The bridge to possible

Securing Starlink Communications

Andrew Benhase, Federal Architect
@CyberSecOps, @ThreatCowboy

cisco Live!

BRKSEC-2037

Cisco Webex App

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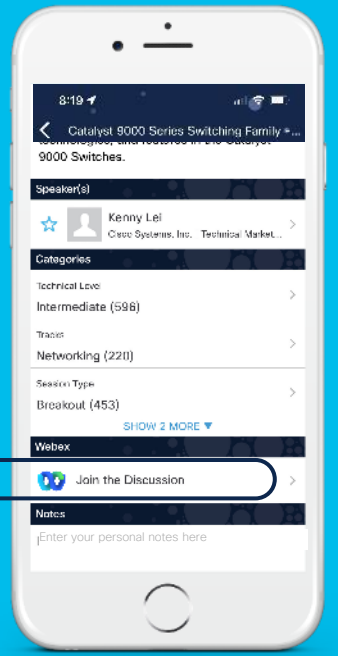
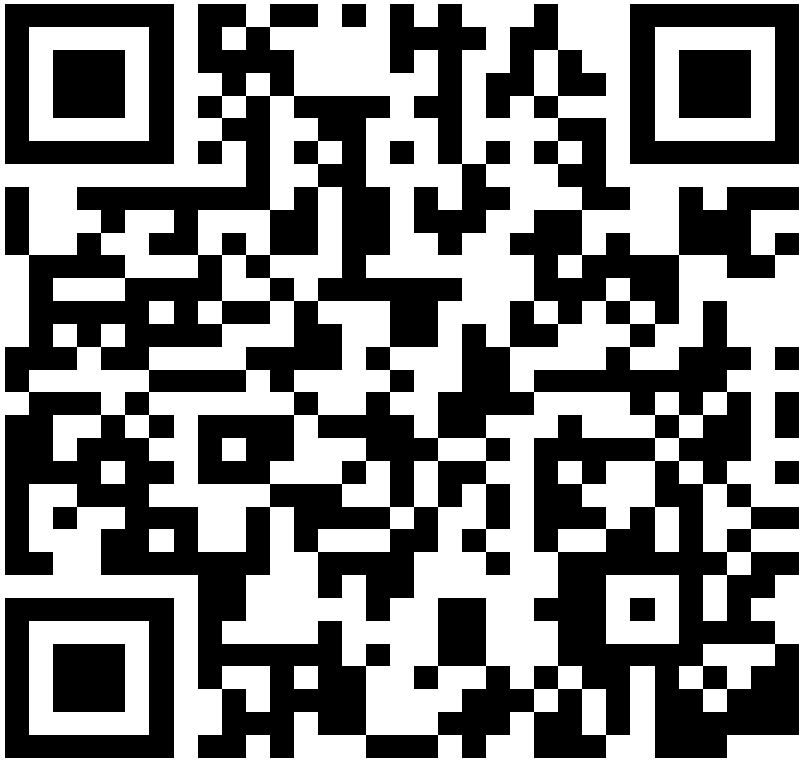
How

1. Find this session in the Cisco Live Mobile App
2. Click “Join the Discussion”
3. Install the Webex App or go directly to the Webex space
4. Enter messages/questions in the Webex space

Webex spaces will be moderated until February 24, 2023.





What I do here @cisco

- Federal Security Architect
- At Cisco >23 years, supporting US Federal Government
- 31 years primarily supporting US Defense, Civilian and Intelligence Communities
- Deep focus on defensive cyber operations, advanced encryption, making security work!
- My first Networkers was in 1995…
- https://www.linkedin.com/in/andrewbenhase/

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@ThreatCowboy
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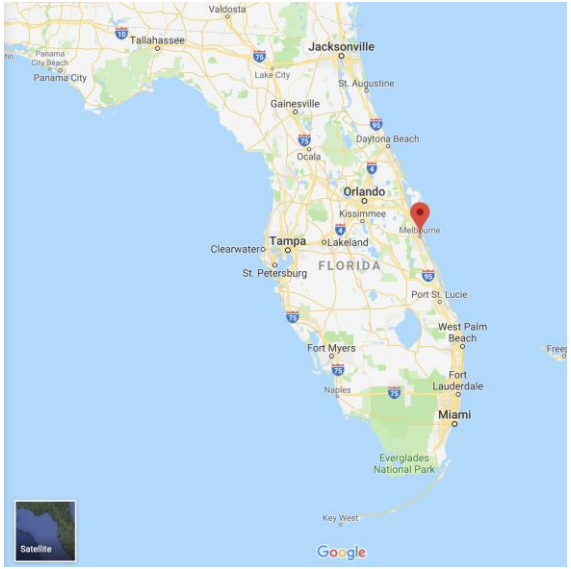
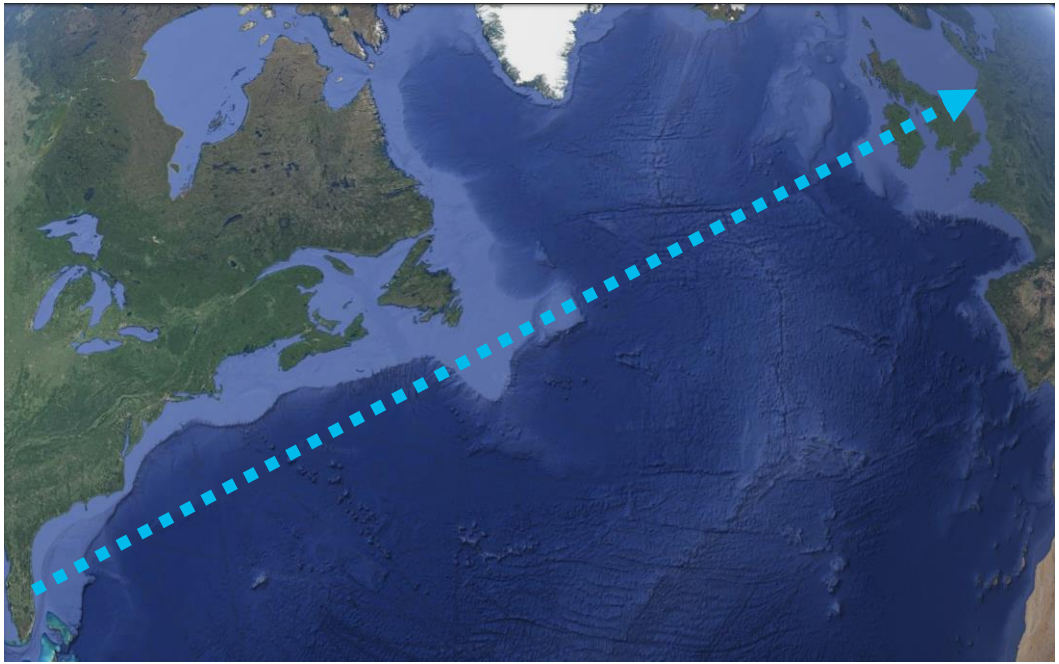
From MLB to AMS





Space-X Heav

Agenda

- Orbital Mechanics 101
- What is Starlink today?
- How does Cisco work with Starlink?
- Securing Starlink
- Things you need to know

Latest News Updates

Latest News – @ CL EMEA

Starlink enters the African market with first launch in Nigeria

2 Feb 2023

Nigeria has become the first country in Africa to see a commercial launch of satellite broadband services by Starlink, the satellite internet business of SpaceX. The firm's Low Earth Orbit (LEO) satellites are designed to offer high speed, low latency broadband internet in remote and rural locations across the globe. The service is currently priced at NGN19,260 (USD41.8) per month, while hardware costs NGN268,584.

As previously reported by TeleGeography's CommsUpdate, Starlink received licences to operate in Nigeria and Mozambique in May last year, marking the start of the company's expansion to Africa. The Nigerian Communications Commission (NCC) confirmed that Starlink received two licences – a ten-year international gateway licence and a five-year ISP

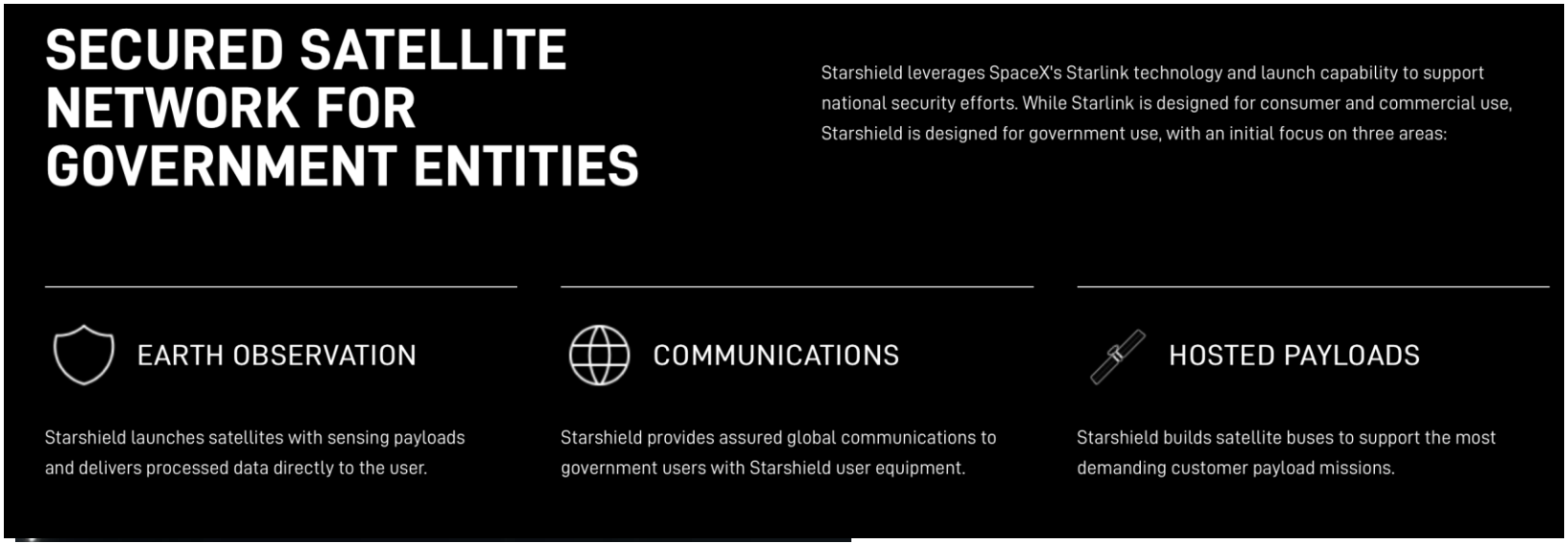
Center for Oldest Ice Exploration
@COLDEX_STC

Despite 30 knot winds at the Allan Hills, Antarctica, where ice cores up to 2,700,000 years old have been found, @SpaceX Starlink continues to give the @NSF-supported COLDEX team unprecedented connectivity! @blueicehiggins @icy_pete

USIceDrillingProgram and 6 others

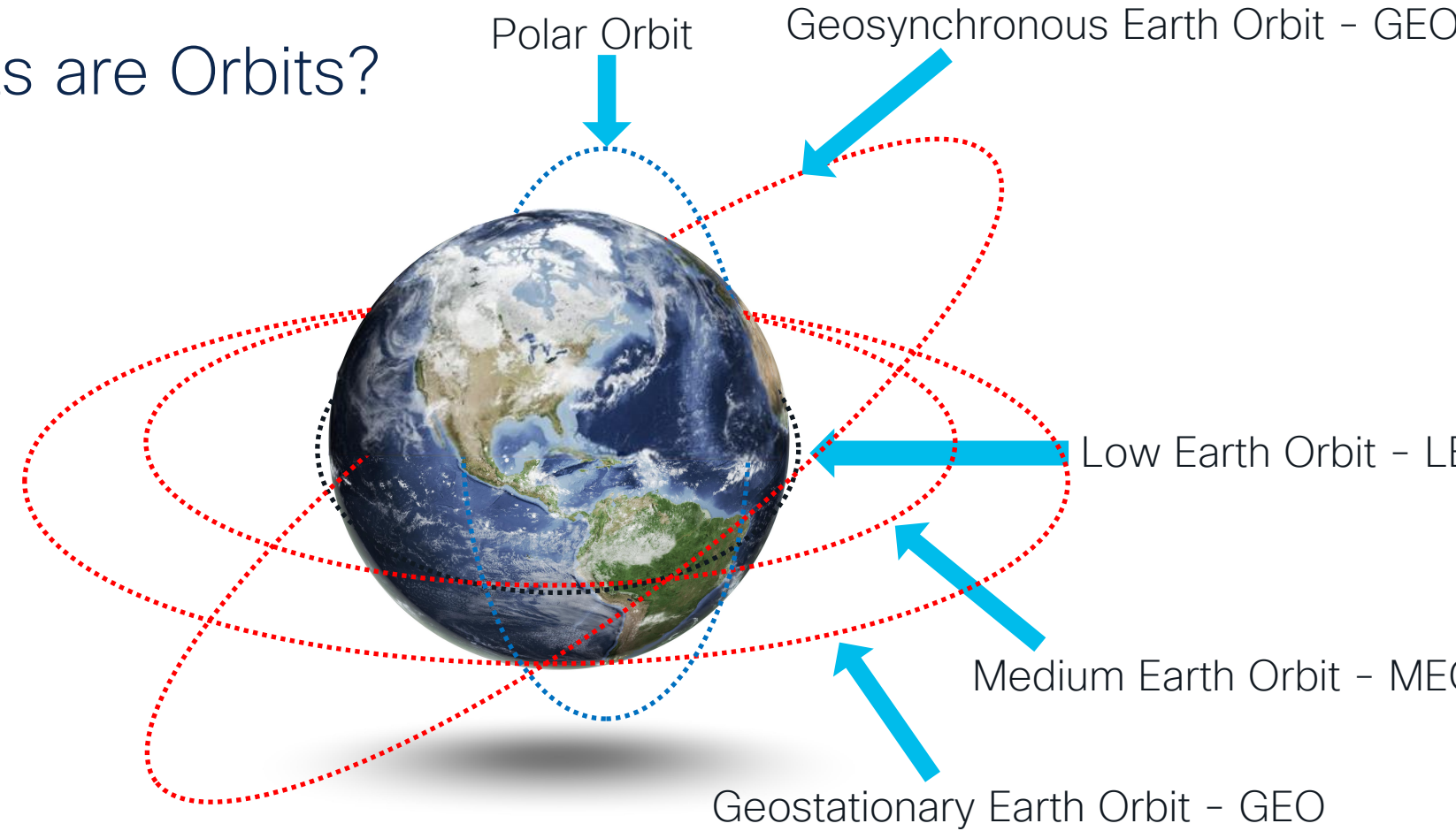
3:06 PM · Dec 5, 2022

Latest News – @ CL EMEA



Orbits are orbits right?

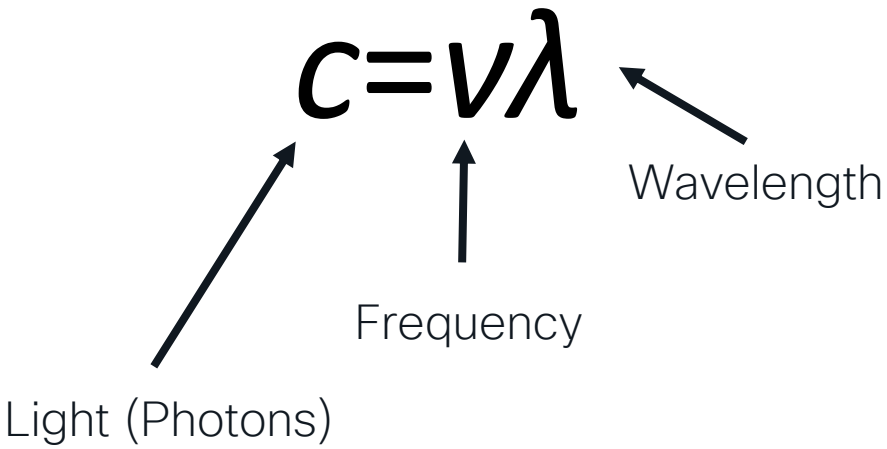
Orbits are Orbits?



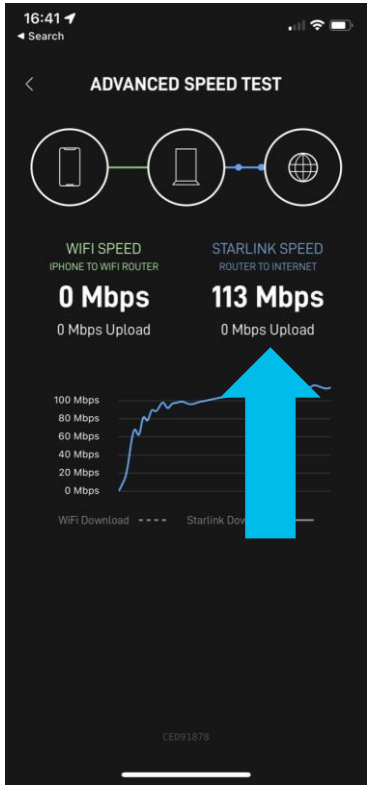
Hey Andrew, this is CiscoLive….
Why do I need to know about physics, orbits, altitudes and latency?

Answer: Because this is an Engineering discussion, not a sales and marketing pitch ☺

Speed of Light in a Vacuum



300,000 km/s



Speed of Light in a Vacuum

Speed of Light in an Atmosphere

Loss Calculation

40ms Great

700ms Not-Great

Terrestrial Ground Delay

10-200ms

Orbits and Networking

- LEO – 1000 kilometers and below
  - Starlink 540km (345 miles)
  - One way latency – ~12-25ms
  - RTT - ~25-50ms

