Using GPS Spoofing to Control Time

Dave/Karit (@nzkarit) – ZX Security

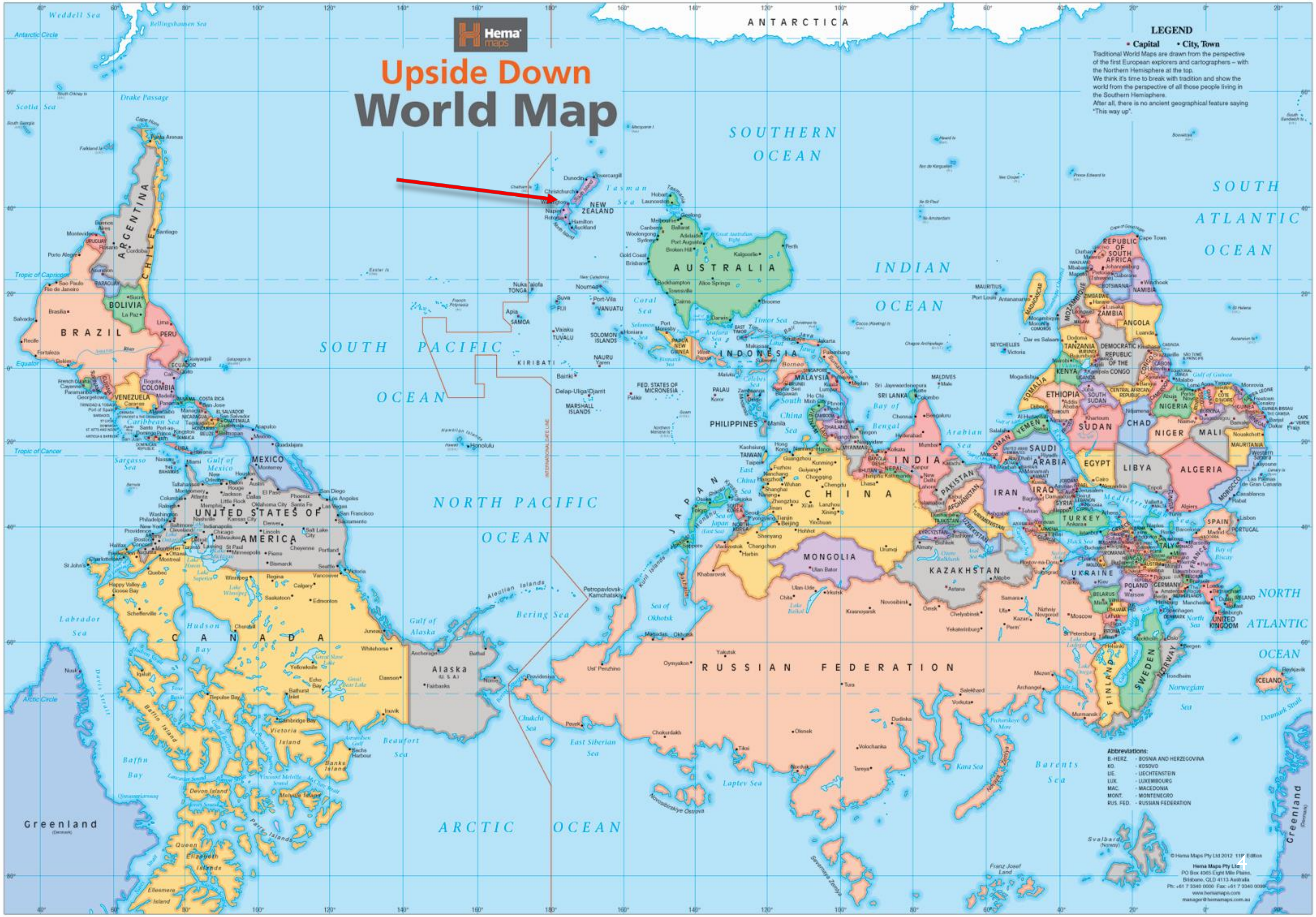
Defcon 2017

Draft

- Draft for Defcon Media server
- A final copy will be posted on https://zxsecurity.co.nz/events.html after the talk is given

whoami

- Dave, Karit, @nzkarit
- Security Consultant/Pen Tester at ZX Security in Wellington, NZ
- Enjoy radio stuff
- Pick Locks and other physical stuff at Locksport



LEGEND

▪ Capital • City, Town

Traditional World Maps are drawn from the perspective of the first European explorers and cartographers – with the Northern Hemisphere at the top.

