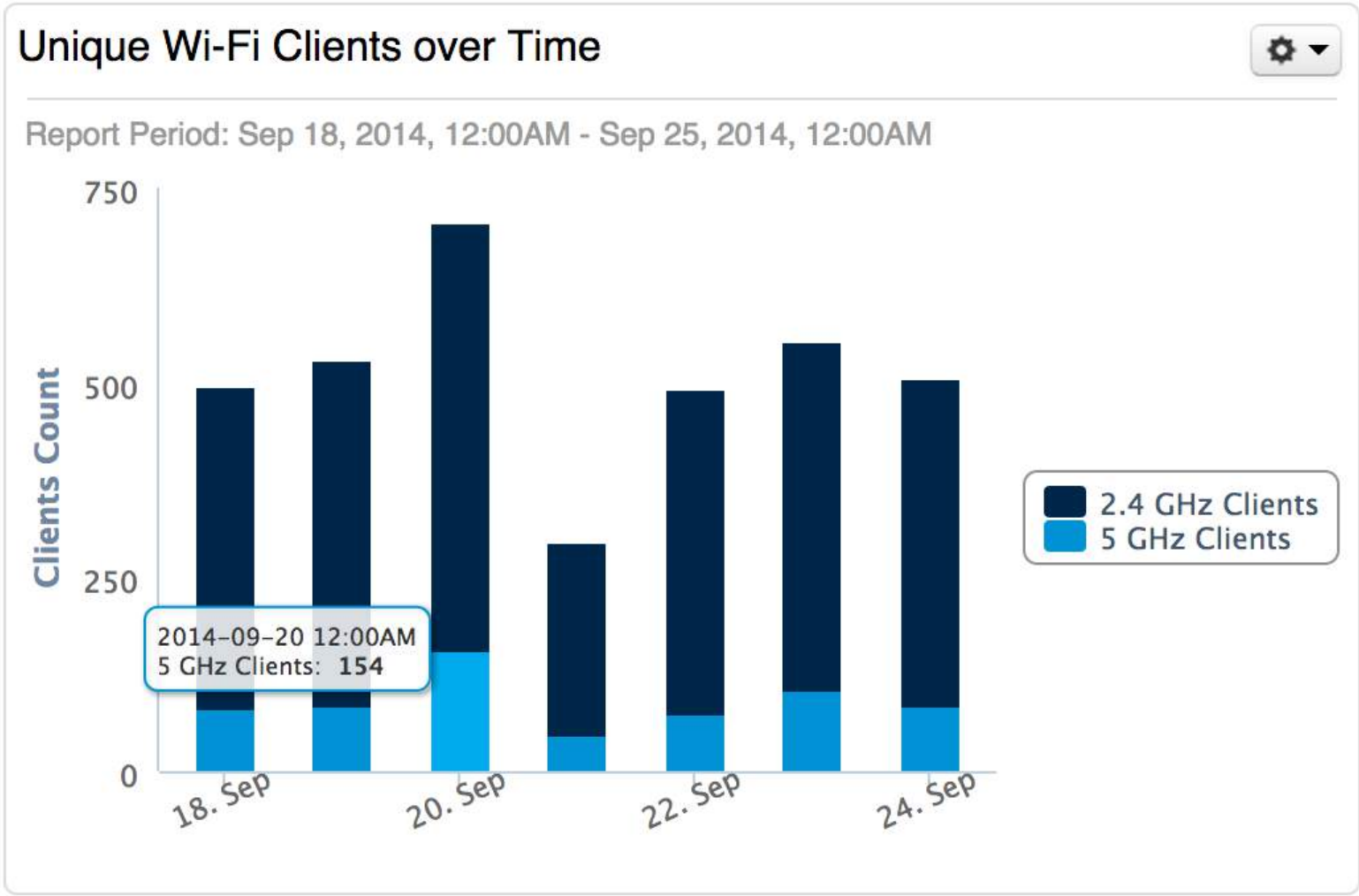
# Network Use



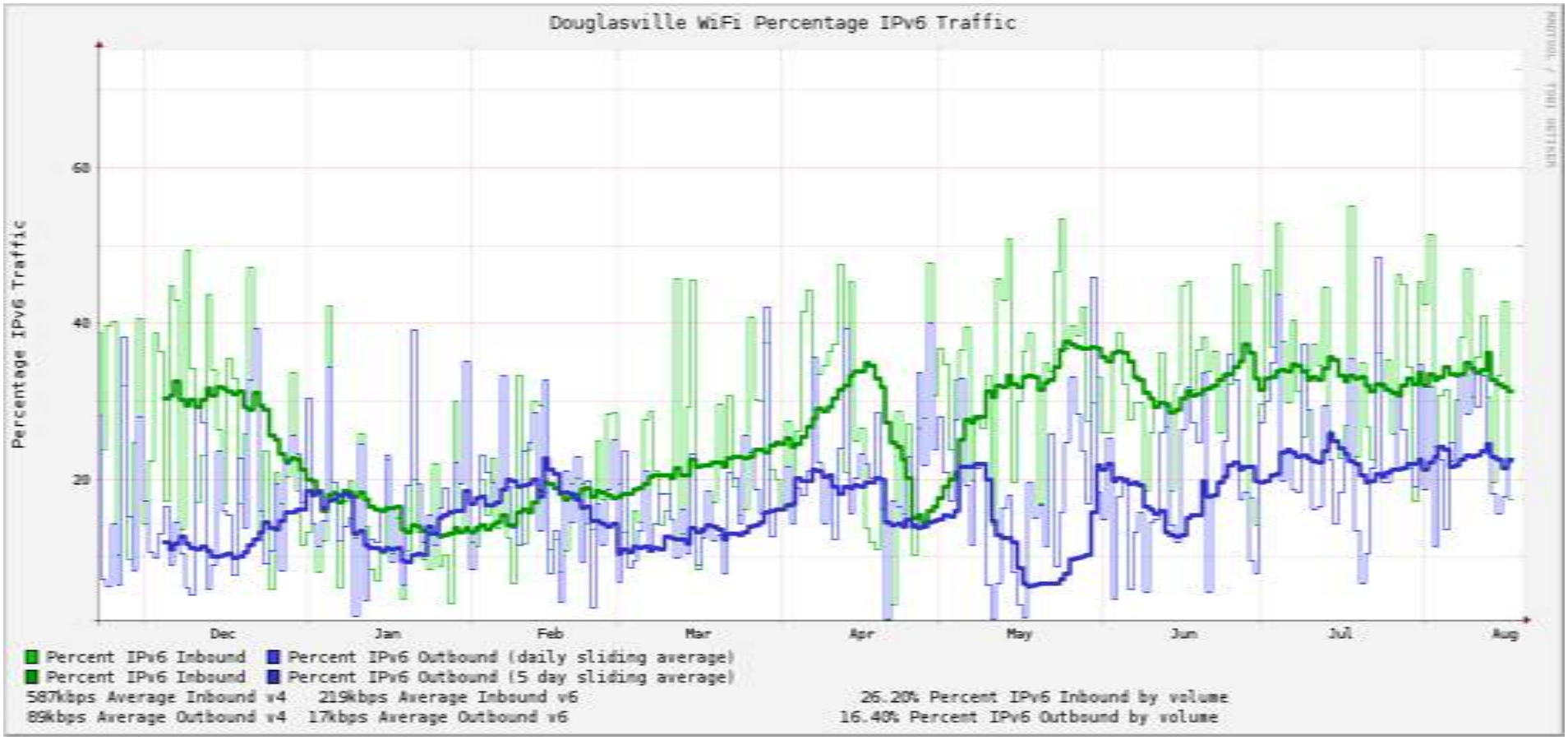
# Network Use



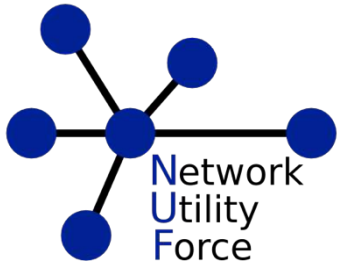
# Network Use



# What were the results

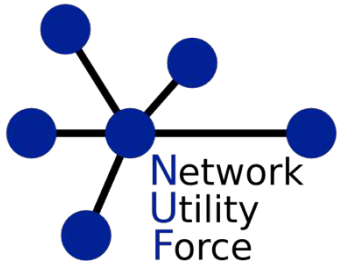


# Conclusions

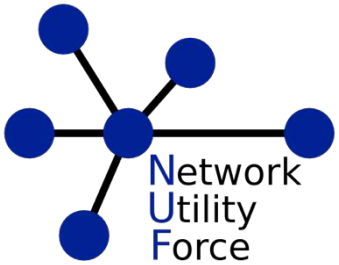



- IPv6 works in the real world and the traffic volume is increasing
- IPv6 is faster
- There are challenges to implementing IPv6, but nothing show-stopping
- Much of the Internet's content is reachable over IPv6 (and growing fast) including all of Google, FaceBook and 3000+ other websites
- Approximately 30% of Douglasville's network traffic is 30% - up 10% from just about 6 months ago

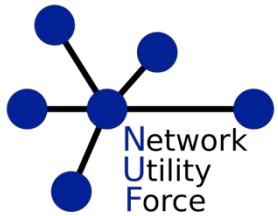
# Questions



# Resources




- ARIN.net
- ipv6forum.com
- internetsociety.org/deploy360/ipv6
- ipv6actnow.org
- Lee Howard, IPv6 Performance Bonus:
  - https://www.youtube.com/watch?v=Ftoy2tp4kDM
- Lee Howard, Total Cost of Ownership (TCO) of IPv6:
  - https://www.youtube.com/watch?v=vXf8ZIew1j0
- ripe.net
- potaroo.net/tools/ipv4
- gogo6.com
- netuf.net/p/ipv6.html (***infographic***)




# Thank You

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