Happy Network Zone

- MEO – 8000 kilometers (5,000 miles)
  - ~RTT 350ms

Sad Network Zone

- GEO – 36,000 kilometers (22,000 miles)
  - ~RTT 725ms

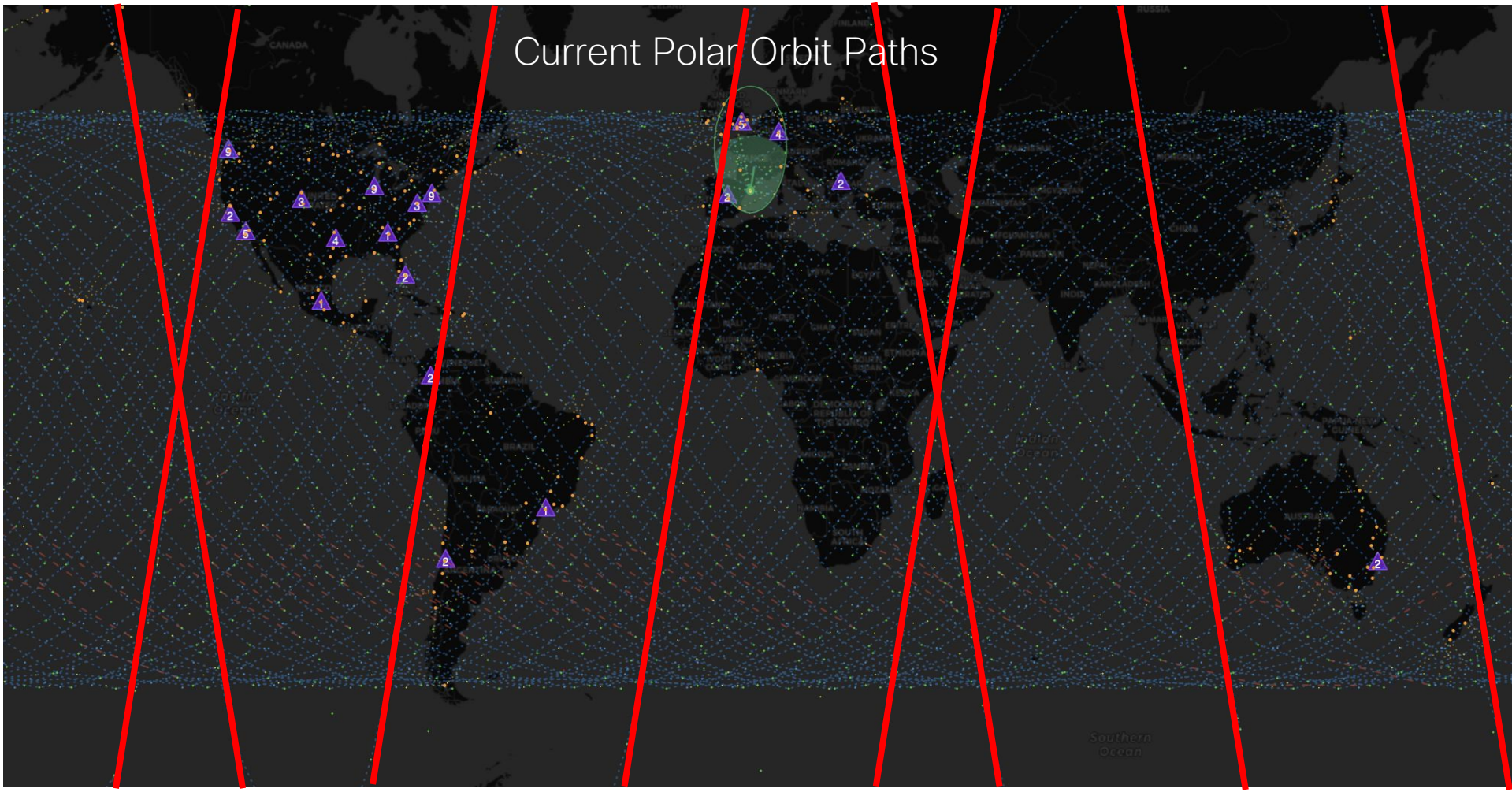
Physics Matters

700ms

350ms

40ms

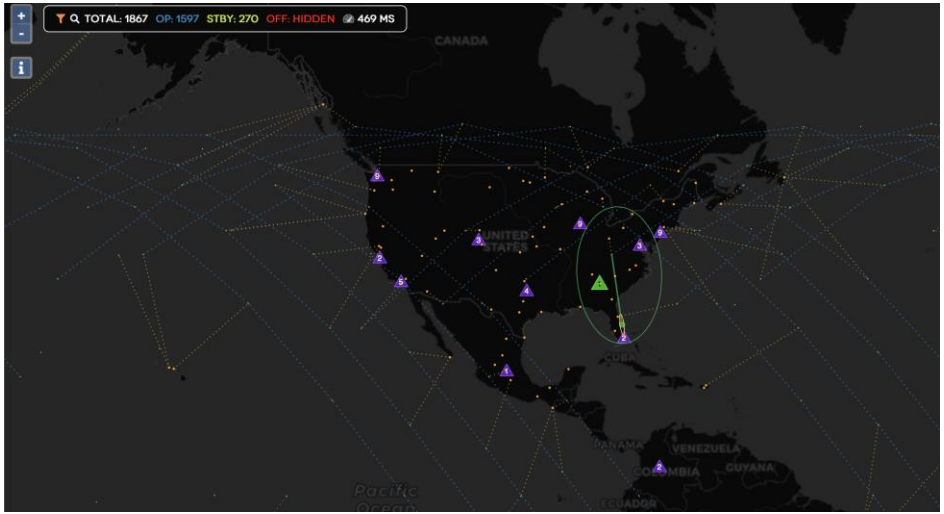
Current Polar Orbit Paths

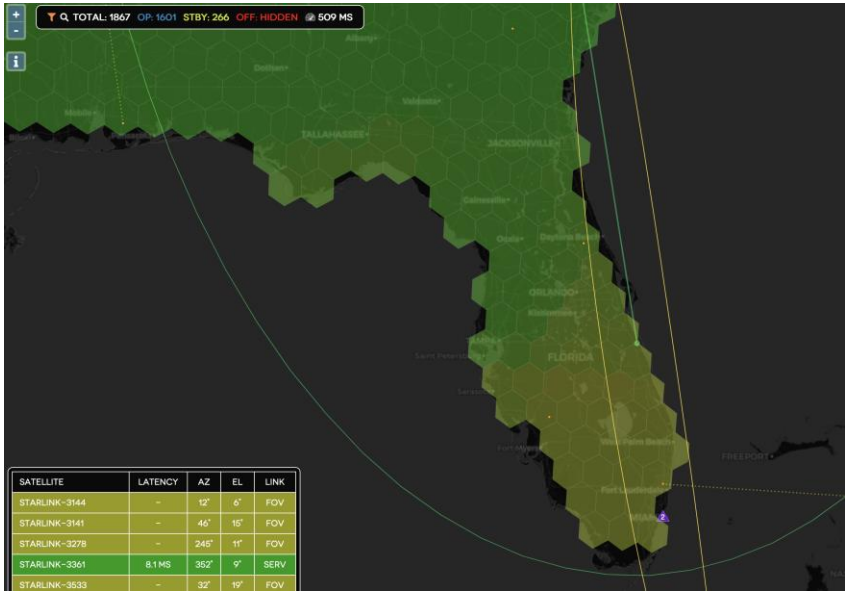


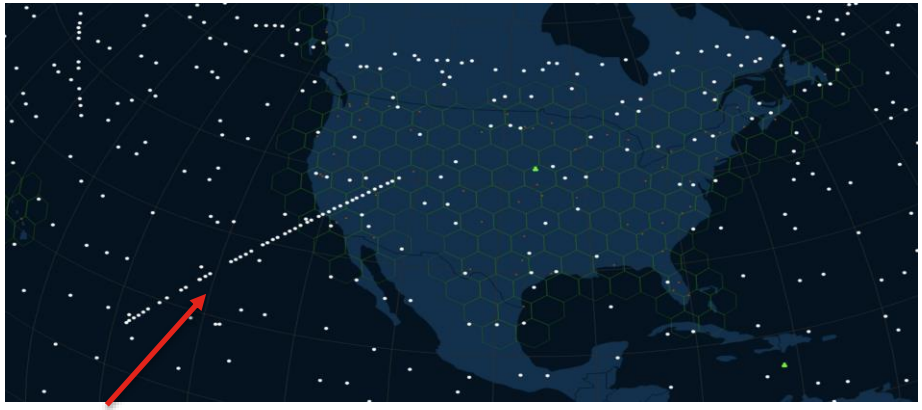
What is Starlink?

What is Starlink?

- A global satellite network in Low Earth Orbit currently consisting of ~3000 satellites*







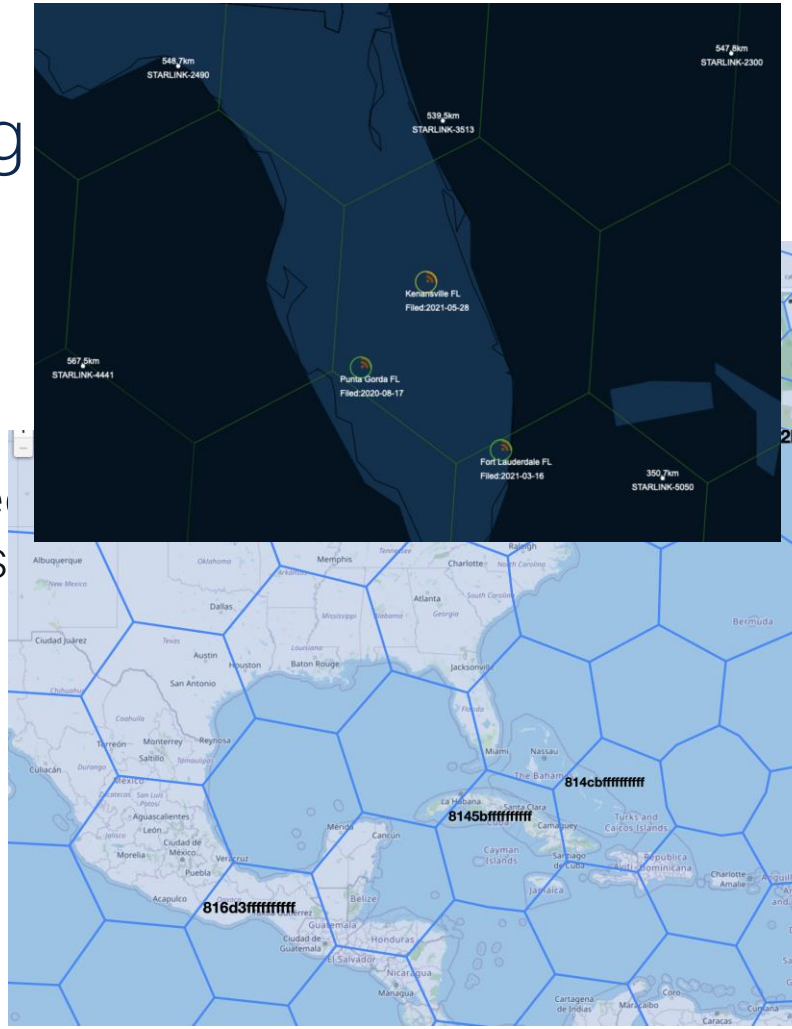
*groups of 53 being launched on a regular basis

Disclaimer

- **Starlink.sx**
  Designed by Mike Puchol, who states this site is NOT affiliated with Starlink or SpaceX. Link is https://starlink.sx/
- It is an excellent website to help understand satellite movement, tracking and orbital mechanics
- Many of the screenshots are from starlink.sx simulation – it is not a Starlink sponsored tool – that said…orbital calculations are really just math…and positions are published
- These are assumptions based on collected knowledge, Starlink does not publish any of this information – for obvious reasons

H3 Geospatial Mapping

- **H3 is a geospatial indexing system that partitions the world into hexagonal cells**
- Each Hexagonal Grid is mappe into ~8000 hexagonal sections for each Satellite Radio Footprint
- Opensource Mapping System
  - https://h3geo.org



Basic Orbital Mechanics

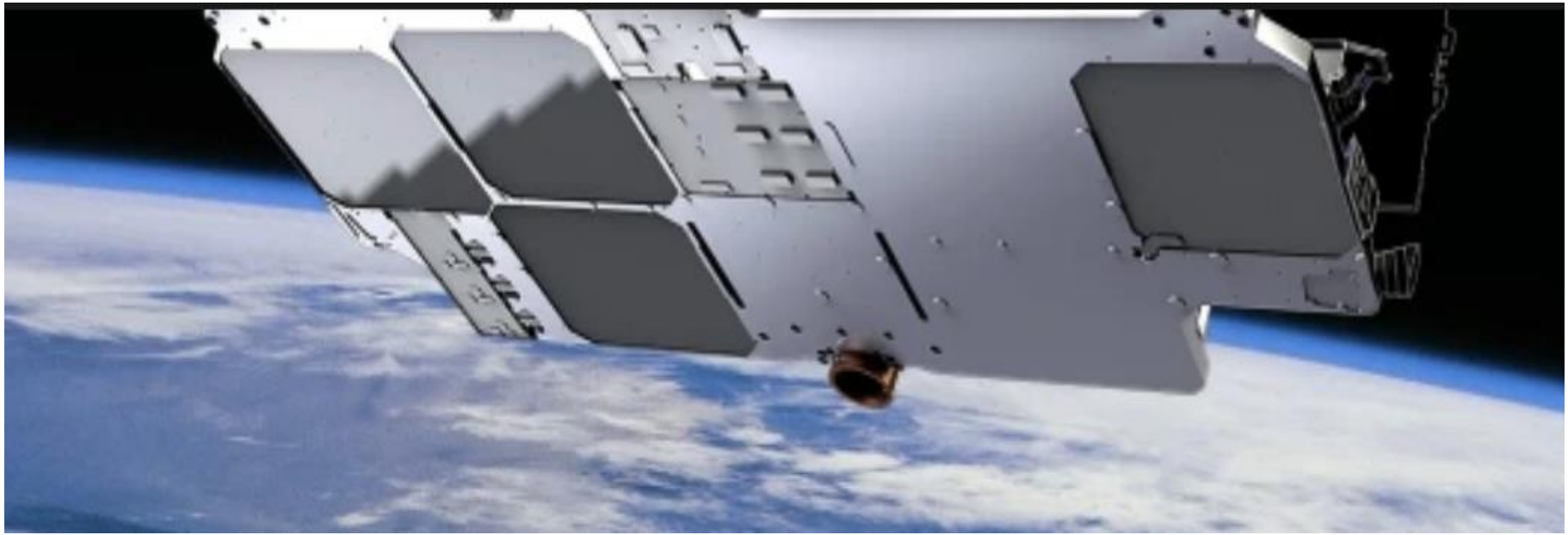
- FCC Approval for 12,000 satellites
- Starlink Satellites operate in five primary defined orbital shells at between 550km-570km in altitude

- First shell: 1,440 in a 550 km (341.8 mi) altitude shell at 53.0° inclination
- Second shell: 1,440 in a 540 km (335.5 mi) shell at 53.2° inclination
- Third shell: 720 in a 570 km (354.2 mi) shell at 70° inclination
- Fourth shell: 336 in a 560 km (348.0 mi) shell at 97.6° inclination
- Fifth shell: 172 satellites in a 560 km (348.0 mi) shell at 97.6° inclination

Satellite

- Each satellite features four antennas in Ku band, one for uplink, three for downlink
- Each antenna is capable of projecting eight beams in two polarizations (RHCP/LHCP), for a total 48 downlink beams and 16 uplink beams.
- The maximum bandwidth available to Starlink in Ku band is 8x 250 MHz channels in downlink (total 2 GHz), and 8x 62.5 MHz channels in uplink (total 500 MHz)
- Each Satellite nominally operates at 10Gbps capacity with future expansion to 20Gbps

Faced towards Ground



Credit: Starlink

Infrared “Space Lasers”

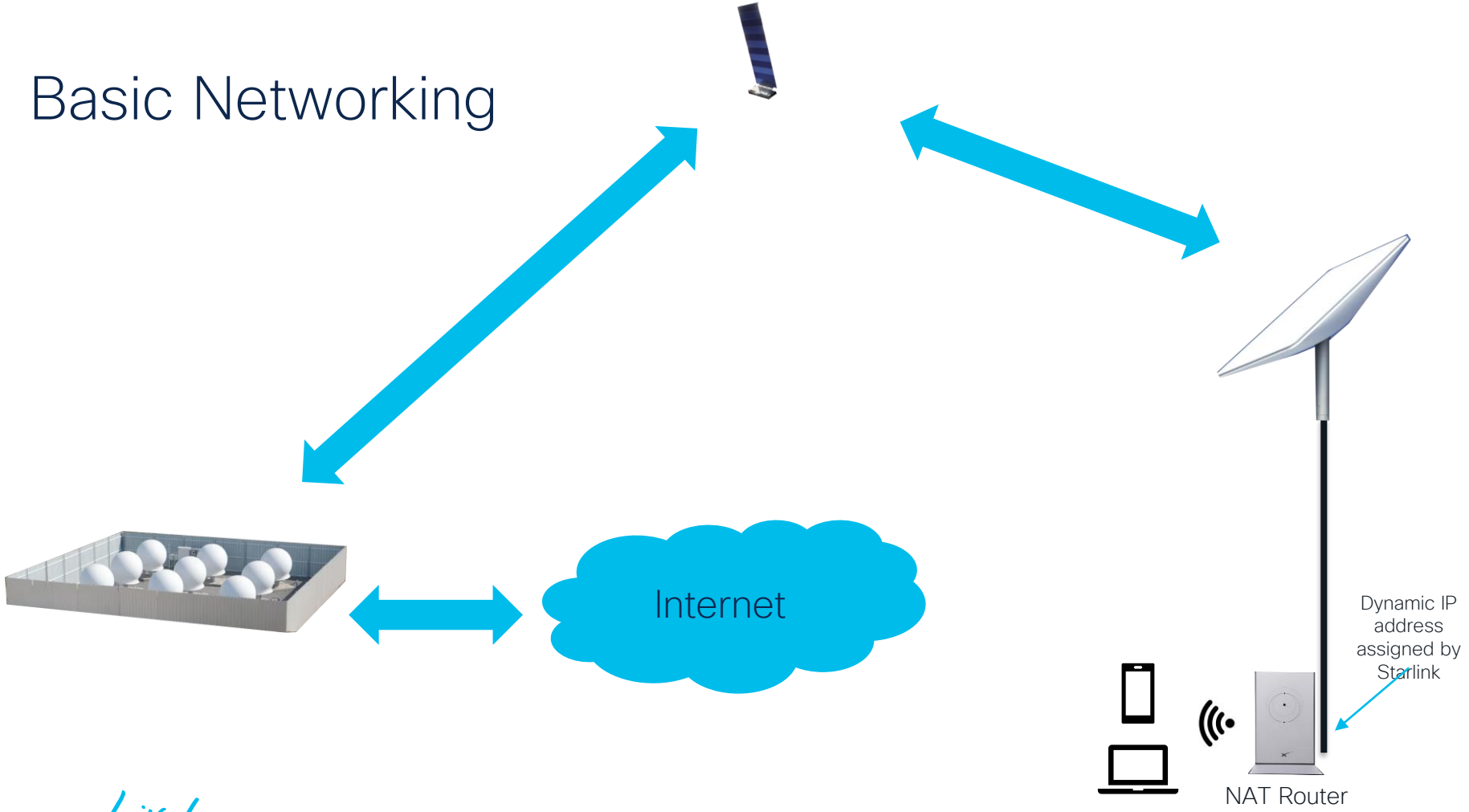
- 3 Beam Optical Head using Infrared Laser
- Same Orbital Plane Operation
- Theoretically could offload to parallel polar plane satellite

Credit: SpaceX/Starlink

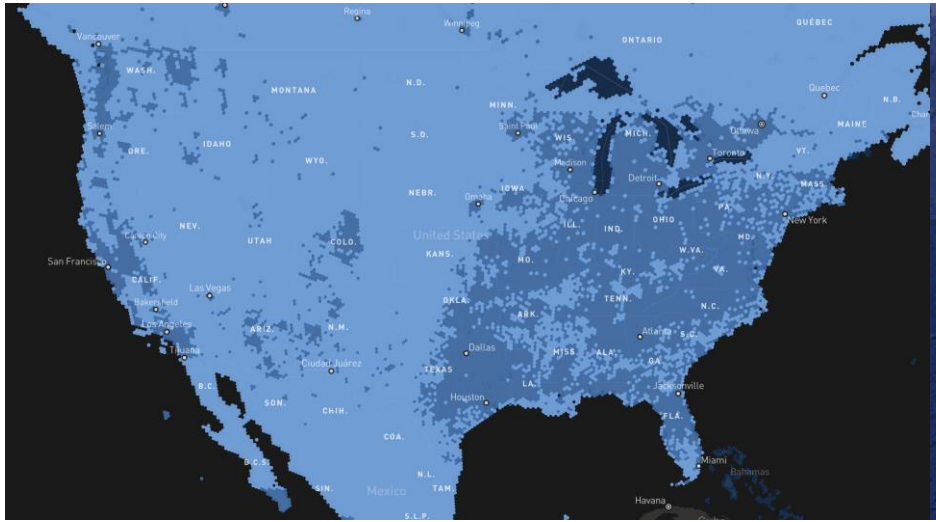
Ground Station

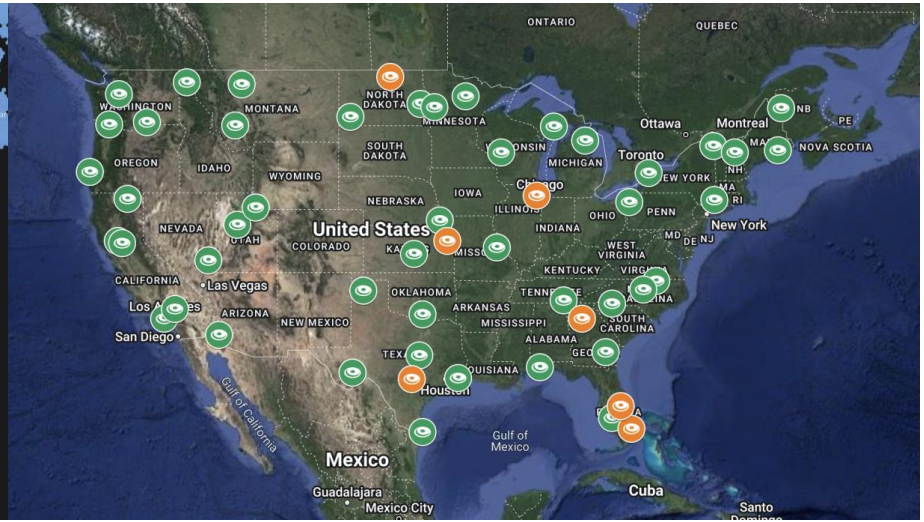
- Each gateway antenna has available a maximum of 4x 500 MHz channels (total 2 GHz) in uplink, and 5x 250 MHz channels (total 1.25 GHz) in downlink
- In this configuration – where 8 antennas are active – would be 10Ghz total active Down and 6Ghz Up per site
- Ground stations are positioned on top of existing Fiber Paths
- Each Parabolic Antenna can support 10Gbps x 2)
- So that's up to 1.6Tbps theoretical bandwidth for a site with 8 active