We think it's time to break with tradition and show the world from the perspective of all those people living in the Southern Hemisphere.

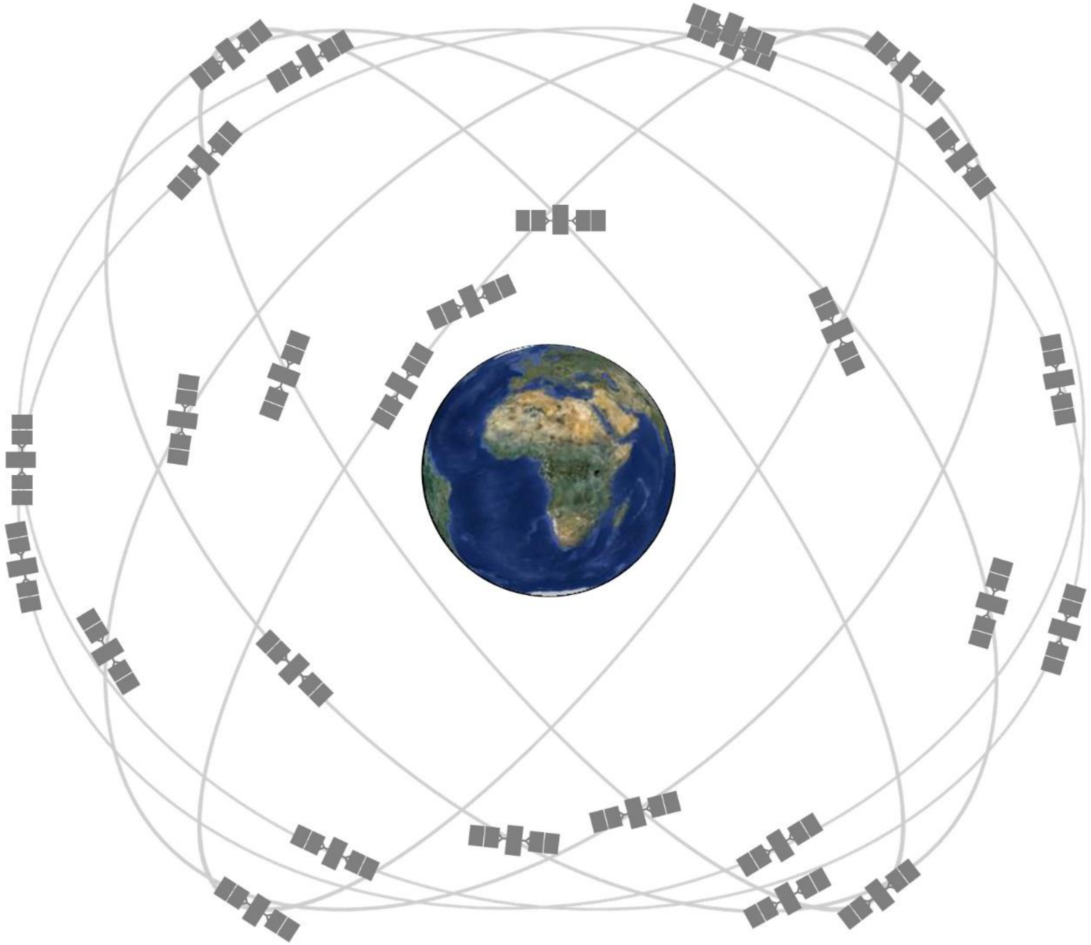
After all, there is no ancient geographical feature saying "This way up".

Today

- GPS (Global Positioning System)
- GPS Spoofing on the cheap
- Let’s change the time!
  - So what?
- Serial Data
  - Pulse Per Second (PPS)
- How we can detect spoofing

GPS

- Tells us where we are
- Tells us the time



We Trust GPS Right? Right?????

- Anyone in the room not currently trust GPS locations?
- Anyone in the room not currently trust GPS time?
- Anyone feel that this will change by the end of the talk?

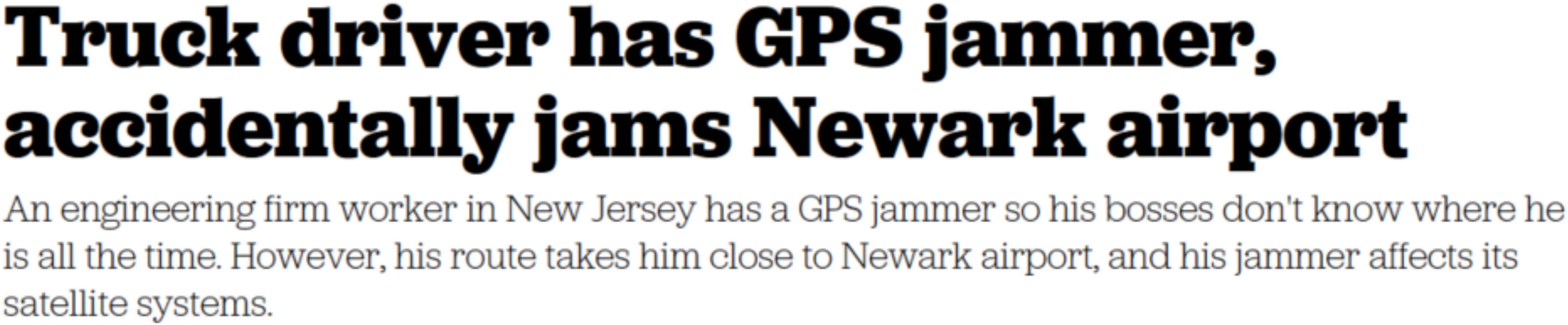
You have to trust it right?

- GPS too important to life?
- GPS must be great and robust? Right?
- Important services rely on it:
  - Uber
  - Tinder

And some other things as well

- NTP Time Source
- Plane Location
- Ship Location
- Tracking Armoured Vans
- Taxi law in NZ no longer knowledge requirement

So why don’t I trust it?



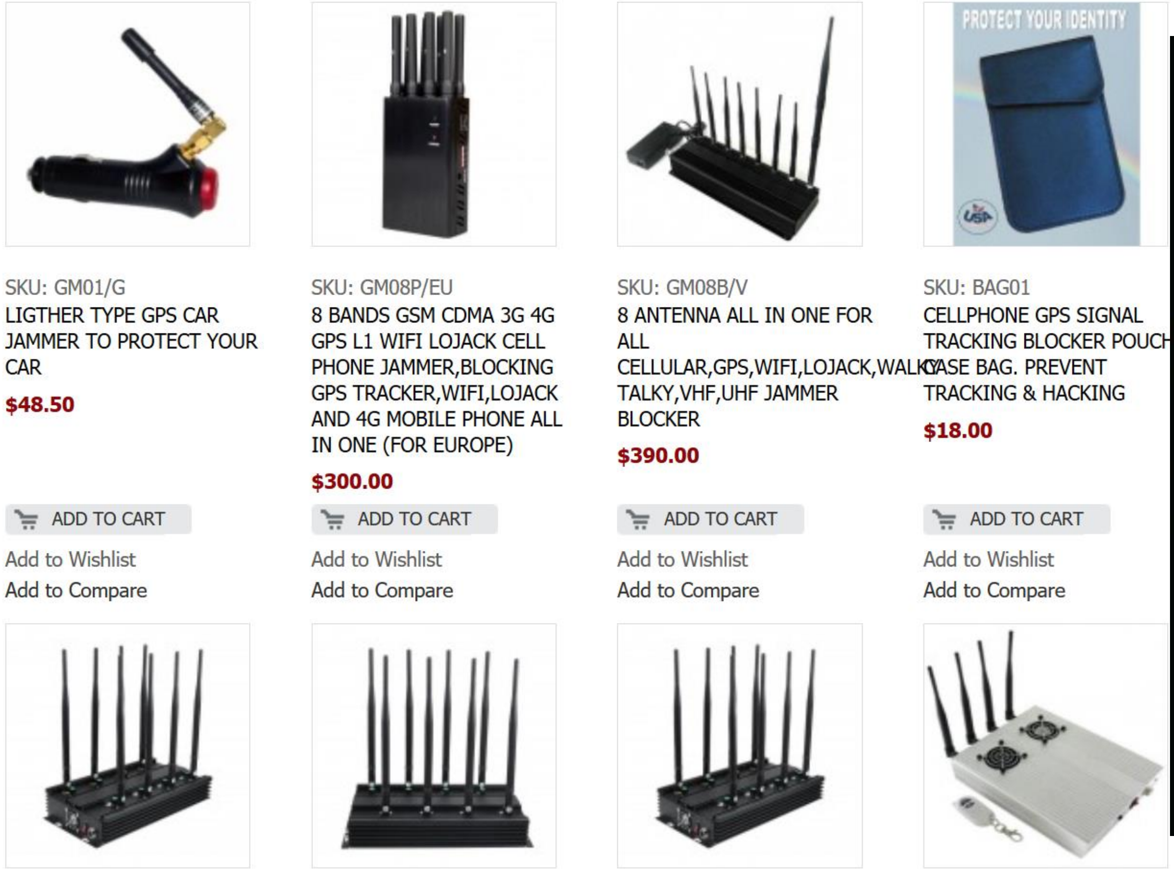
Truck driver has GPS jammer, accidentally jams Newark airport