Basic Networking

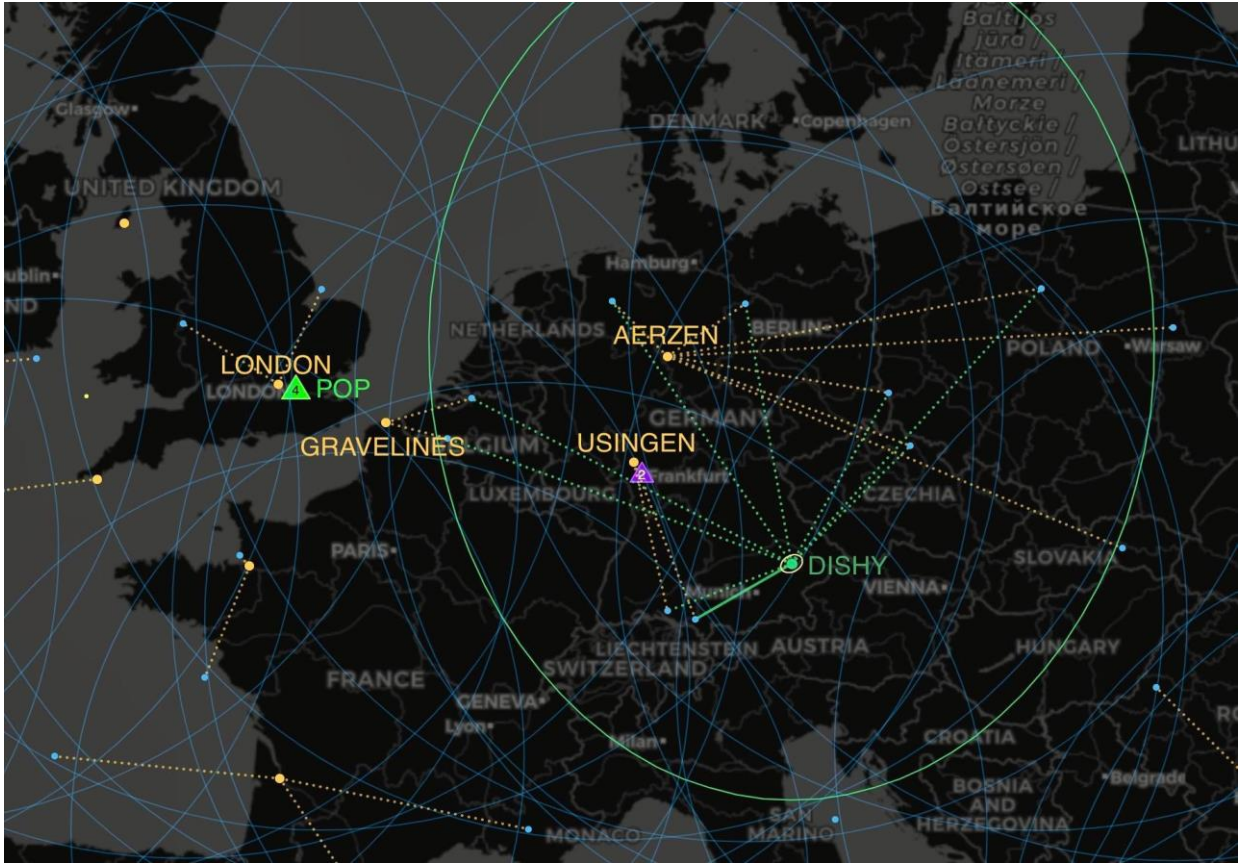


US Gateway Locations





EMEA Gateway Locations

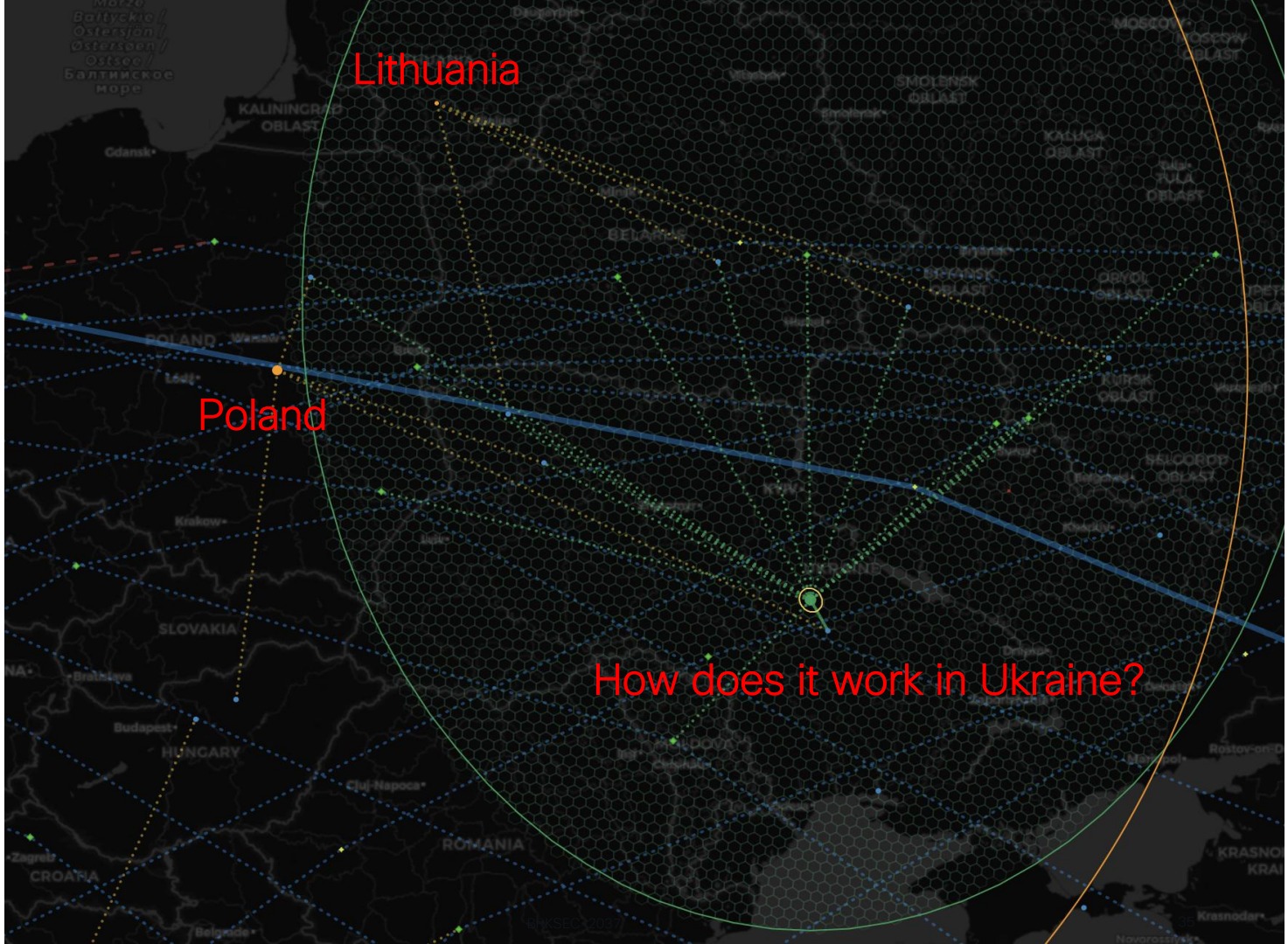


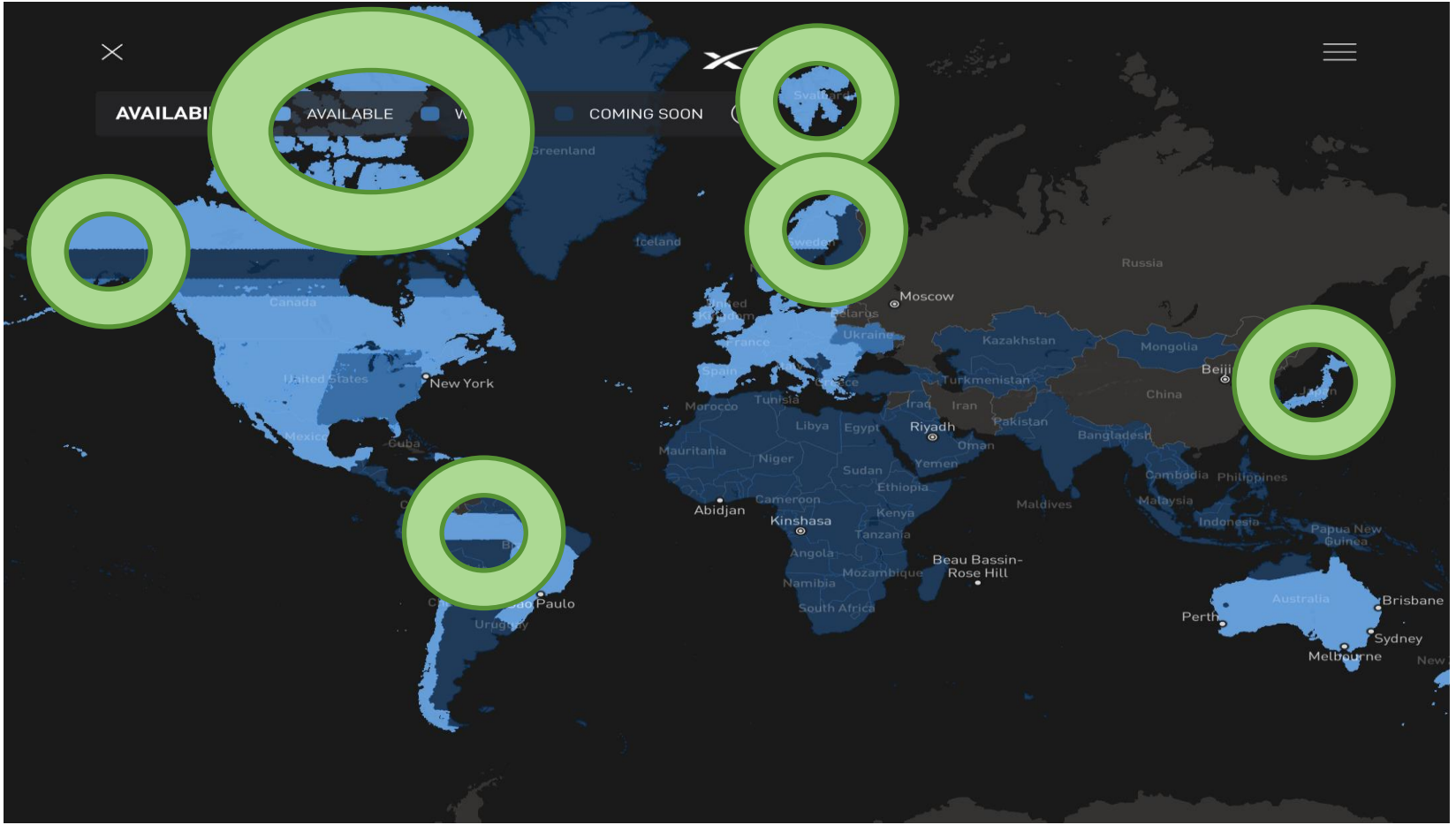
Radio Gateways

Lithuania
Poland

Internet Gateways

Frankfurt
London





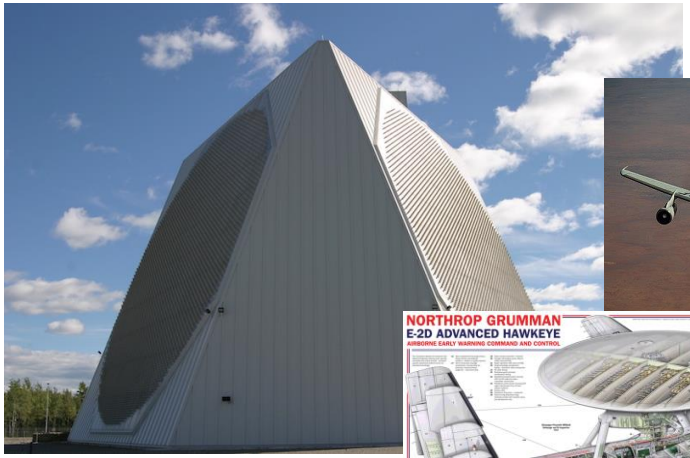
Things we know

- Dense Orbital shells are extremely robust
- Frequency shifts can be simple software operations
- Receive only satellite arrays are critically important
- Low observability packages are important
- Low cost Software Defined Radios (SDRs) are being used for offensive hunt operations

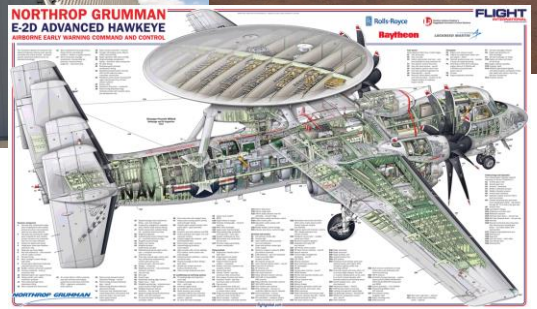
Phased Array Antenna

Examples of Phased Arrays

- Space Observation Radar



E-3 Sentry
AWACS

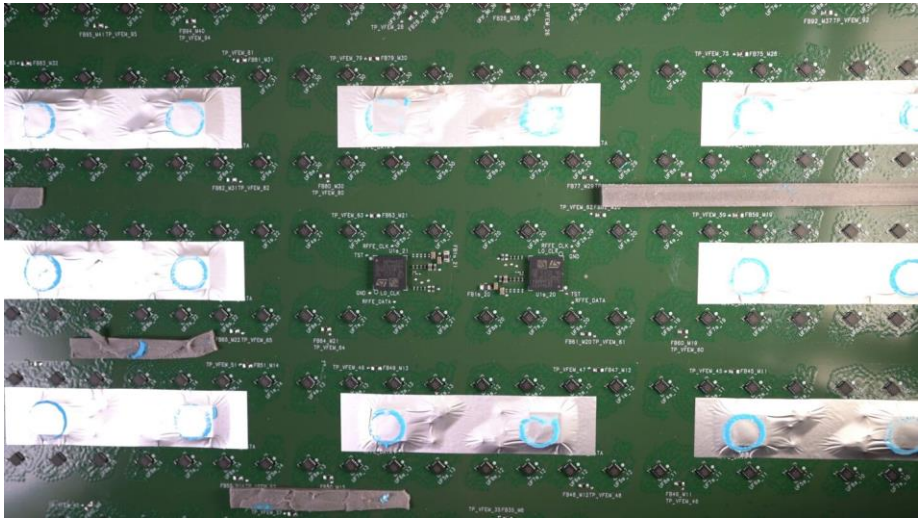


E-2D
Early Warning

- AN-SPY-1 Phased Array
- AEGIS Deployed and Ashore

How does Starlink work?

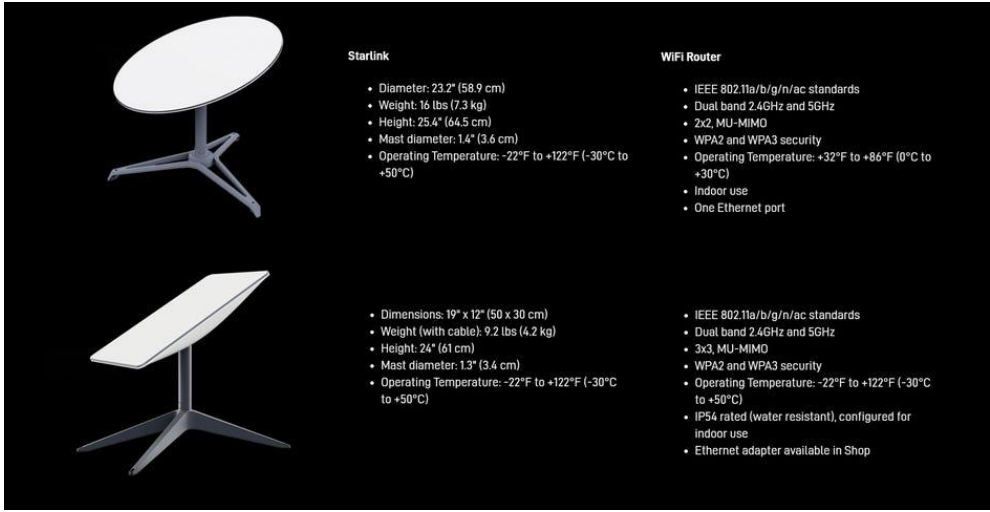
- Up / Down configuration
- Ground Terminal is a phased array antenna in one of two current configurations – Round (Gen1) or Rectangle (Gen2)
- Each array has hundreds of transceivers



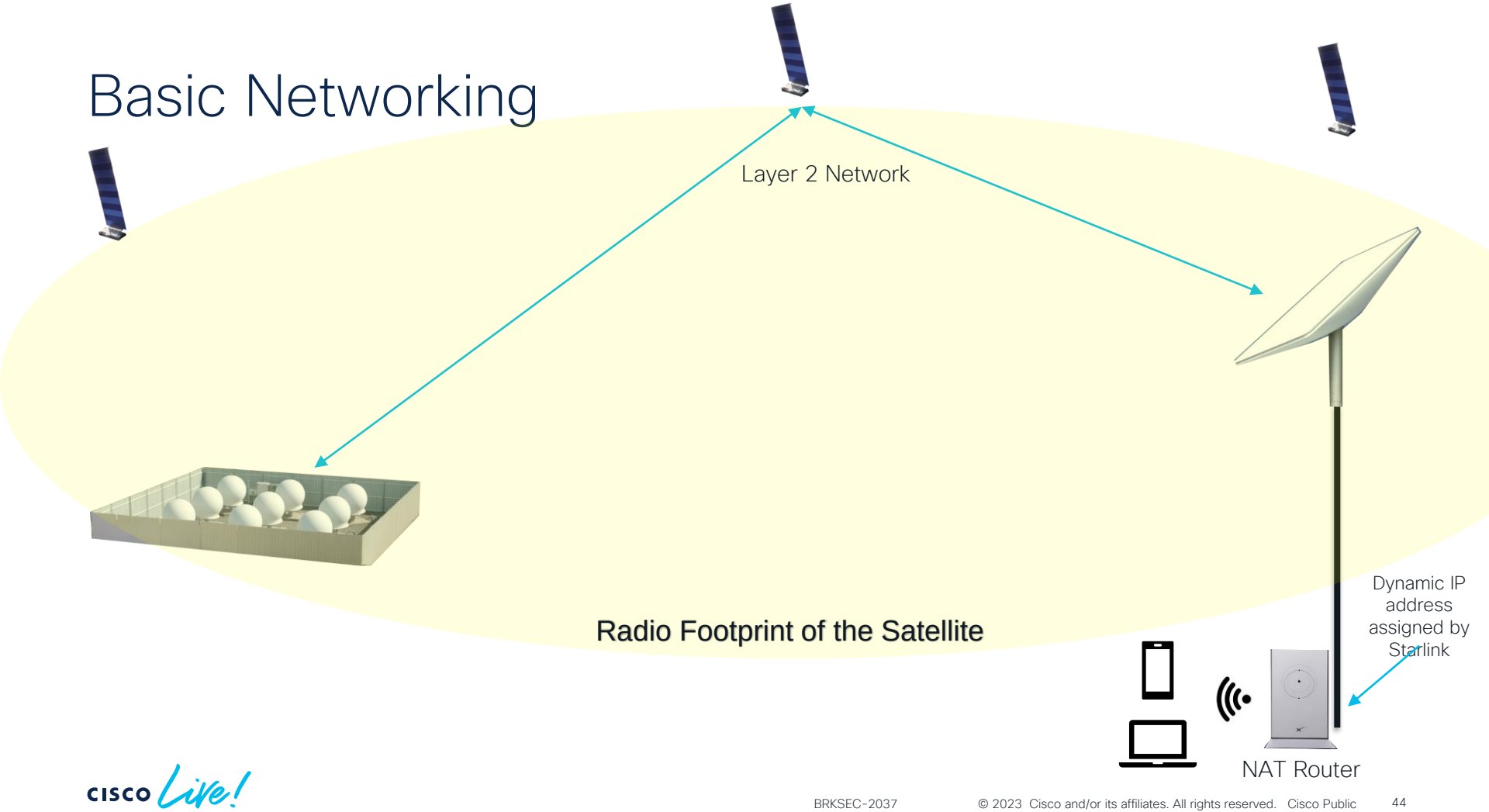
- 12-18 and 26.5-49 GHz bands

Ground Terminal

- Phased Array Antenna
- Starlink Router (more on that later)
- Ethernet Cable with proprietary ends



Basic Networking

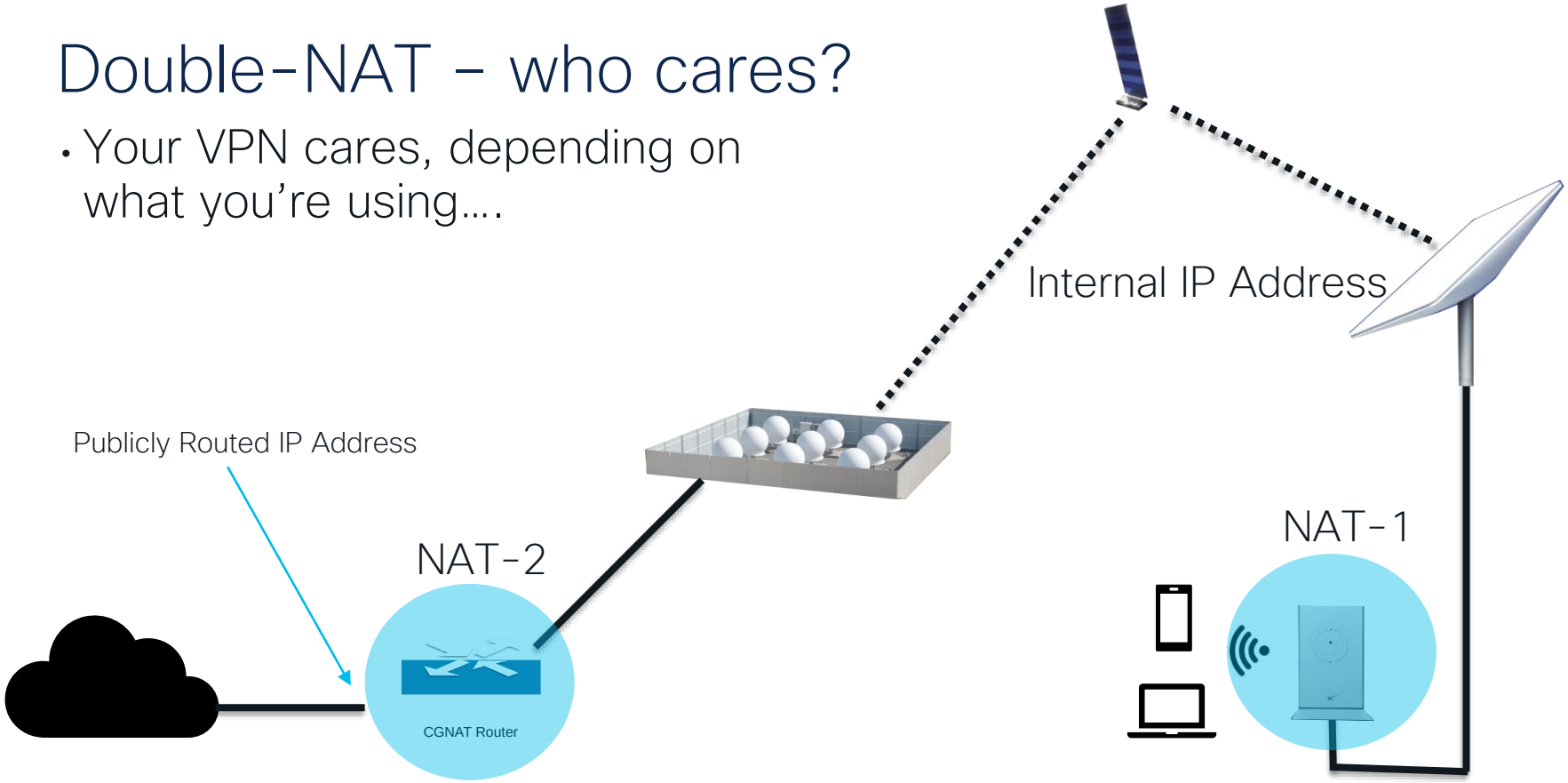


Starlink Router

- Micro Linux Router
- NAT Operations
- 60 second boot time
- 192.168.128.0 NAT Pool

Double-NAT – who cares?

- Your VPN cares, depending on what you're using….