An engineering firm worker in New Jersey has a GPS jammer so his bosses don't know where he is all the time. However, his route takes him close to Newark airport, and his jammer affects its satellite systems.

Black Cabs in London

- Have GPS jammers to mess with Uber

Jammers Boring………

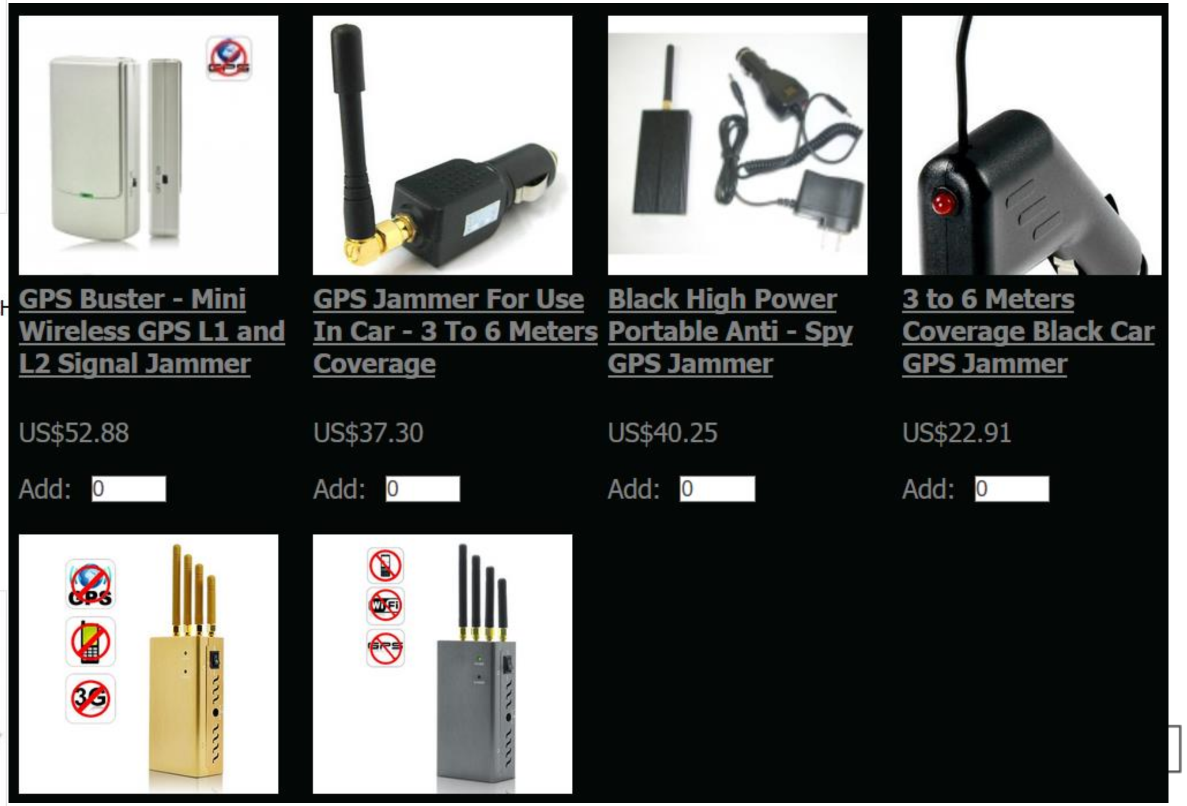


SKU: GM01/G
LIGTHER TYPE GPS CAR JAMMER TO PROTECT YOUR CAR
$48.50
ADD TO CART
Add to Wishlist
Add to Compare