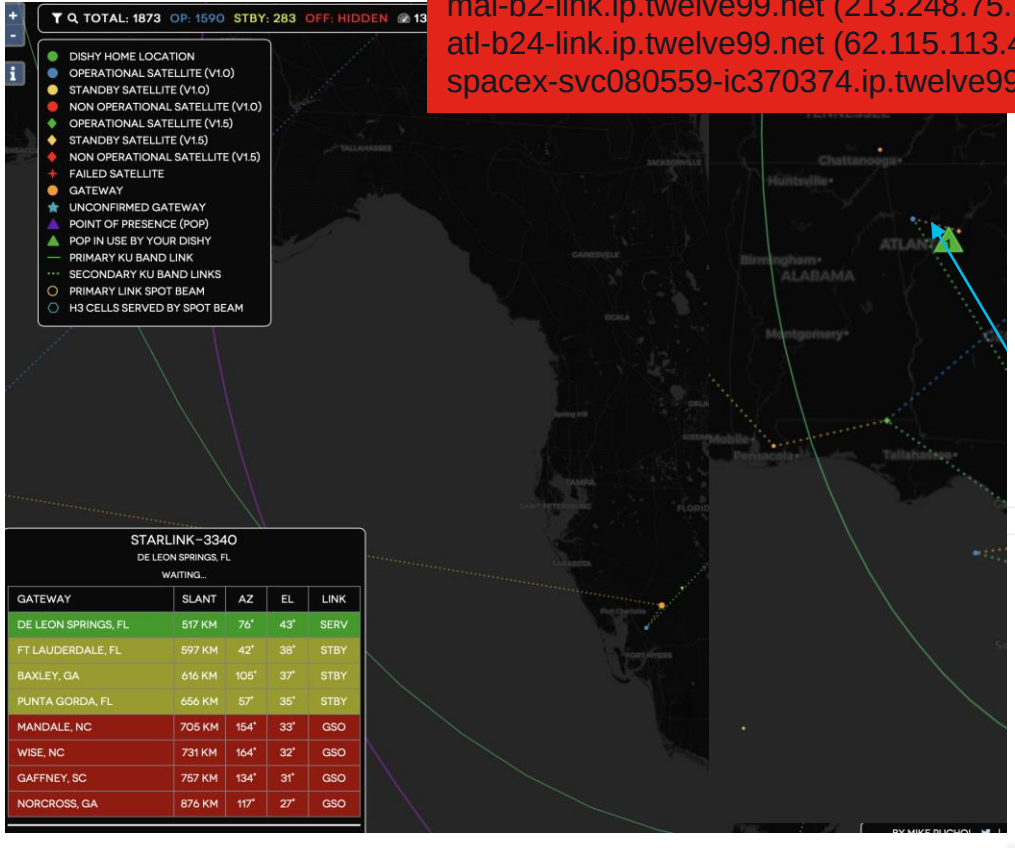


Things that Fix NAT Problems

- Static NAT configuration – impossible with Starlink and CG-NAT carriers
- GRE/IPSec+NAT-T Tunnels
- Straight NAT-T Tunnels
- IPv6
- TCP VPN Tunnels

How the network works

```
1 gi0-0-0-18.221.agr13.mia01.atlas.cogentco.com (66.28.3.217) 0.661 ms 0.727 ms 2 te0-5-0-1.ccr21.mia01.atlas.cogentco.com (154.54.6.57) 0.896 ms te0-0-0-11.ccr22.mia01.atlas.cogentco.com (154.54.31.229) 0.998 ms 3 be3087.ccr41.mia03.atlas.cogentco.com (154.54.88.234) 0.839 ms be3081.ccr41.mia03.atlas.cogentco.com (154.54.88.226) 0.843 ms 4 mai-b2-link.ip.twelve99.net (213.248.75.1) 0.606 ms 0.625 ms 5 atl-b24-link.ip.twelve99.net (62.115.113.48) 14.858 ms 14.762 ms 6 spacex-svc080559-ic370374.ip.twelve99-cust.net (62.115.146.55) 14.741 ms 14.796 ms
```



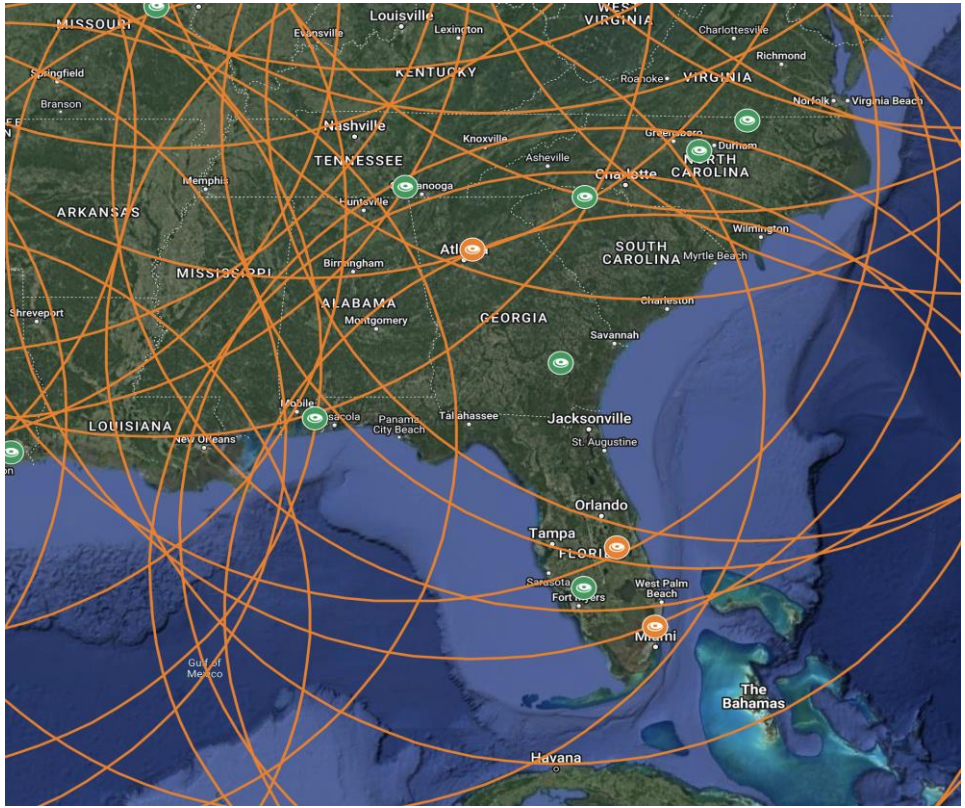
Summary

Country	United States
Domain	spacex.com
ASN	AS14593
Registry	arin
Hosted IPs	128
ID	NET-SUB-98-97-178-0

WHOIS Details

```
NetHandle:      NET-98-97-178-0-1
OrgID:          C08091088
Parent:         NET-98-97-128-0-1
NetName:        NET-SUB-98-97-178-0
NetRange:       98.97.178.0 - 98.97.178.255
NetType:        reassignment
OriginAS:       14593
RegDate:        2021-11-05
```

How the network works



IP range details

98.97.179.128/25

AS14593 · Space Exploration Technologies Corporation

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NetRange:       98.97.178.0 - 98.97.178.255
NetType:        reassignment
OriginAS:       14593
RegDate:        2021-11-05
```

Observations of the Starlink Network

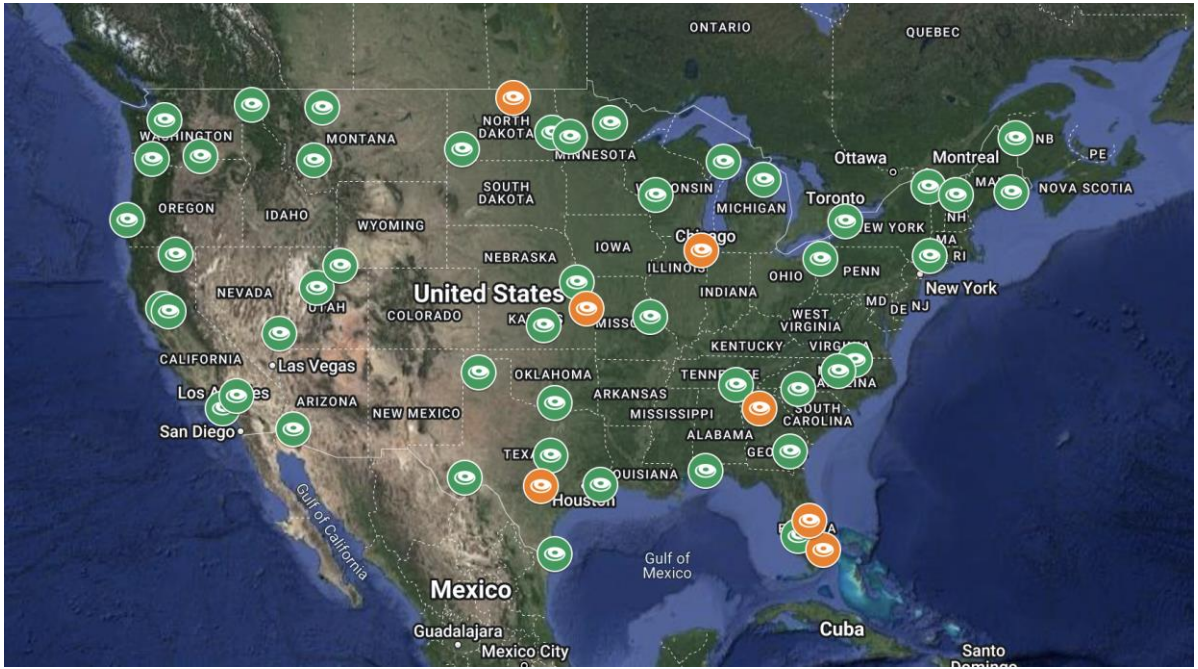
- CGNAT Employed
- Array to Satellite to Ground Station are all Flat
- Appears that Ground to NAP is a series of Exit MPLS Networks
- Exit Routing is based on your specific Terminal
- *Network Configuration changes are frequent and unannounced

- Exit Path is currently static based on your Service Class