SKU: GM08P/EU
8 BANDS GSM CDMA 3G 4G GPS L1 WIFI LOJACK CELL PHONE JAMMER,BLOCKING GPS TRACKER,WIFI,LOJACK AND 4G MOBILE PHONE ALL IN ONE (FOR EUROPE)
$300.00
ADD TO CART
Add to Wishlist
Add to Compare

SKU: GM08B/V
8 ANTENNA ALL IN ONE FOR ALL CELLULAR,GPS,WIFI,LOJACK,WALKY TALKY,VHF,UHF JAMMER BLOCKER
$390.00
ADD TO CART
Add to Wishlist
Add to Compare

SKU: BAG01
CELLPHONE GPS SIGNAL TRACKING BLOCKER POUCH CASE BAG. PREVENT TRACKING & HACKING
$18.00
ADD TO CART
Add to Wishlist
Add to Compare



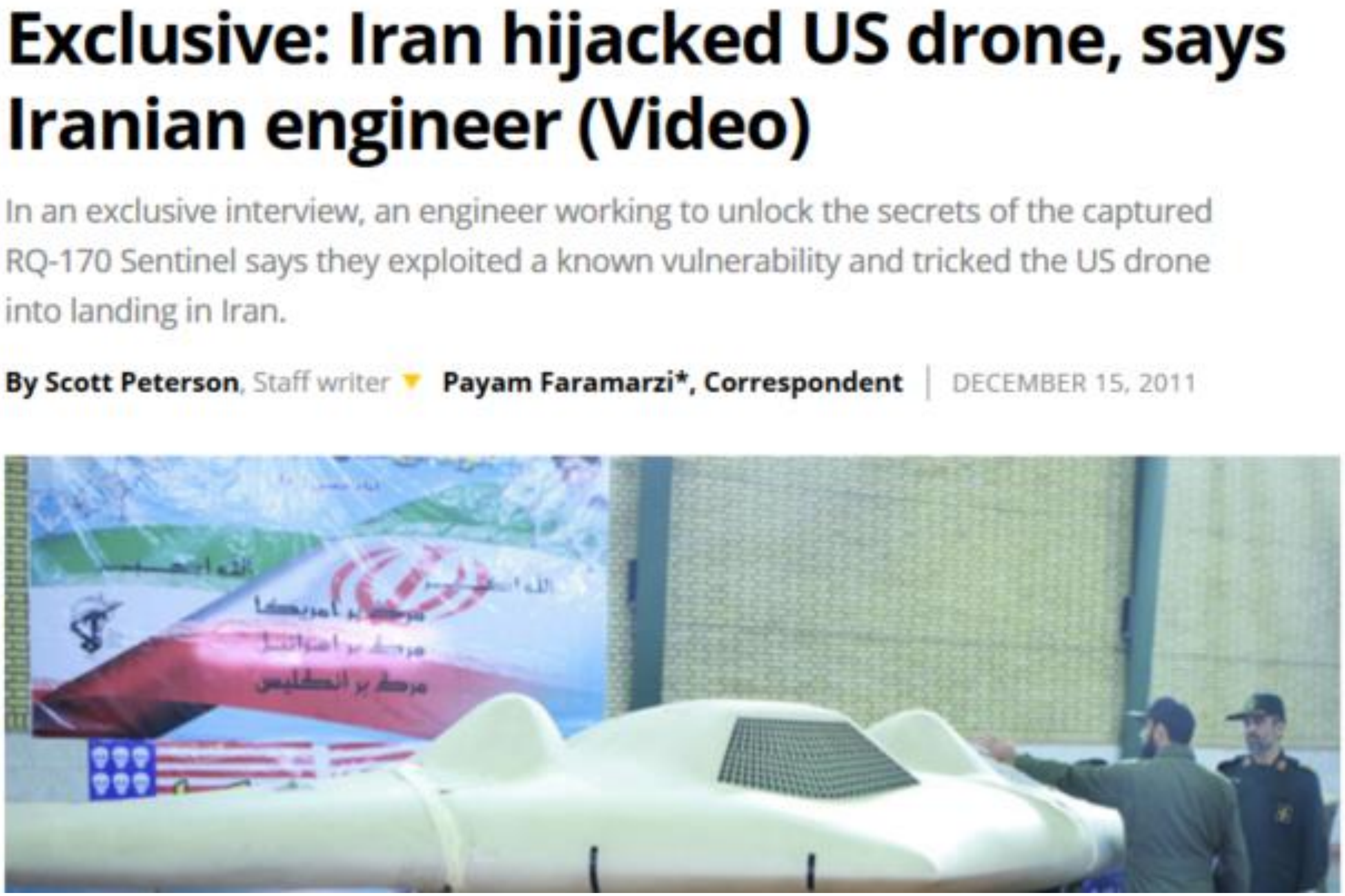
GPS Buster - Mini Wireless GPS L1 and L2 Signal Jammer
US$52.88
Add: 0