- Portabililty, Marine, RV, Aviation means that you can be placed in different exit VPNs, we assume dynamically

Network Static Exit Routes

In Florida, my array lands in Central Florida, but exits from the Atlanta Internet Gateway

Mobile Roaming still sends my traffic out of Atlanta, clearly tied to my Array_ID



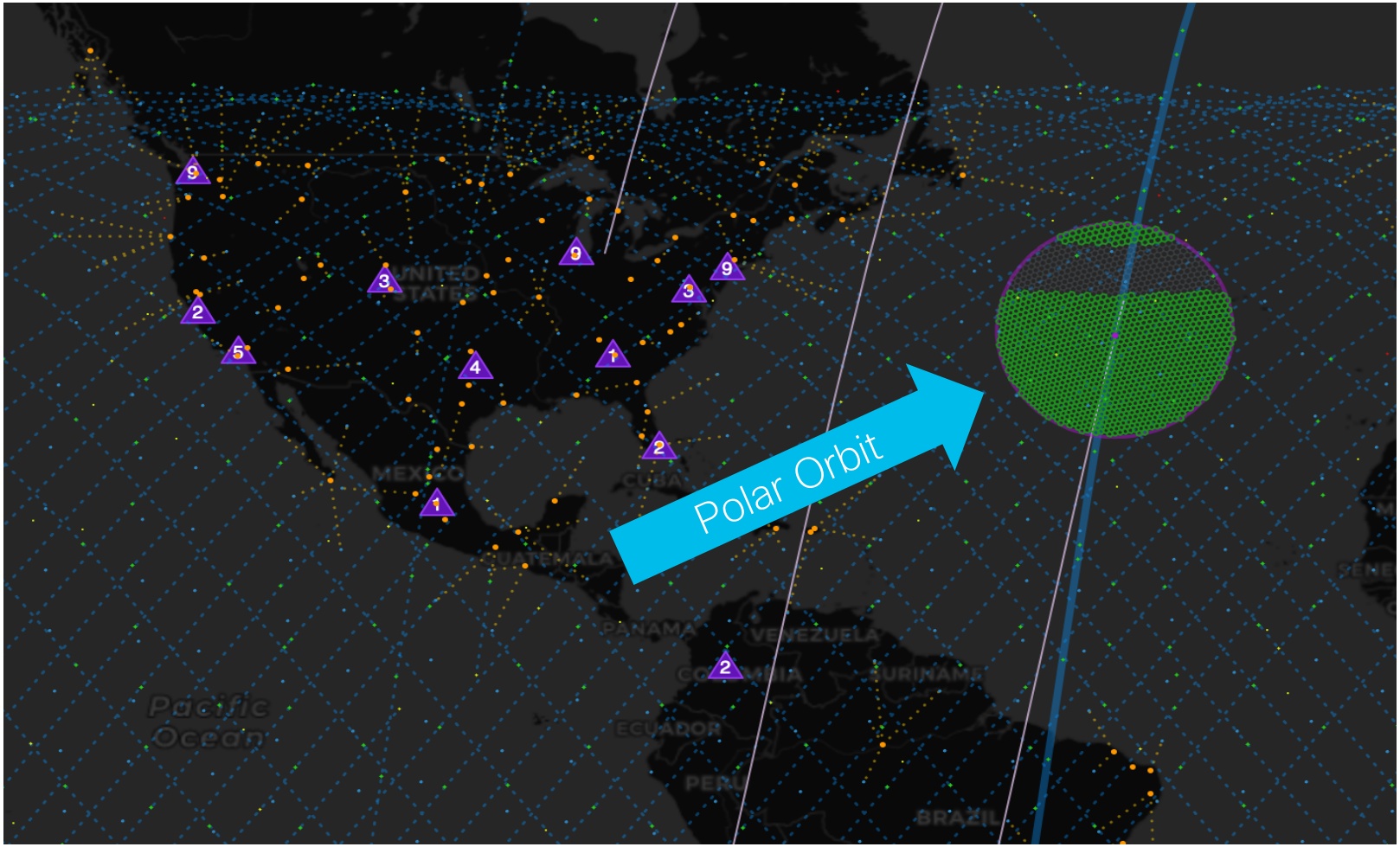
Polar Orbits and “Space Lasers”

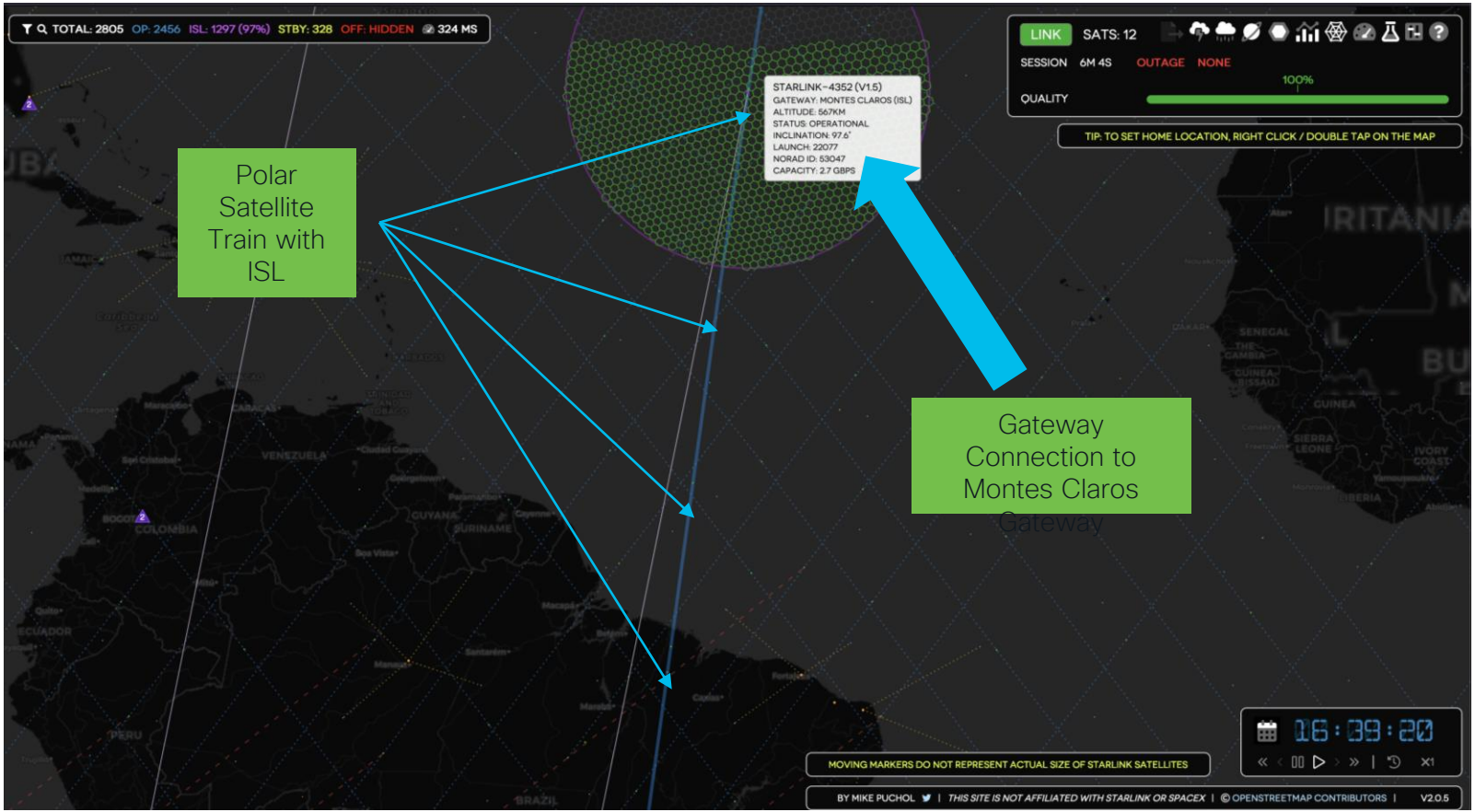
Satellite Truths and Myths

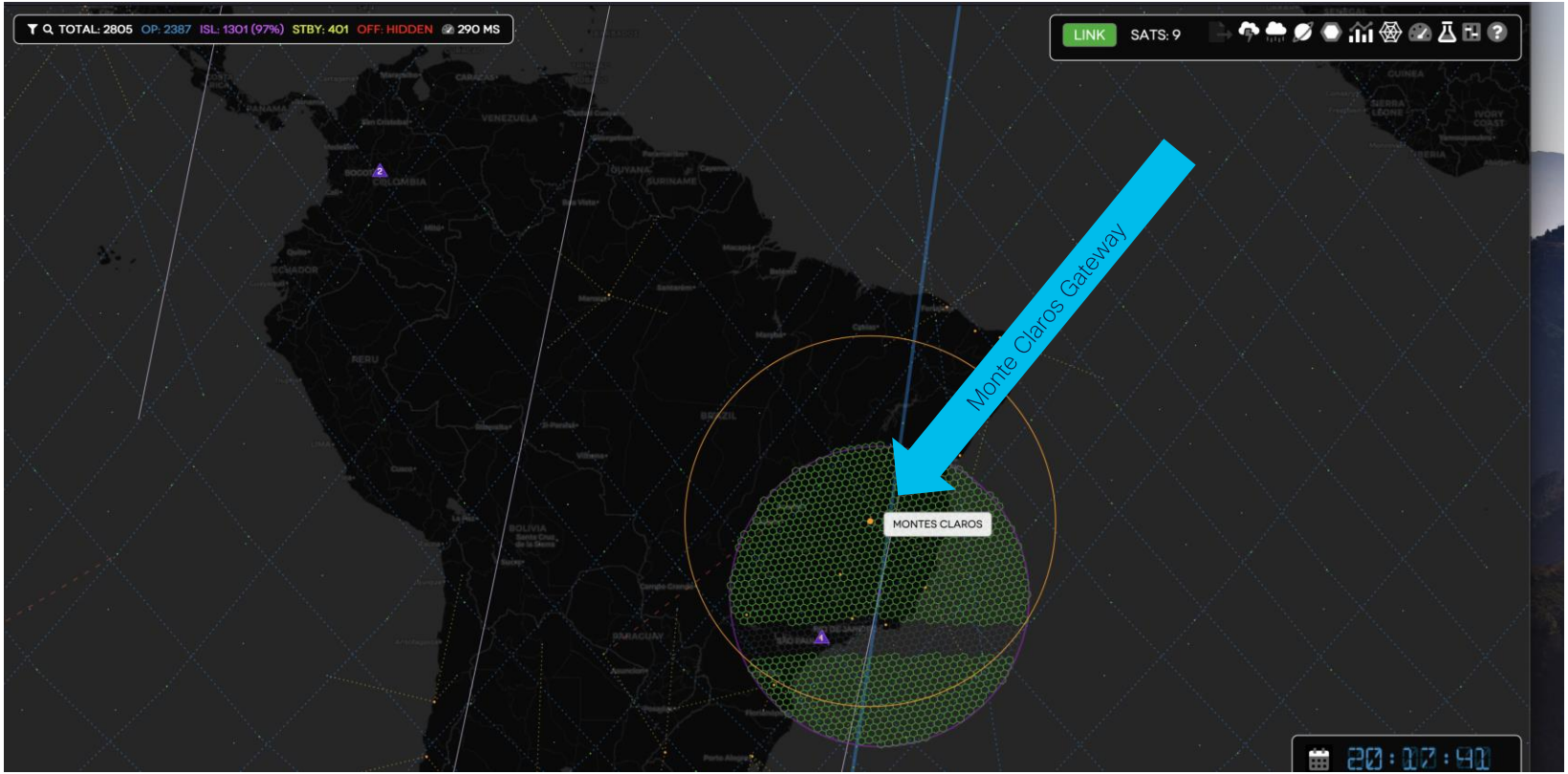
- All Starlink Satellites have “Lasers” – FALSE
- All Starlink Satellites can cross communicate to each other – FALSE
- Some Starlink Satellites have laser based optics that can point ahead of them to the next satellite – TRUE
- On-orbit Satellites can calculate multi-planar ephemeris to dynamically communicate to satellites in different orbits - FALSE

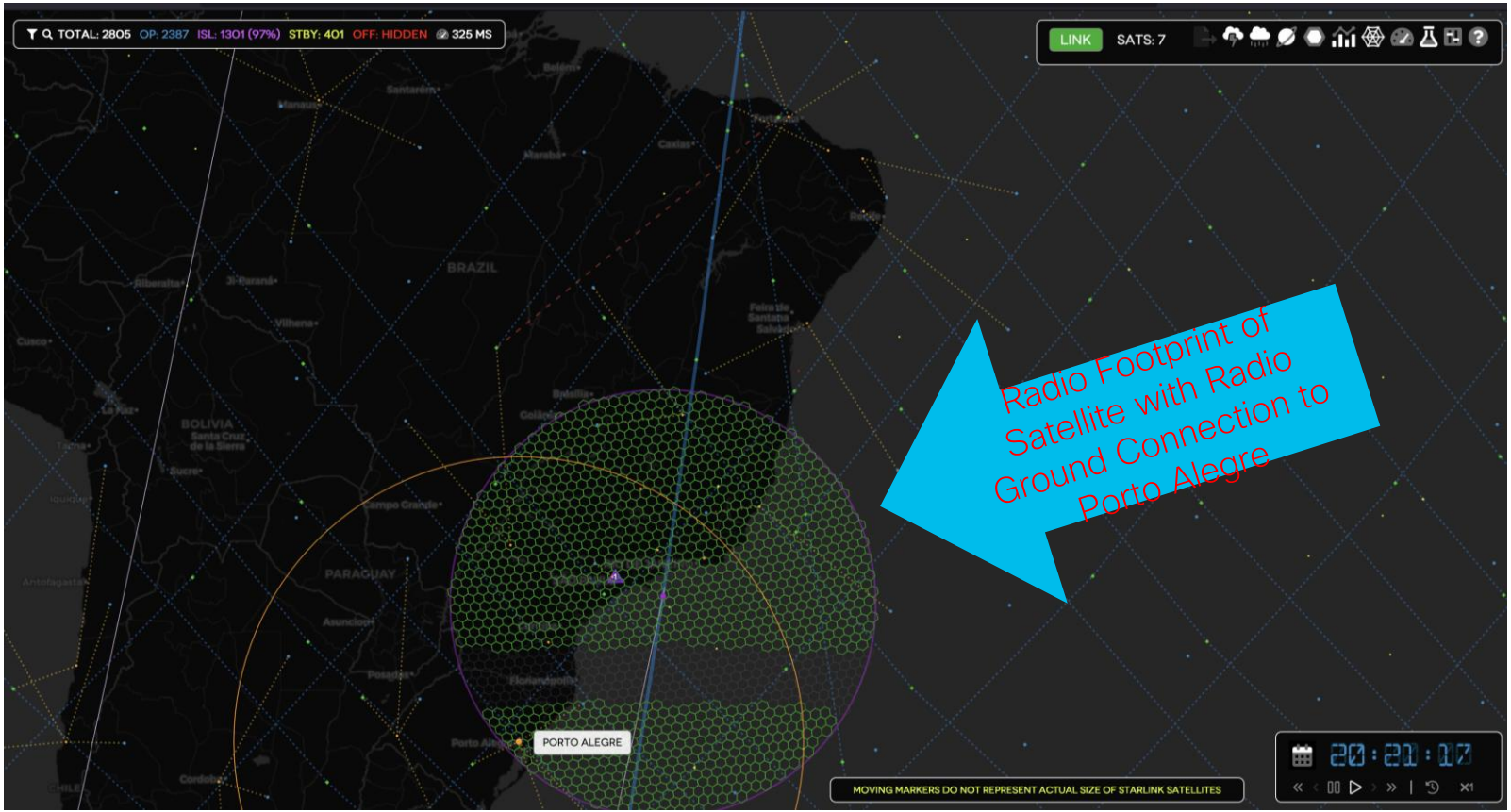
Polar Orbit Satellites and Free Space Optics

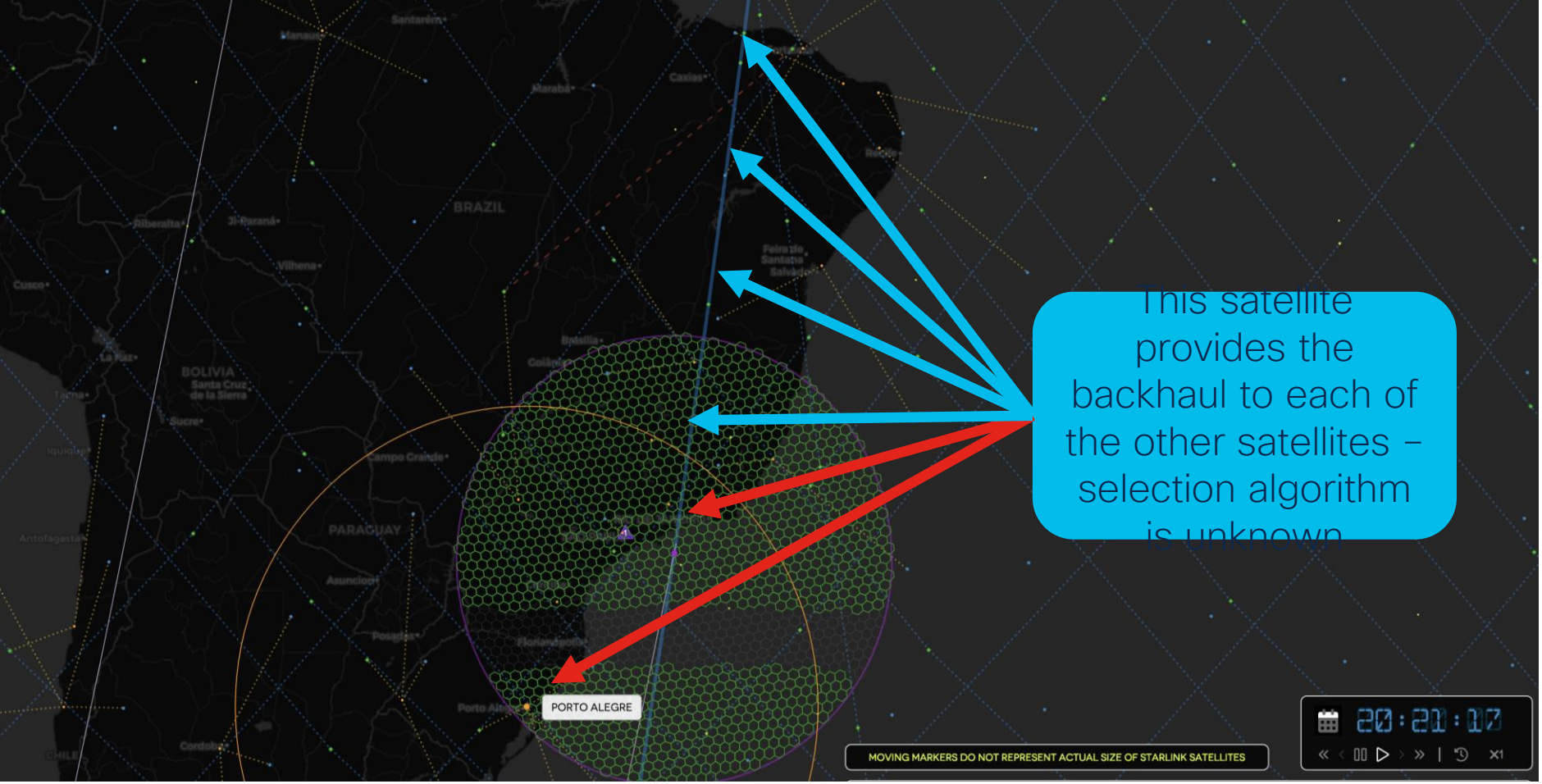
- Generation 1 Satellites are Radio Only
- Generation 1.5 and 2.0 Satellites are capable of Inter-Satellite Links (ISL)
- ISL Links work currently in a follow-me configuration
- A polar string of satellites provide hop to hop communications in single file
- Closest Radio Gateway provides the downlink for the chain of satellites
- Only use for satellites in polar orbits and where there is a Gateway connection
- You may not pop-out onto the Internet in a country that you expect
- You may not come out in a country you want



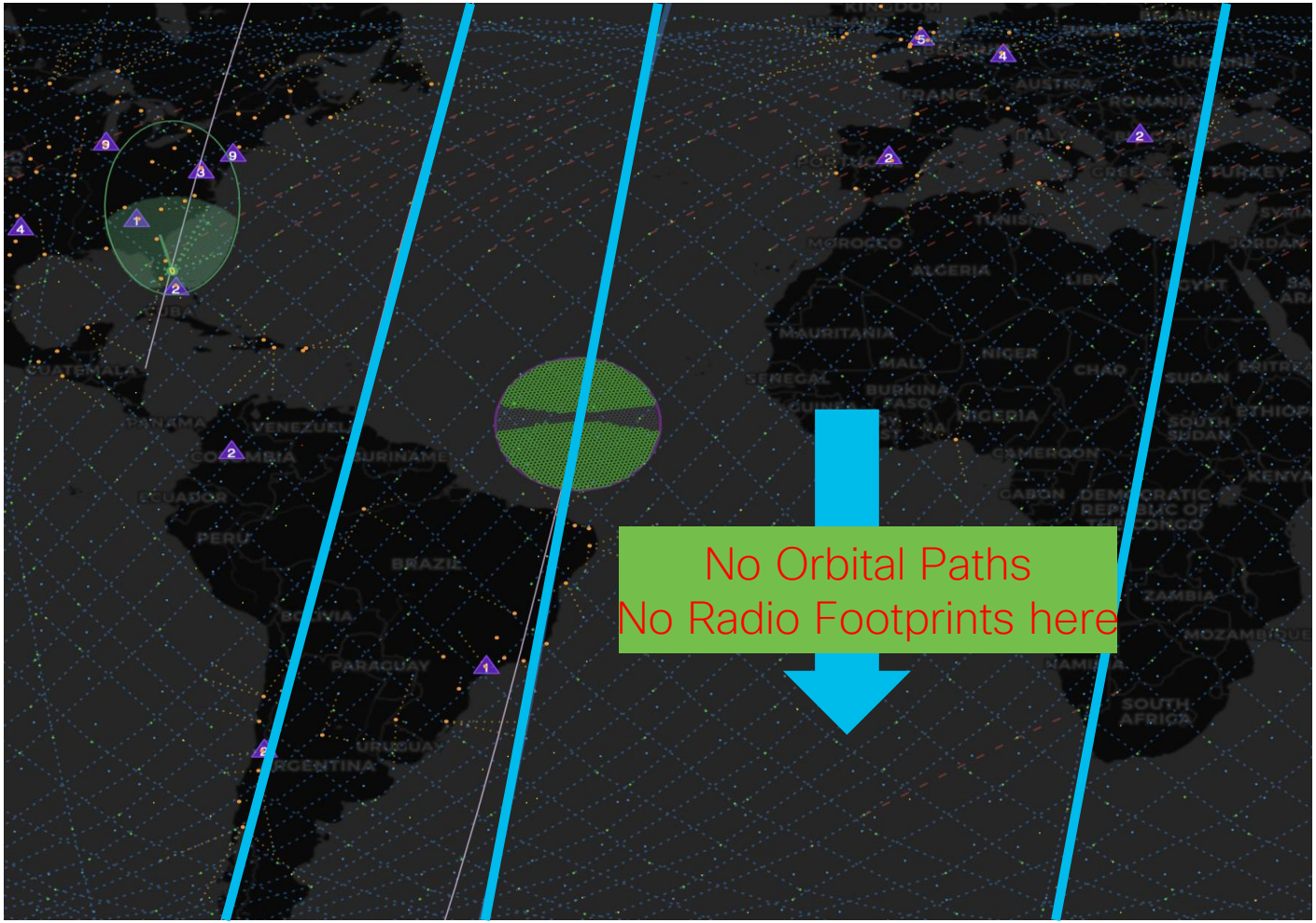


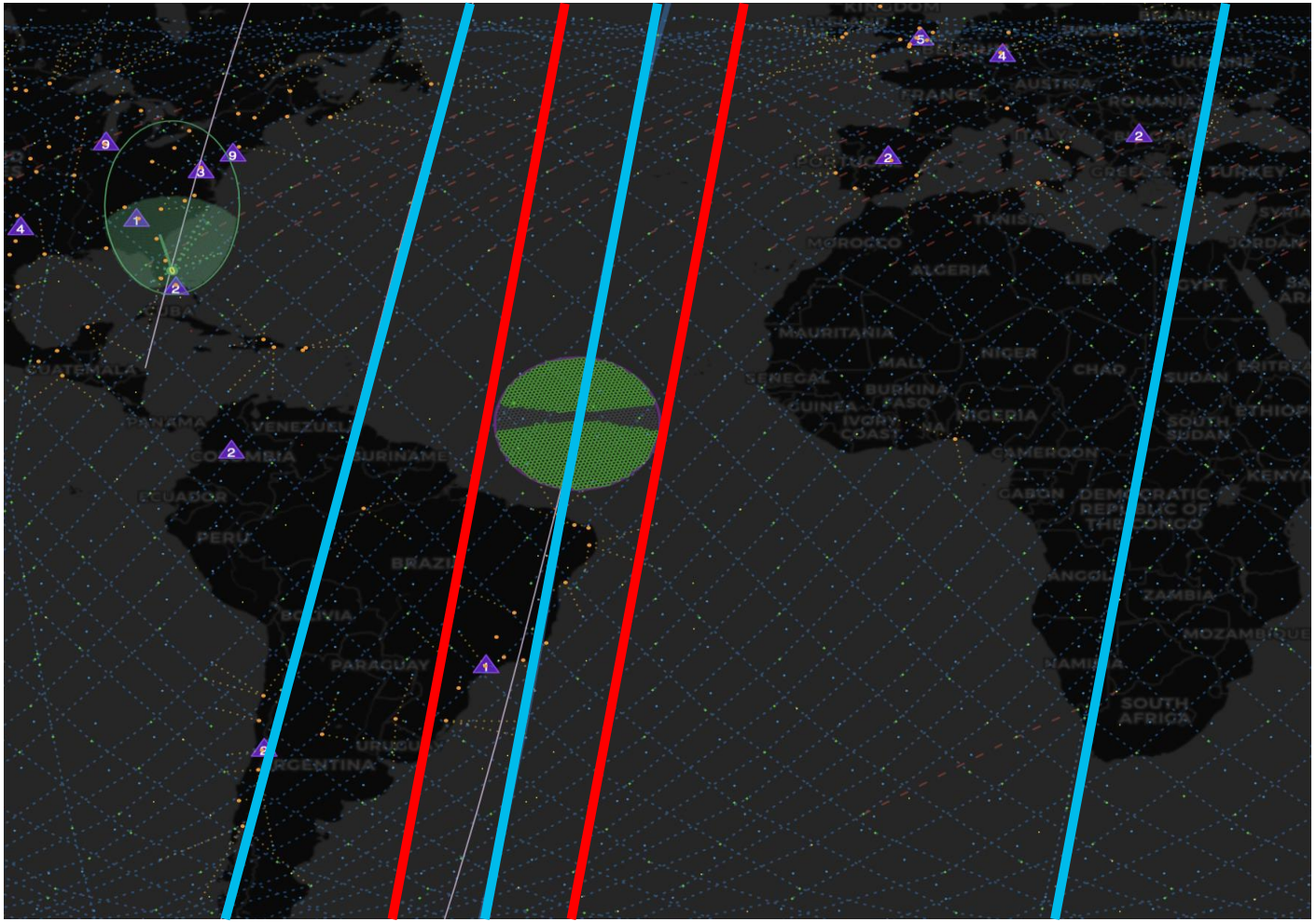


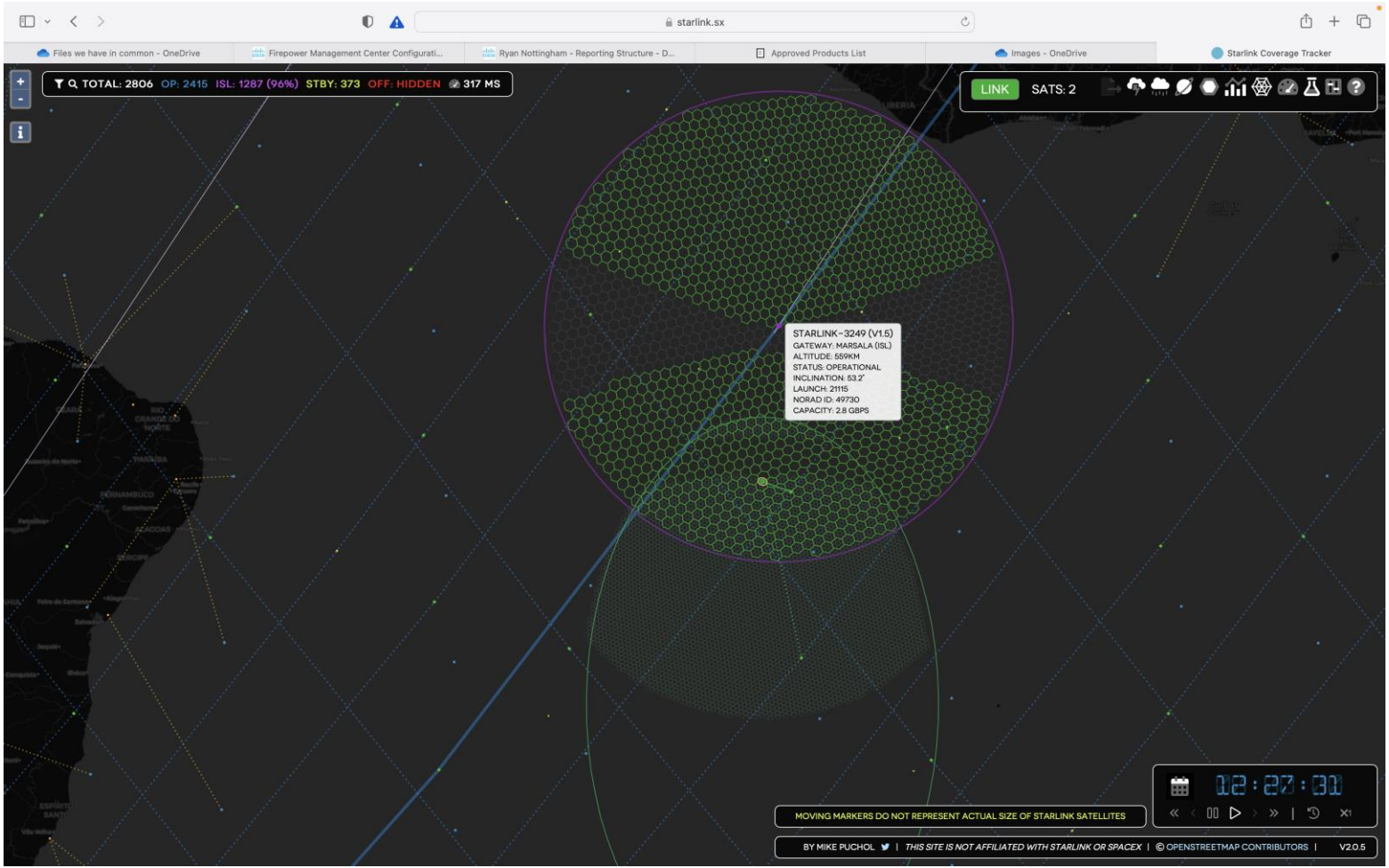




Challenges with Polar Orbits







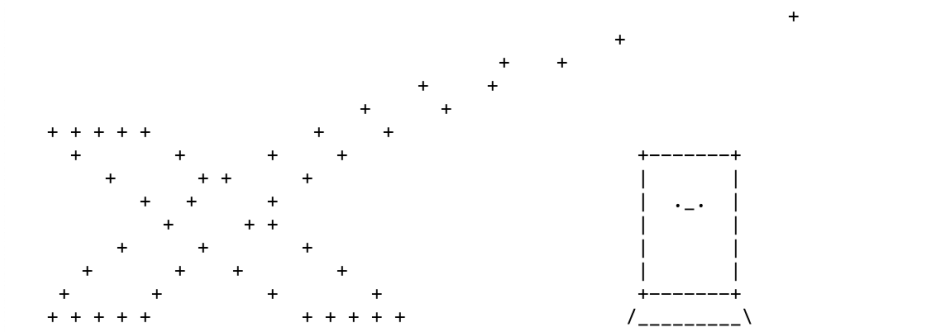
Starlink Security

Starlink Security

There is no security other than what you bring yourself

BYOS – Bring Your Own Security

Starlink Router