GPS Jammer For Use In Car - 3 To 6 Meters Coverage
US$37.30
Add: 0

Black High Power Portable Anti - Spy GPS Jammer
US$40.25
Add: 0

3 to 6 Meters Coverage Black Car GPS Jammer
US$22.91
Add: 0

Nation State

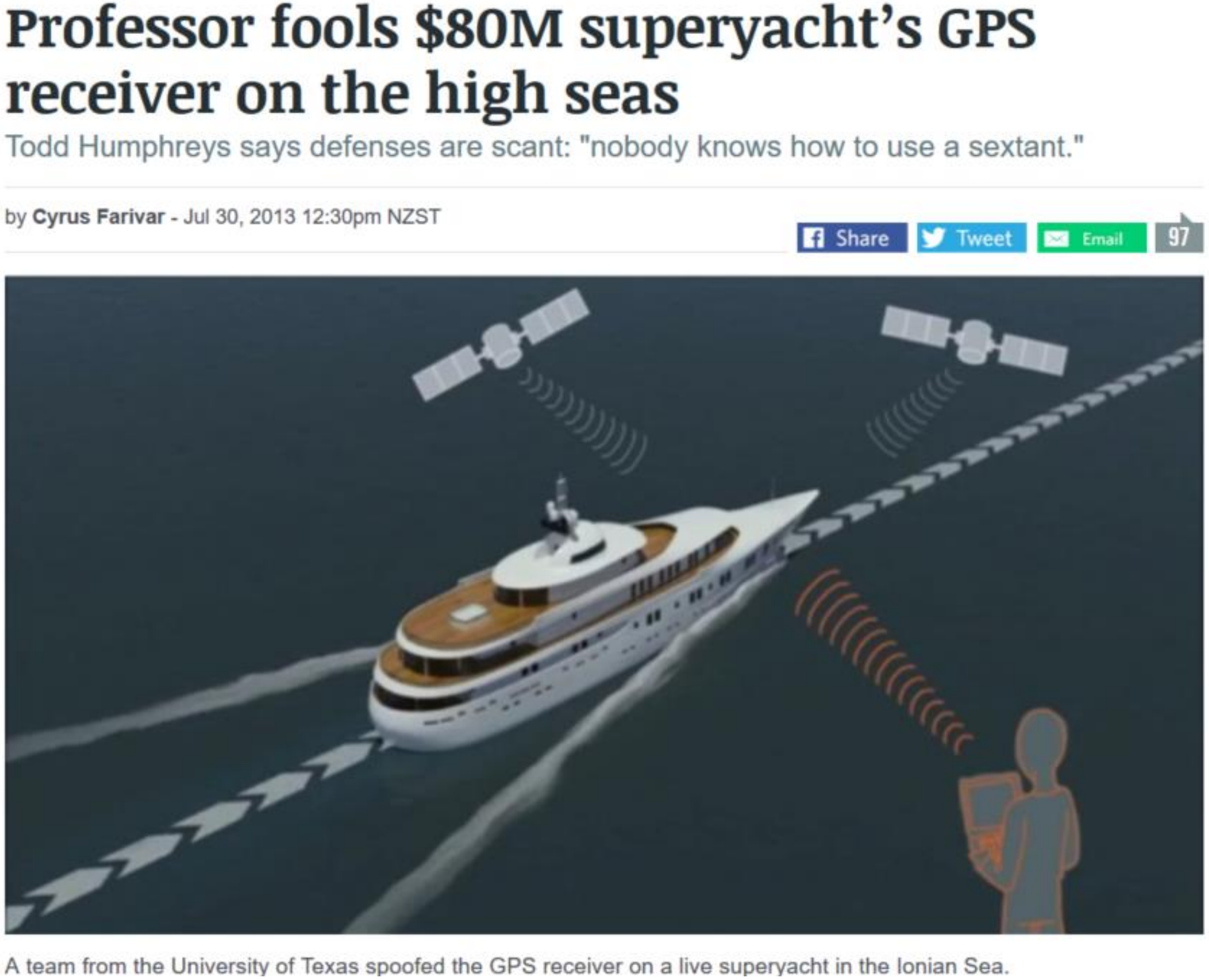


Exclusive: Iran hijacked US drone, says Iranian engineer (Video)