```
When I was a kid, I wanted to be a WiFi router more than anything in the world.
I stretched my arms out wide, and I hid in the corner. I tried to glue antennas
to my head, I had ethernet cables, I had an LED indicator. Everybody knew me
and was afraid of me. And one day, my dad said, "Bobby, you're 17. It's time to
throw childish things aside," and I said, "OK, Pop." But he didn't really say
that. He said, "Stop being a WiFi router and become a Dishy."

  2022.19.0.mr13442                      Router-01000000000000001F2F12
```

```
abenhase@192.168.1.1: Permission denied (publickey,keyboard-interactive).
abenhase@ABENHASE-M-526H .ssh %
```

- Nmap scan report for 192.168.1.1
- Host is up (0.0040s latency).
- Not shown: 994 filtered tcp ports (no-response)
- PORT STATE SERVICE
- 22/tcp open ssh
- 53/tcp open domain
- 80/tcp open http
- 9000/tcp open cslistener
- 9001/tcp open tor-orport
- 9002/tcp open dynamid

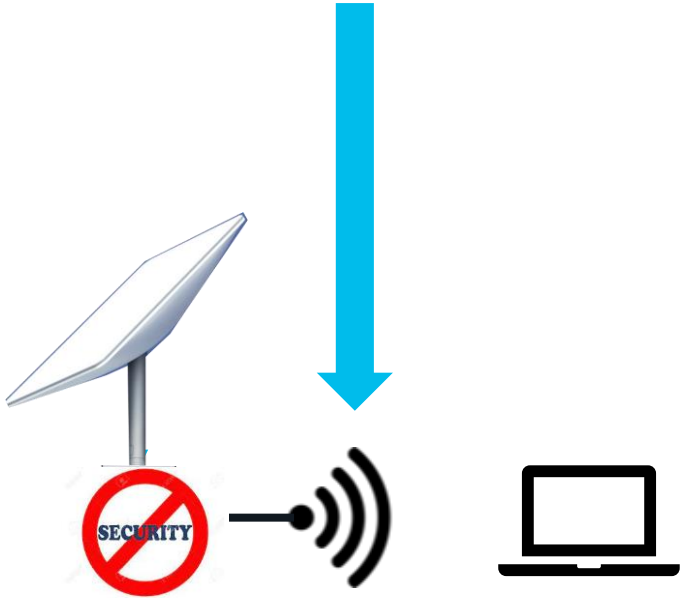
- Nmap done: 1 IP address (1 host up) scanned in 45.68 seconds

Things we know about Starlink Network

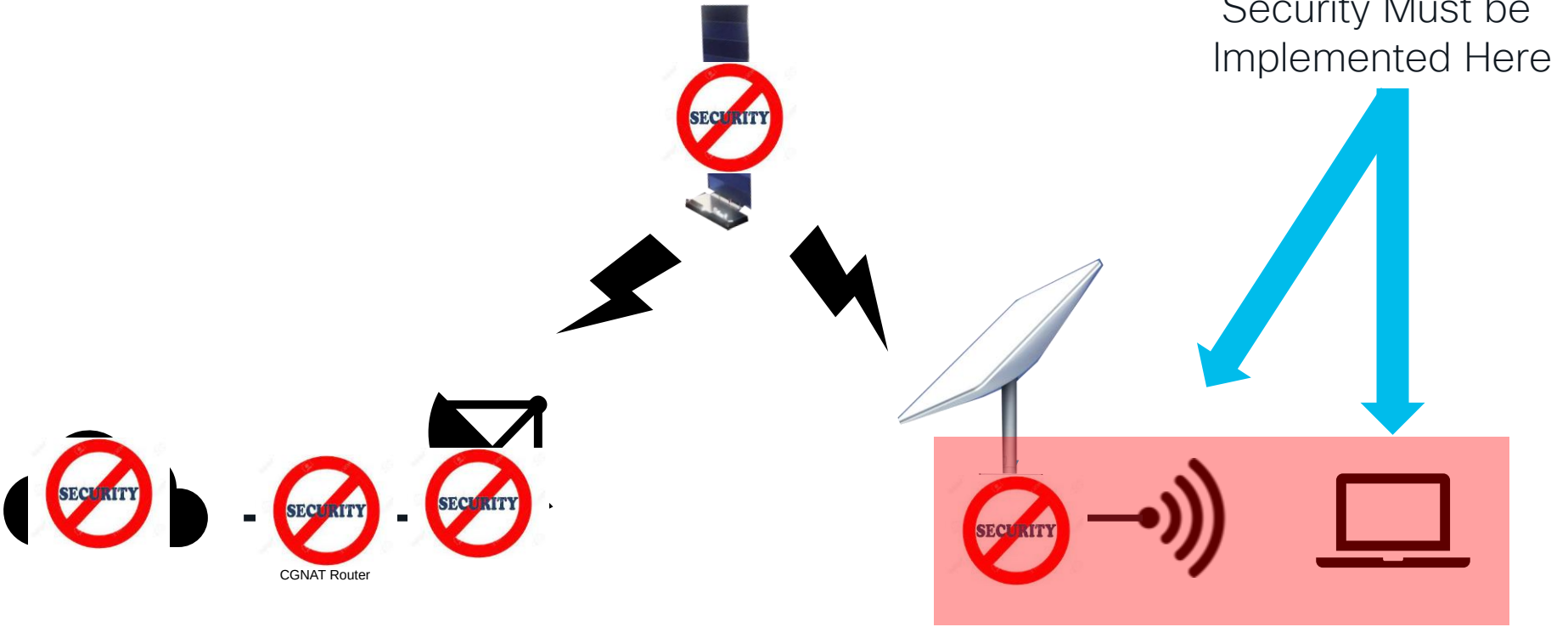
- Carrier Grade NAT (CGNAT) at the Internet Gateway
- IPv4 DHCP is assigned across the network
- IPv6 Prefix Delegation works on some Gateways
- Layer 2 network from terminal to ground to exit point (MPLS)
- Native IPSec will not work (CGNAT) 
- IPSec Encapsulation works – NAT-T (udp4500) 
- TLS VPNs work 
- There is NO local NAT configuration possible on the SL Router

Starlink Security Today

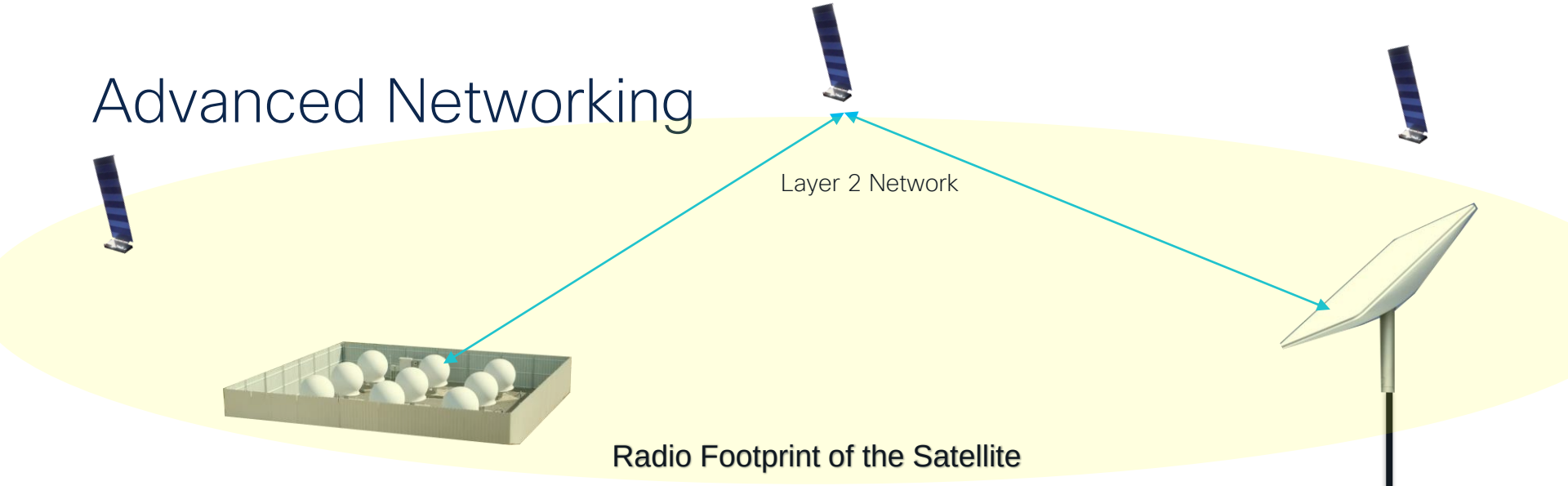
WPA2 Implemented here



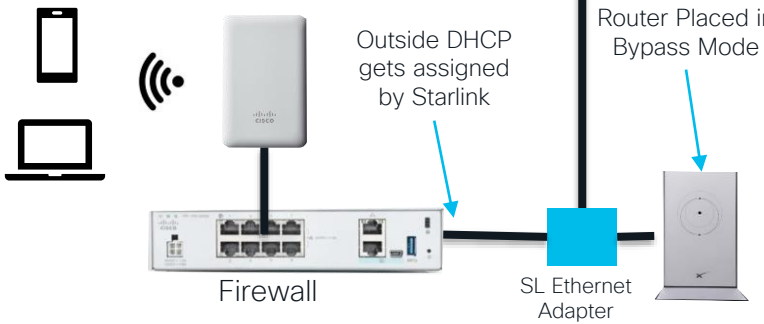
Starlink Security Today



Advanced Networking

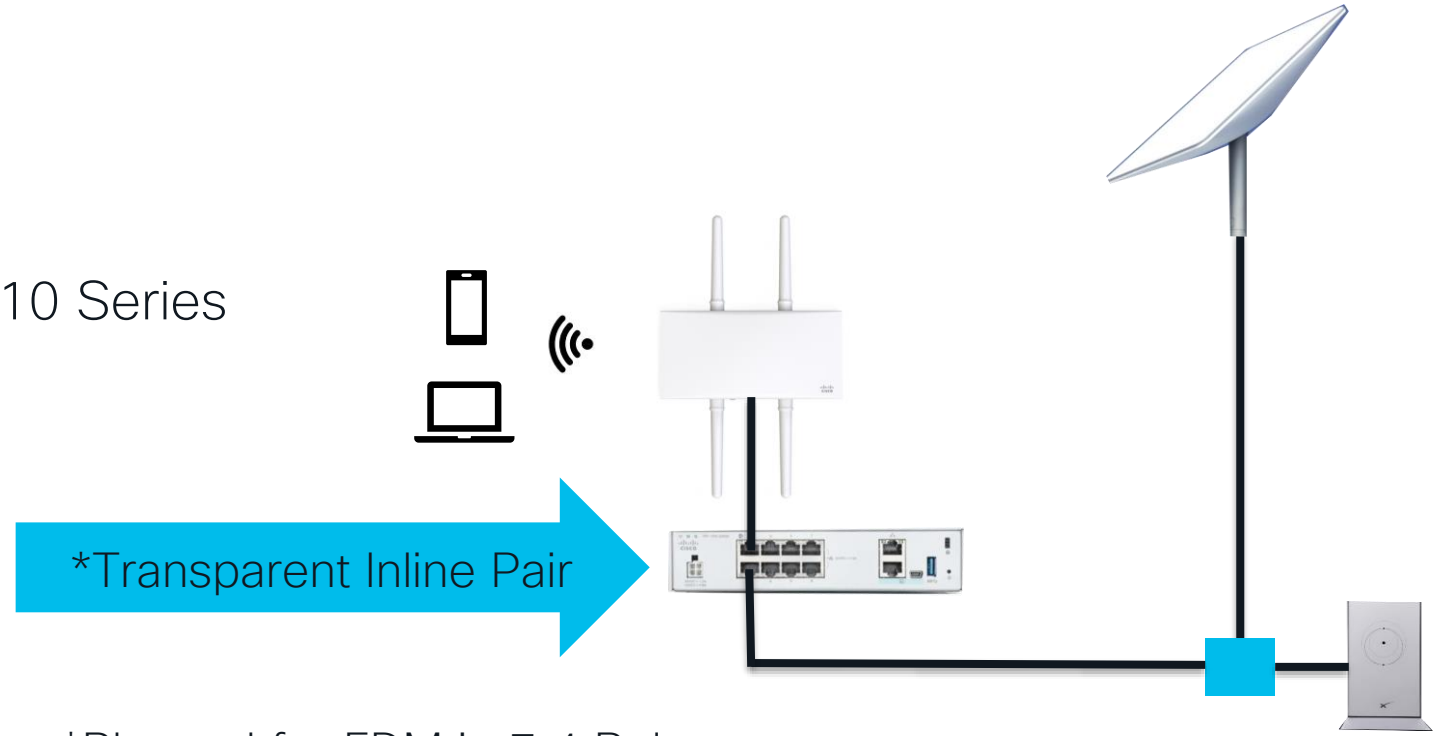


SL Router in Bypass Mode:
WIFI Gets disabled
Router is no longer locally accessible
Statistics are stored in SL Cloud
Array connects to SL Cloud and delivers updates



Meraki+Firepower Deployment

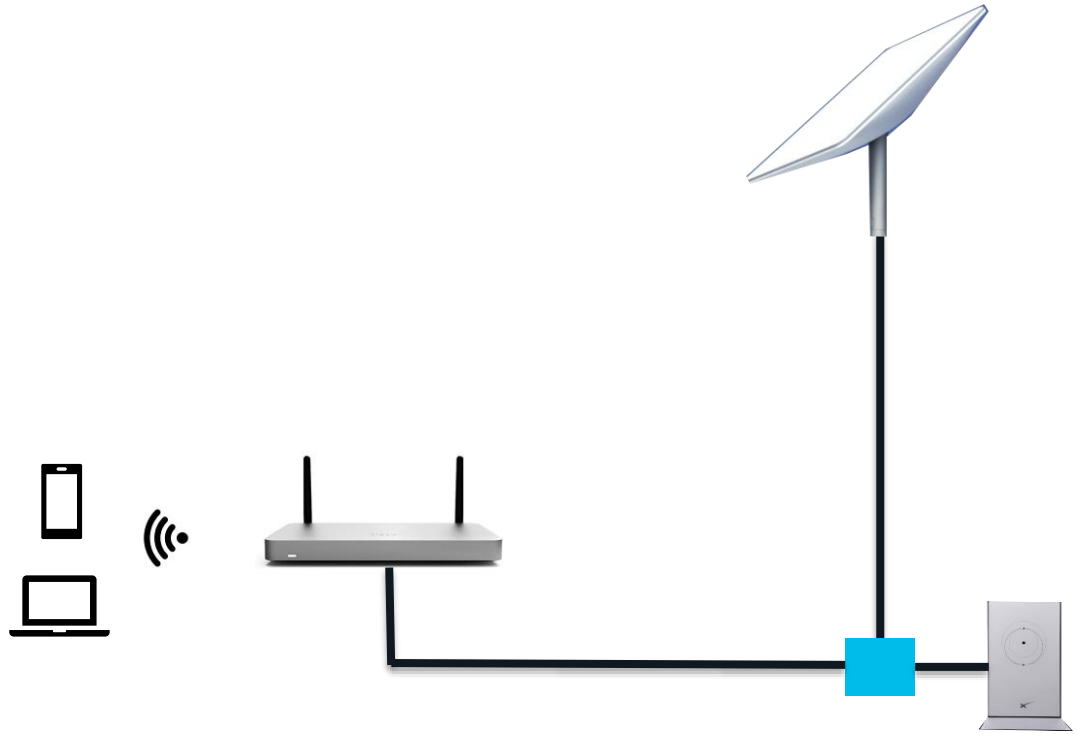
- MX Series
- MR Series
- Z3 Series
- Firepower 1010 Series



*Planned for FDM in 7.4 Release

Meraki MX/MR/Z3 Deployment

- MX Series
- MR Series
- Z3 Series



Native IPv6 Support on MX and MR Platforms

IPv6 Support on MX Security & SD-WAN Platforms [Core Fundamentals]

Last updated: Nov 12, 2022

+ TABLE OF CONTENT

Note: IPv6 is an ongoing cross-product initiative for Meraki as IPv4 addresses are being exhausted and with more hosts such as IoT devices requiring addressing, IPv6 provides a new structure to accommodate a larger number of hosts.

This article describes general information on IPv6 Support on MX Security & SD-WAN Platforms. For more information on compatible devices, please see our IPv6 Device Compatibility documentation.

Overview

- This document describes the IPv6 functionality and configuration available on the MX Security & SD-WAN Platforms. It will include information such as: supported MX and teleworker models, minimum firmware, and how to configure and use IPv6 on a network.

Note:

- MX cannot currently function in a native IPv6-only environment. It is recommended that dual-stack is implemented in order to leverage IPv6 functionality and management.
- High-availability (HA) and template deployments are not supported at this time.

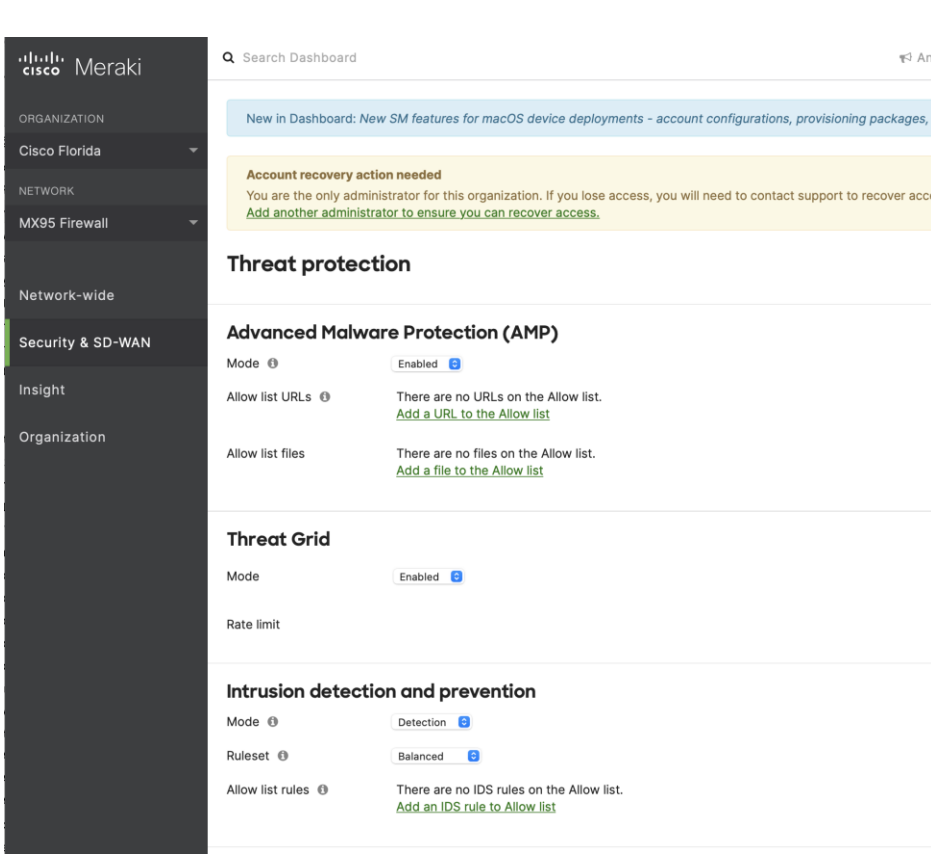
Minimum Firmware

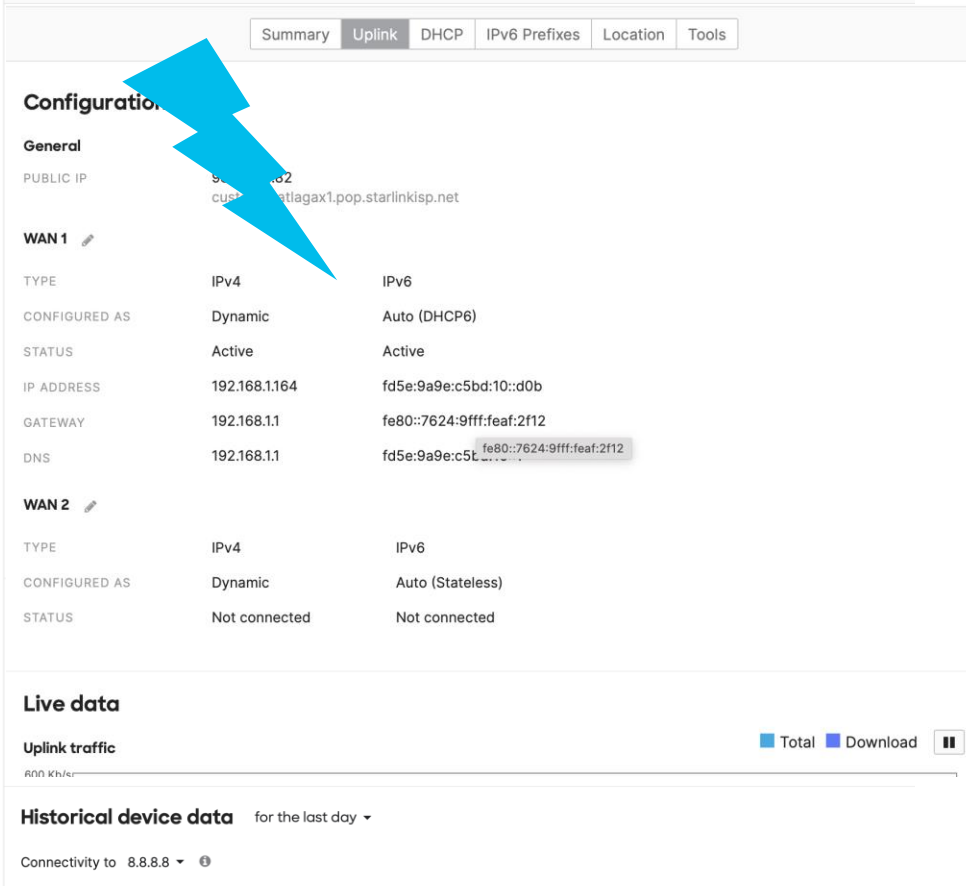
- MX 17.5+ firmware is required for IPv6 functionality on MX Security & SD-WAN Platforms.

Supported Models

- Z3, Z3C, MX64, MX64W, MX65, MX65W, MX67, MX67W, MX67C, MX68, MX68W, MX68CW, MX75, MX84, MX85, MX95, MX100, MX105, MX250, MX450.
- All current MX/Z models listed on our website here.

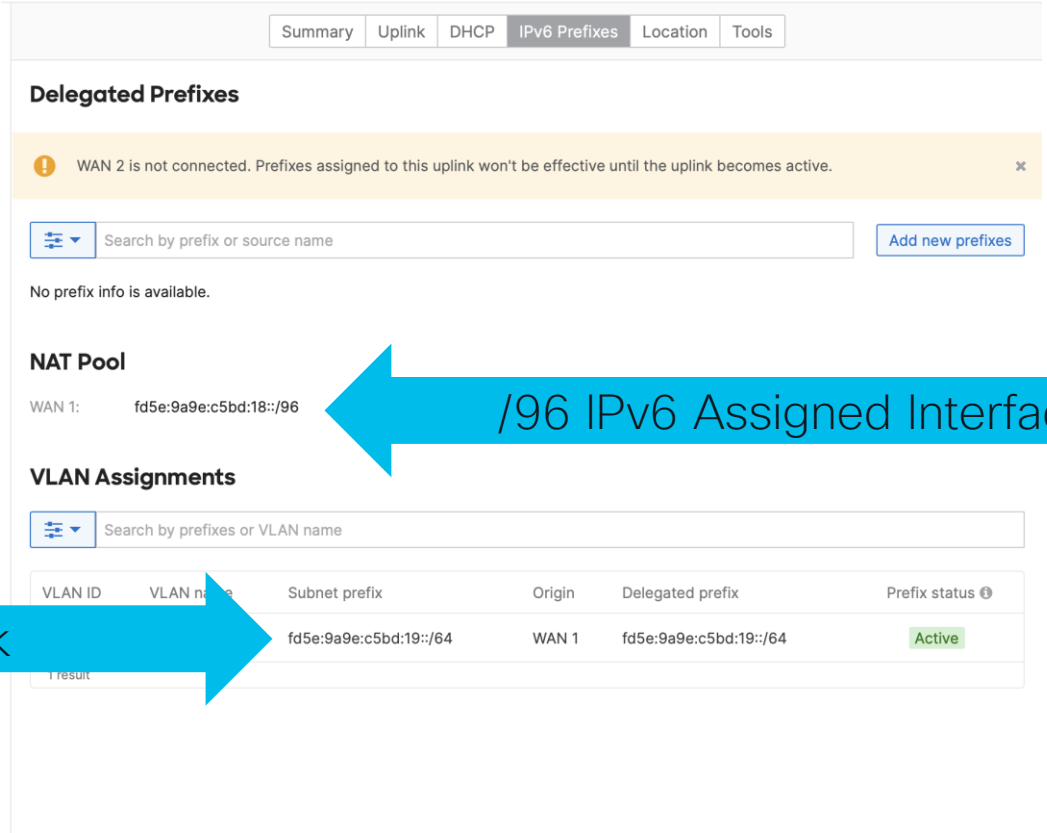
Meraki is the simplest security option





Meraki is the simplest IPv6 Deployment Option

- Takes the downstream Prefix Delegation
- Automatically deploys it to the downstream networks
- Clients will be assigned IPv6 address out of your assigned Prefix



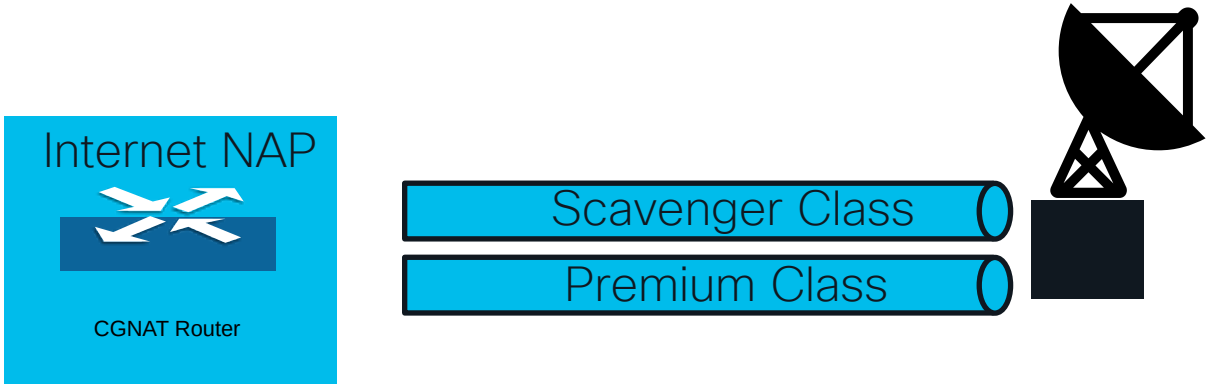
Keep it simple, don’t overcomplicate things

Deployment Considerations

QoS Observations

- Terminals (arrays) are statically linked to what we believe to be MPLS VPNs with static exits to the Internet

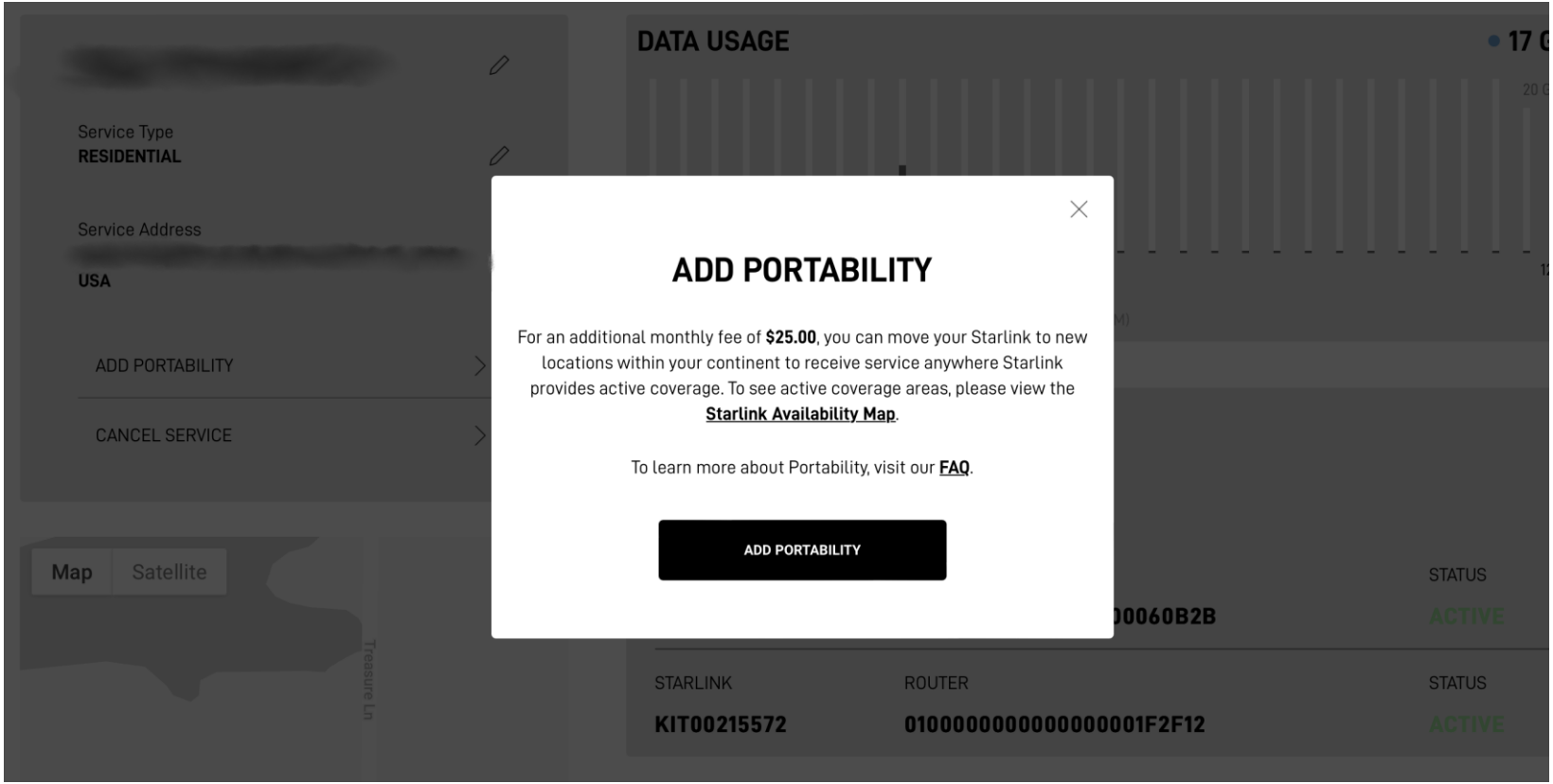
Scavenger class QoS



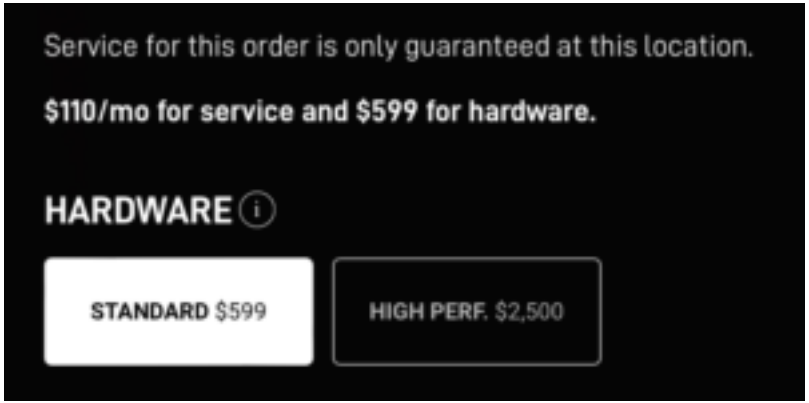
Residential QoS

Deployment Considerations

- You will probably want a 150 foot cable
- You can make a 300+ foot cable easily by inserting Ethernet in the middle
  - Use High Quality watertight connectors

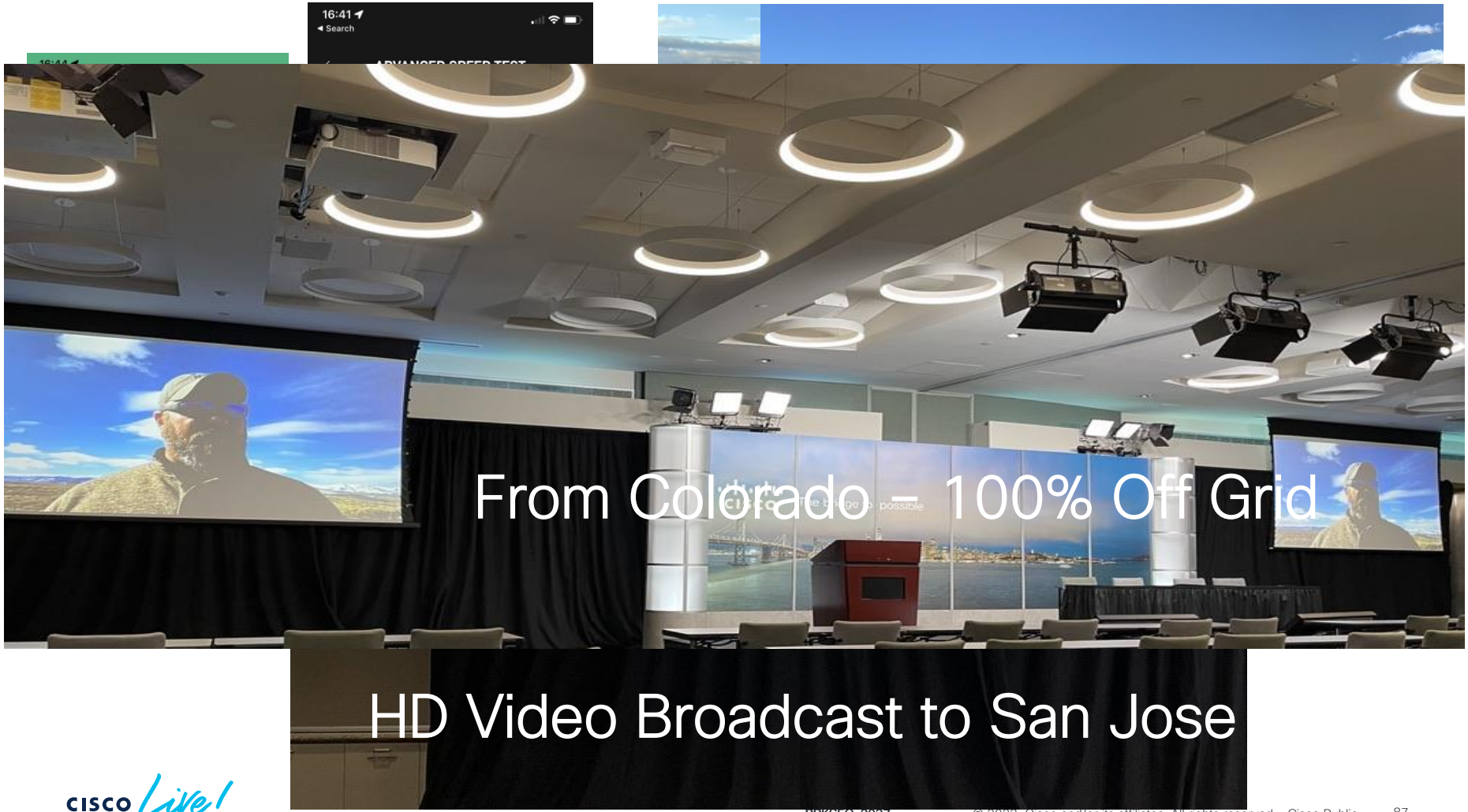


Decisions



- “High Performance” is simply double the array
- They have a single GigE output – but have doubled the transceivers
- They are clearly creating a Service Class for High Performance users and doing traffic engineering to support it

‘I had a recent important meeting to attend but it conflicted with PTO….’



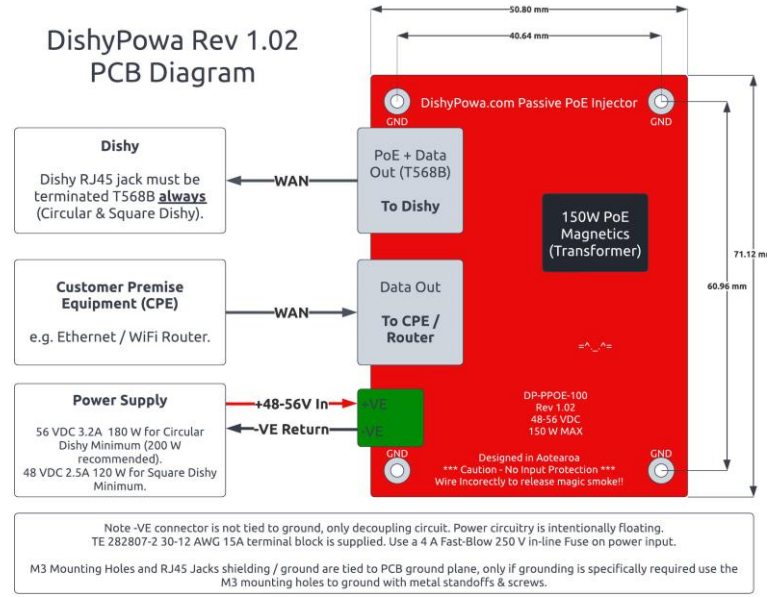
Austere Deployment Options

Disclaimer

I make 100% zero guarantees or warranty you won't damage something….

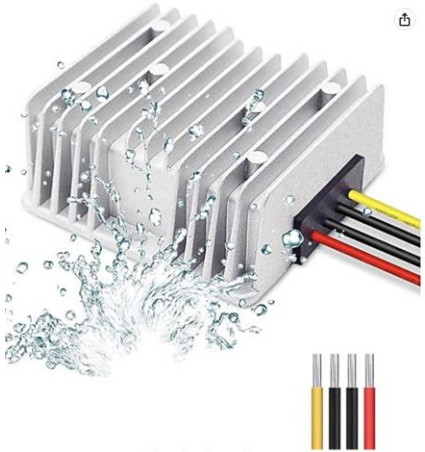
Ditching the Starlink Router

- https://dishypowa.com
- 48-56V DC passive PoE injector
- Allows you to remove Starlink Router entirely
- Connect up BYOS options
- Needs 48v DC Power



Credit: dishypowa.com

Parts Needed



Roll over image to zoom in

DC 12V Step Up to 48V Boost Converter 3A 144W DC Voltage Regulator Power Converter Adapter Waterproof Module Transformer for Golf Cart Club Car LED Light

Brand: Protooma

★★★★★ 26 ratings | 4 answered questions

$17.99

FREE Returns

Get 40% off eligible products sold and shipped by Amazon when you pay with Discover rewards. Max discount $50. Activation required. Limited-time offer, see terms.

Color: **12V to 48V 3A**

Brand	Protooma
Model Name	Boost Converter
Color	12V to 48V 3A
Item Dimensions LxWxH	2 x 2 x 0.8 inches
Input Voltage	12 Volts

About this item

- Input Voltage:DC 12V nominal; Voltage Range: 9-20V(12V); Output Voltage: DC 48V 3A 144W; Maximum Efficiency:≥95%; Ripple Wave: 50Mv; Starting delay time:≤2s.
- Protection: Built in over-load, over-current, over-temperature and

Roll over image to zoom in

LiTime 12V 100Ah Lithium LiFePO4 Battery, Built-in 100A BMS, 4000-15000 Cycles, 10-year Lifetime, Perfect for RV, Solar, Backup Power, Off Grid Application, Boat, Trolling motor.

Brand: Litime

6 answered questions

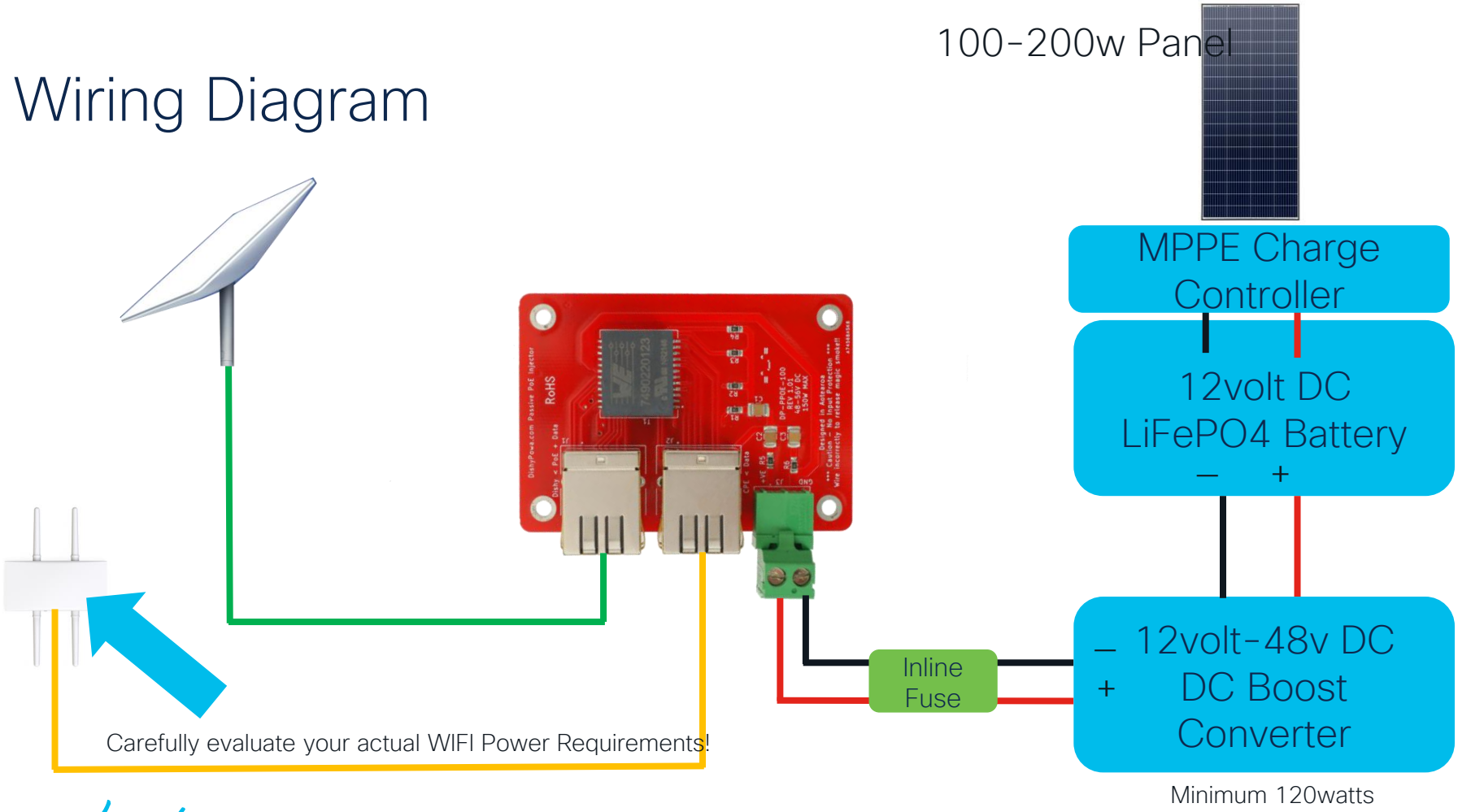
$299.99

Pay $25.00/month for 12 months, interest-free upon approval for the Amazon Prime Rewards Visa Card

Size: **12V100Ah**

12V50Ah $179.98	**12V100Ah $299.99**
12V100Ah Smart $479.99	12V200Ah $599.99
12V300Ah $999.99	24V100Ah $649.99
48V100Ah $1,699.98	

Wiring Diagram



SOLAR POWER

12:00

ADVANCED SPEED TEST

WIFI SPEED
IPHONE TO WIFI ROUTER

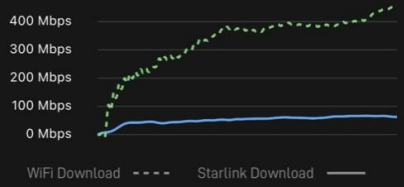
499 Mbps

388 Mbps Upload

STARLINK SPEED
ROUTER TO INTERNET

64 Mbps

4.4 Mbps Upload



9F8E4566

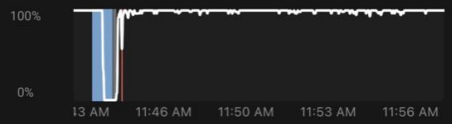
11:58
◂ Search

NETWORK STATISTICS

Your Starlink just powered on. Network performance should stabilize after about 15 minutes.

UPTIME

OUTAGES



Last 14 minutes:

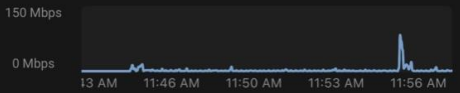
- Possibly Obstructed 3s
- Network Issue 8s

LATENCY

Min: 0 ms Max: 1383 ms Last: 40 ms

THROUGHPUT

SPEED TEST



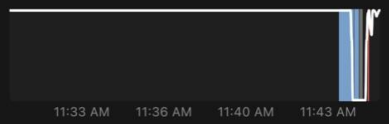
11:45
ch

NETWORK STATISTICS

Your Starlink just powered on. Network performance should stabilize after about 15 minutes.

IME

OUTAGES

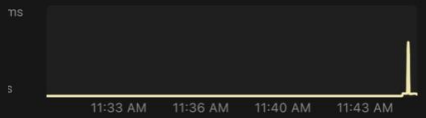


2 minutes:

- ossibly Obstructed 3s
- etwork Issue 8s

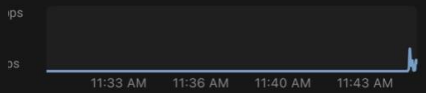
ENCY

Min: 0 ms Max: 1383 ms Last: 38 ms



OUGHPUT

SPEED TEST



11:46
◂ Search

EB3A2226002144201

Power off

72%

DC

AC

Power/Solar Conclusions

1

You will need more stored power than you think

2

You will need more solar power than you think

3

You will have to trial 24hr operation to be sure it works

4

You will have to account for lack of full solar cycles

Electron Security

Gen 1 and Gen 2 Phased Arrays

Starlink

- Diameter: 23.2" (58.9 cm)
- Weight: 16 lbs (7.3 kg)
- Height: 25.4" (64.5 cm)
- Mast diameter: 1.4" (3.6 cm)
- Operating Temperature: -22°F to +122°F (-30°C to +50°C)

WiFi Router

- IEEE 802.11a/b/g/n/ac standards
- Dual band 2.4GHz and 5GHz
- 2x2, MU-MIMO
- WPA2 and WPA3 security
- Operating Temperature: +32°F to +86°F (0°C to +30°C)
- Indoor use
- One Ethernet port

- Dimensions: 19" x 12" (50 x 30 cm)
- Weight (with cable): 9.2 lbs (4.2 kg)
- Height: 24" (61 cm)
- Mast diameter: 1.3" (3.4 cm)
- Operating Temperature: -22°F to +122°F (-30°C to +50°C)

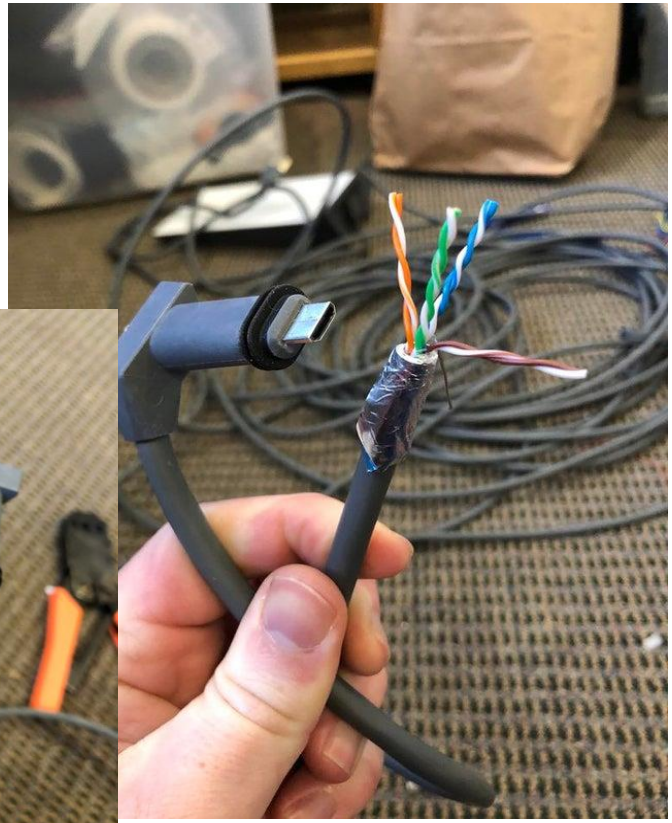
- IEEE 802.11a/b/g/n/ac standards
- Dual band 2.4GHz and 5GHz
- 3x3, MU-MIMO
- WPA2 and WPA3 security
- Operating Temperature: -22°F to +122°F (-30°C to +50°C)
- IP54 rated (water resistant), configured for indoor use
- Ethernet adapter available in Shop

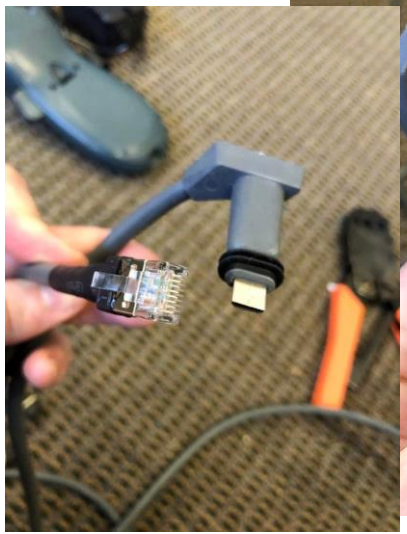
How to properly ground your Starlink Array

- Grounding is very important
- A normal ground path will be direct to your equipment, which is an Ethernet adapter and Starlink Router
- Spike will travel to the closest ground – which if attached directly to the ground is great
- If not done properly, you could easily loose all equipment attached
- Insure that you have a proper ground path
- Take your time, employ thought and basic knowledge of physics

Re-Terminate your Starlink Cable

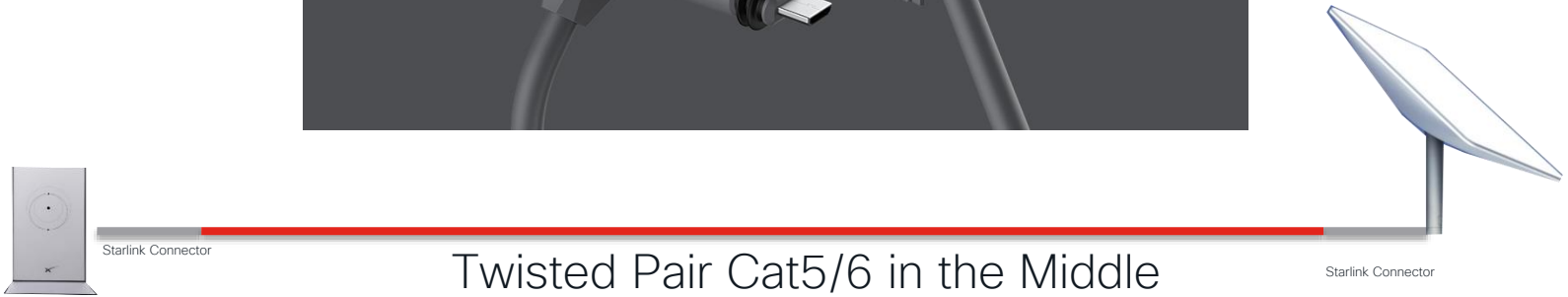
- Proprietary Connector to Router and Array must stay in place
- 568B Termination in the middle
- Use Shielded RJ45 connecters
- Remember the path – if a surge travels, where is it going?





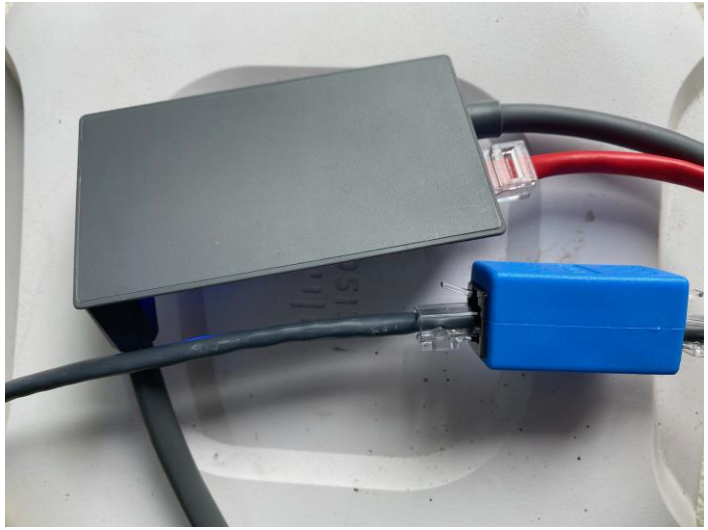
Mounting Matters – Grounding Matters

These ends have to stay on…



Cut the Cable

- Re-Terminated Starlink



- Stock 150 foot

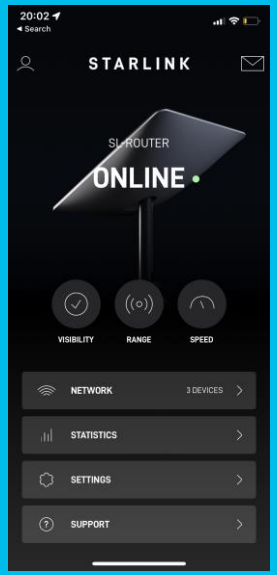
Use Waterproof IP68 Connectors

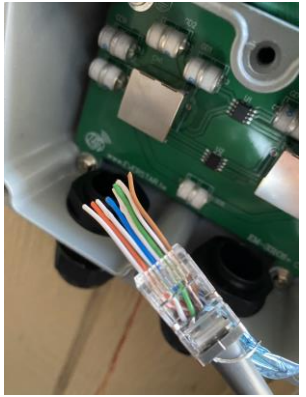
Use Shielded RJ45 Connectors

Leave Grounding Shield in Place
Terminate with Shield touch the connector

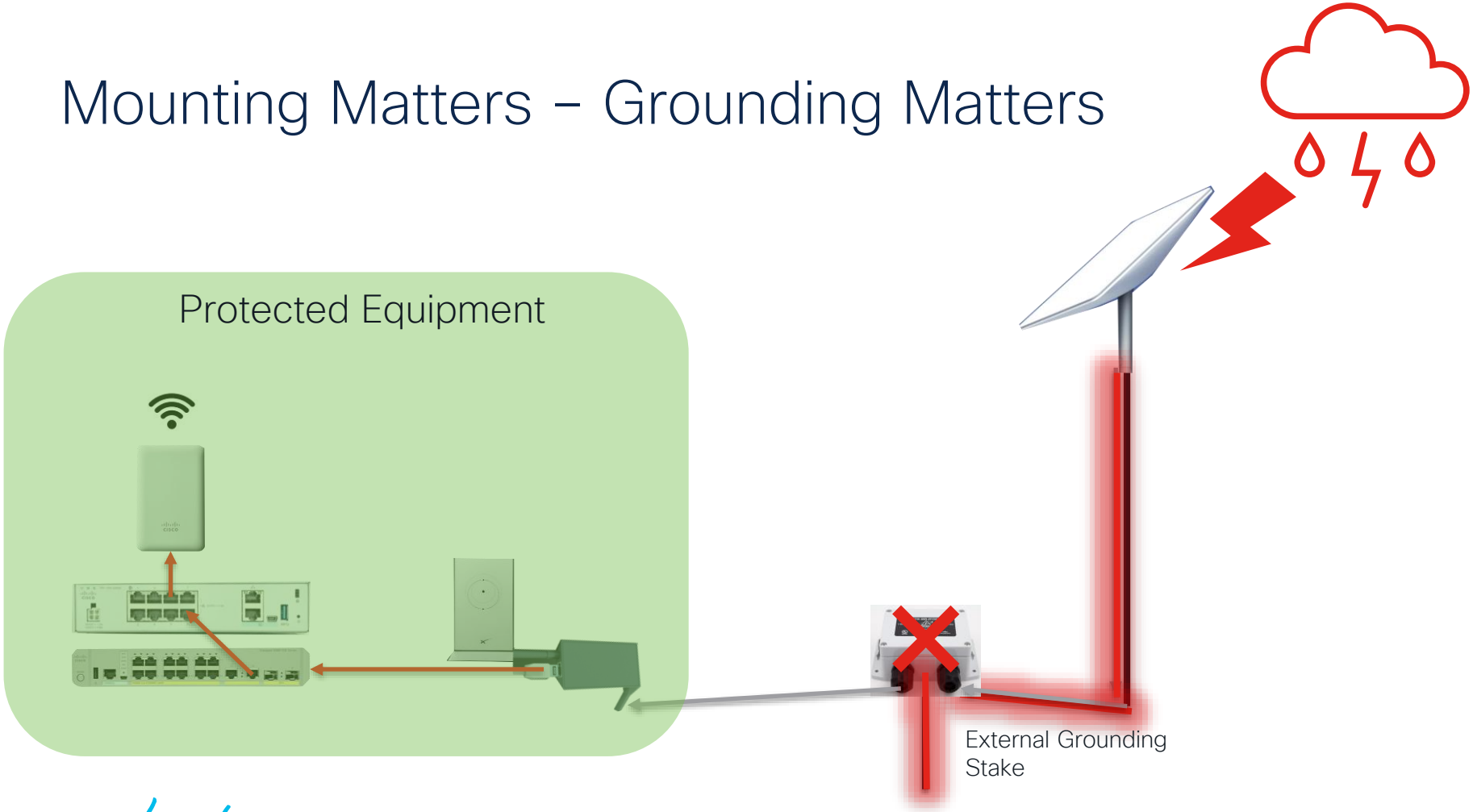
Ethernet Surge Suppression and Grounding Block

Proper Grounding





Mounting Matters – Grounding Matters



Debugging

Debugging at the CLI

```
abenhase@ABENHASE-M-526H starlink-grpc-tools-main % python3 poll_history.py | grep software_version
status: {'id': 'ut01000000-00000000-0008d16e', 'hardware_version': 'rev3_proto2', 'software_version': 'f562e306-0cd5-44c2-9058-9ab6800c4b50.uterm.release',
to_first_nonempty_slot': 0.0, 'pop_ping_drop_rate': 0.0, 'downlink_throughput_bps': 1429922.125, 'uplink_throughput_bps': 270549.375, 'pop_ping_latency_ms':
currently_obstructed': False, 'seconds_obstructed': None, 'obstruction_duration': None, 'obstruction_interval': None, 'direction_azimuth': 1.722228288650512
ise_floor': True}
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se_floor': True}
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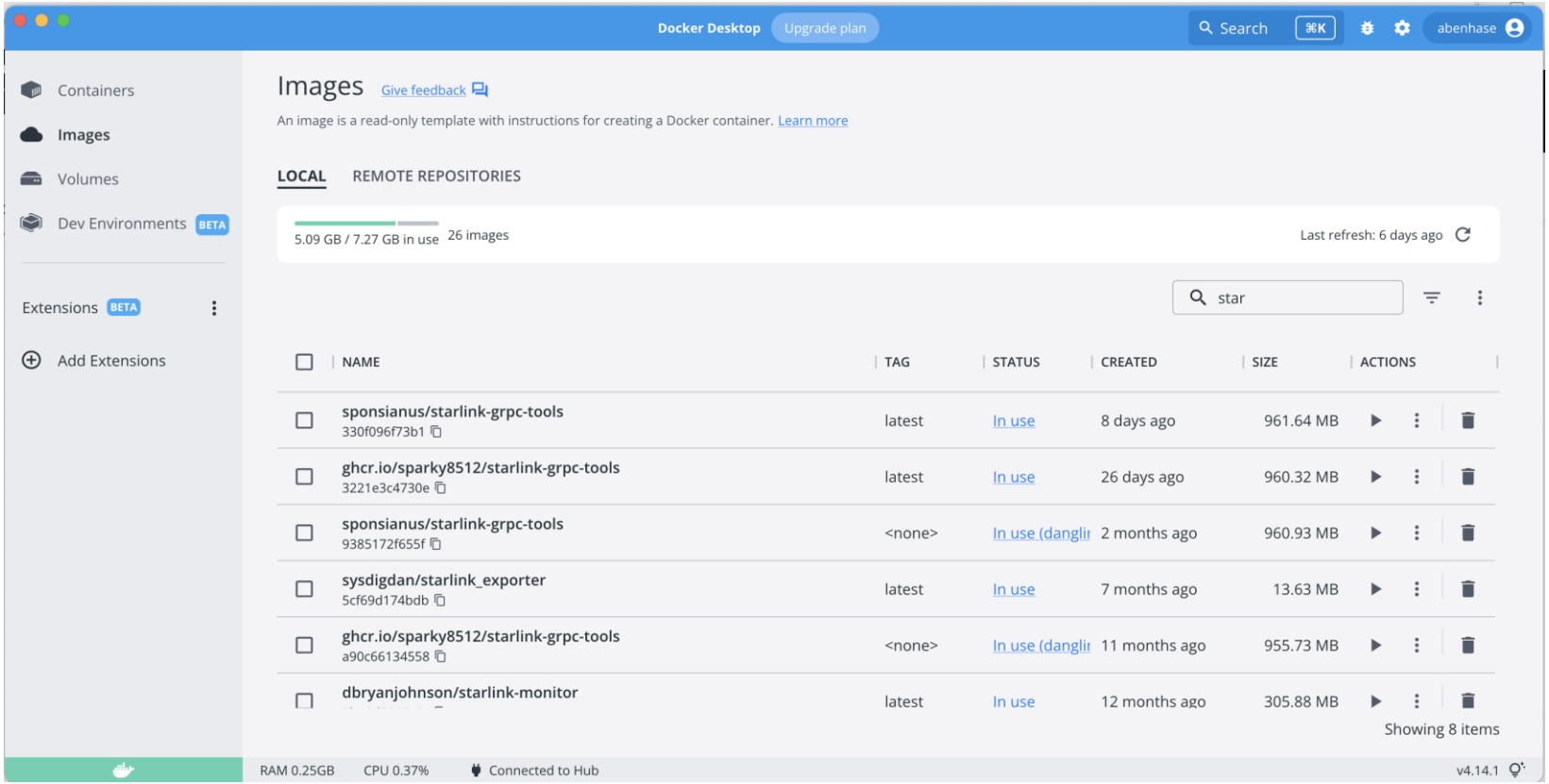
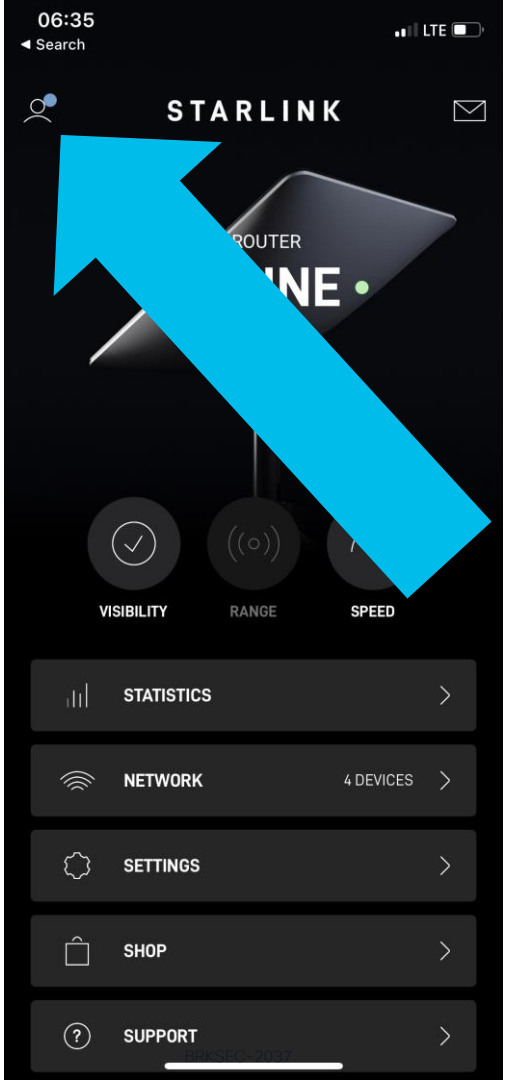
oise_floor': True}
status: {'id': 'ut01000000-00000000-0008d16e', 'hardware_version': 'rev3_proto2', 'software_version': 'f562e306-0cd5-44c2-9058-9ab6800c4b50.uterm.release',
to_first_nonempty_slot': 0.0, 'pop_ping_drop_rate': 0.0, 'downlink_throughput_bps': 9985874.0, 'uplink_throughput_bps': 485163.53125, 'pop_ping_latency_ms':
```

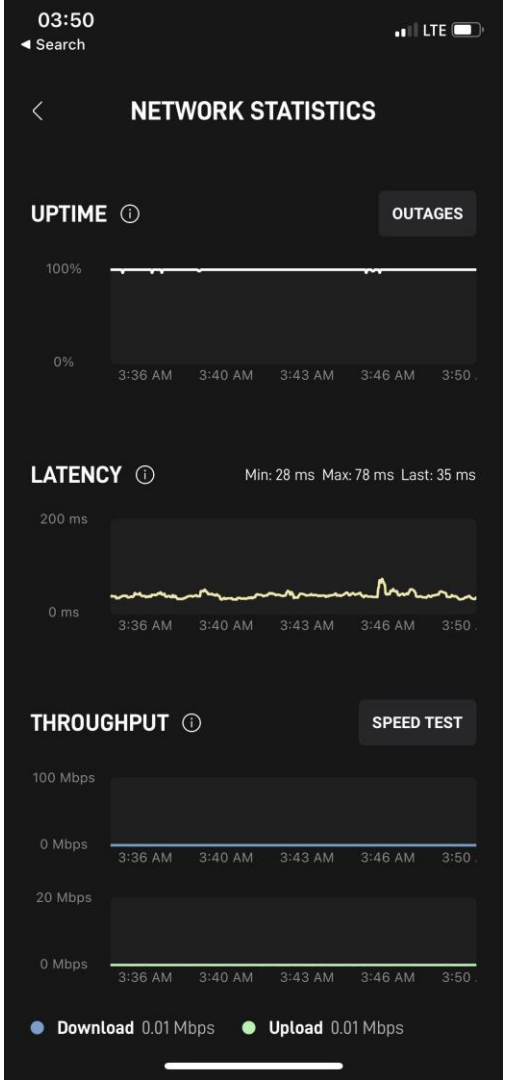
Docker Tools Repository



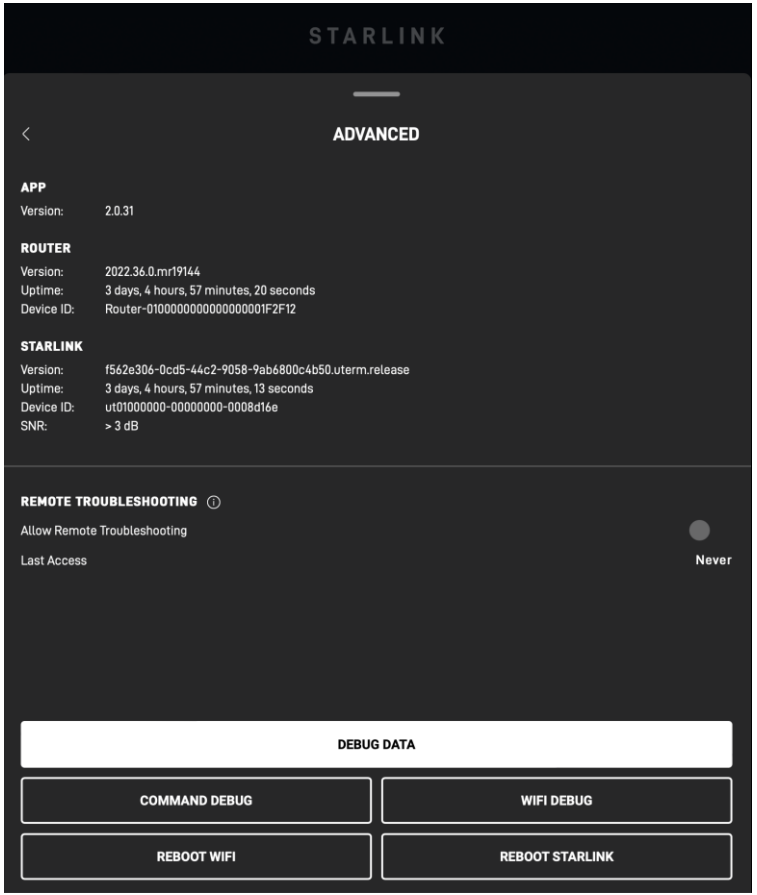
Remote Connections

- Performance Data is stored in the Starlink Cloud
- Allows remote access to data statistics from your local network without being there





http://dishy.starlink.com



Starlink Debug


```
"dish": {
  "reachable": true,
  "service": "dish",
  "cloud": false,
  "features": {
    "stowRequested": true,
    "unstow": true
  },
  "timestamp": 1666895243,
  "deviceInfo": {
    "id": "ut01000000-00000000-0008d16e",
```

```
"auth": {
    "accessToken": "<len=848>",
    "refreshToken": "<len=66>",
    "accessTokenExpirationDate": "2022-10-27T18:39:21Z",
    "idToken": "<len=723>",
    "tokenType": "Bearer"
```

```
    "isDev": false,
    "bootcount": 129,
    "antiRollbackVersion": 0,
    "isHitl": false
  },
```

```
    "installPending": false,
    "isHeating": false,
    "powerSupplyThermalThrottle": false
  },
  "gpsStats": {
```

```
"gpsStats": {
  "gpsValid": true,
  "gpsSats": 16,
```

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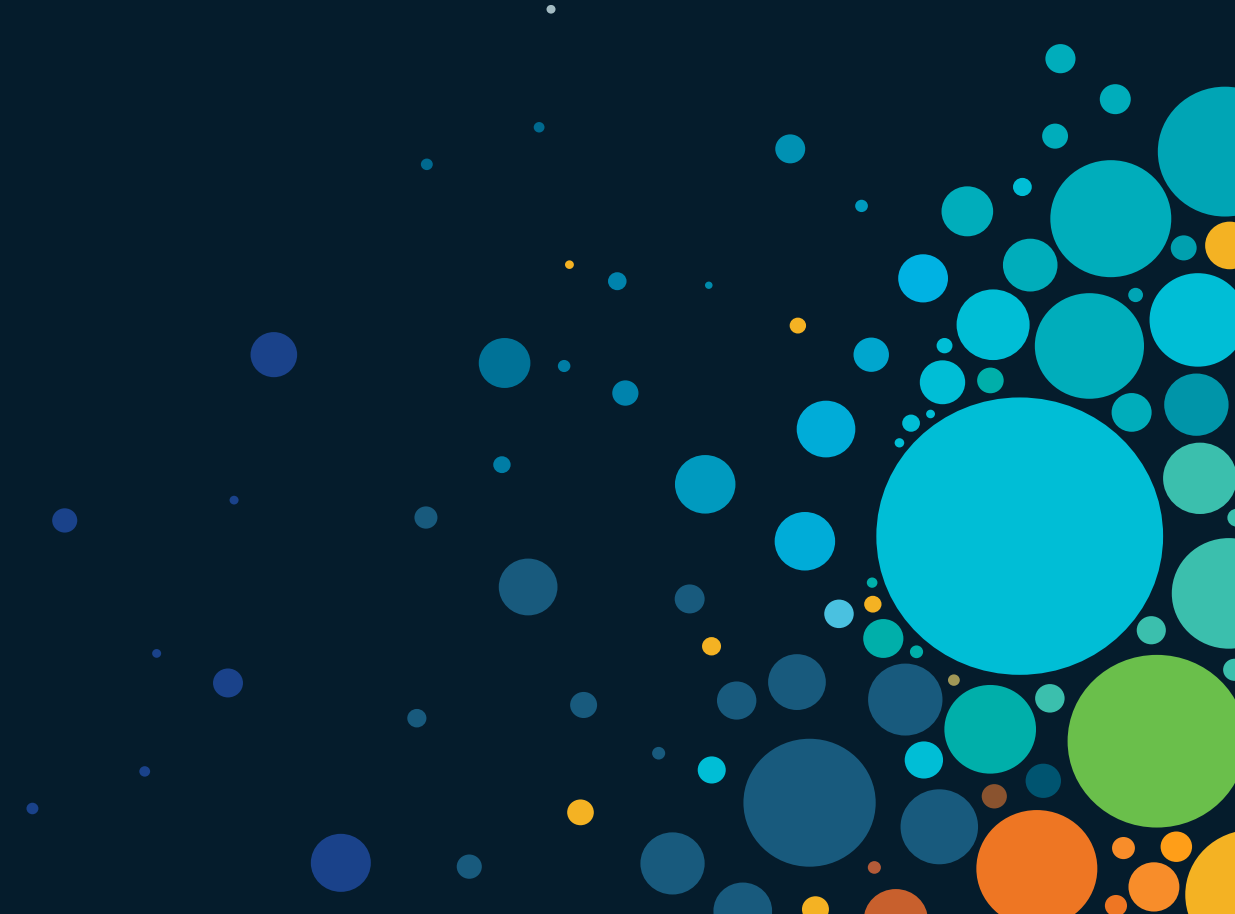
Questions

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