In an exclusive interview, an engineer working to unlock the secrets of the captured RQ-170 Sentinel says they exploited a known vulnerability and tricked the US drone into landing in Iran.

By Scott Peterson, Staff writer ▼ **Payam Faramarzi*, Correspondent** | DECEMBER 15, 2011

A University



Professor fools $80M superyacht's GPS receiver on the high seas

Todd Humphreys says defenses are scant: "nobody knows how to use a sextant."

by **Cyrus Farivar** - Jul 30, 2013 12:30pm NZST

A team from the University of Texas spoofed the GPS receiver on a live superyacht in the Ionian Sea.

The Chinese are in the NTPs

Time is on my side

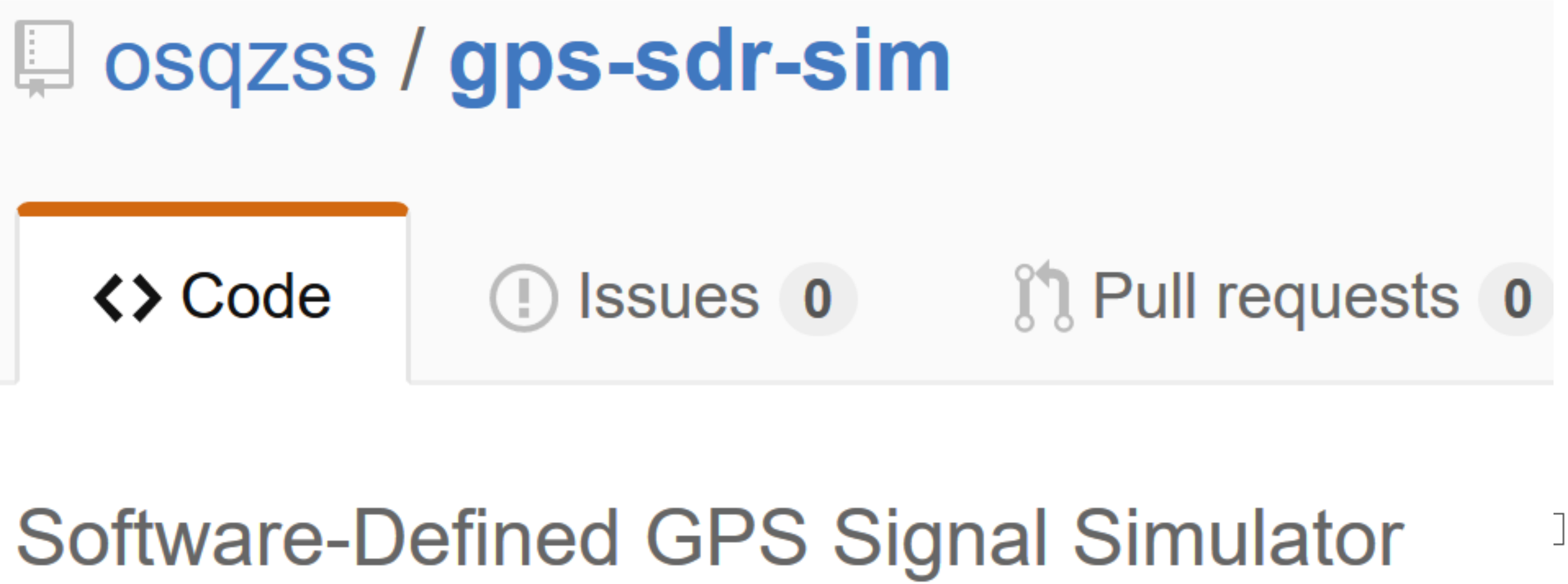
Forging Wireless Timing Signals to Attack the NTP Server

Yuwei Zheng @HITB
Haoqi Shan @HITB
From: Qihoo360 Unicorn Team

Time is on my side

HITB
360UNICORNTEAM

Now we are talking

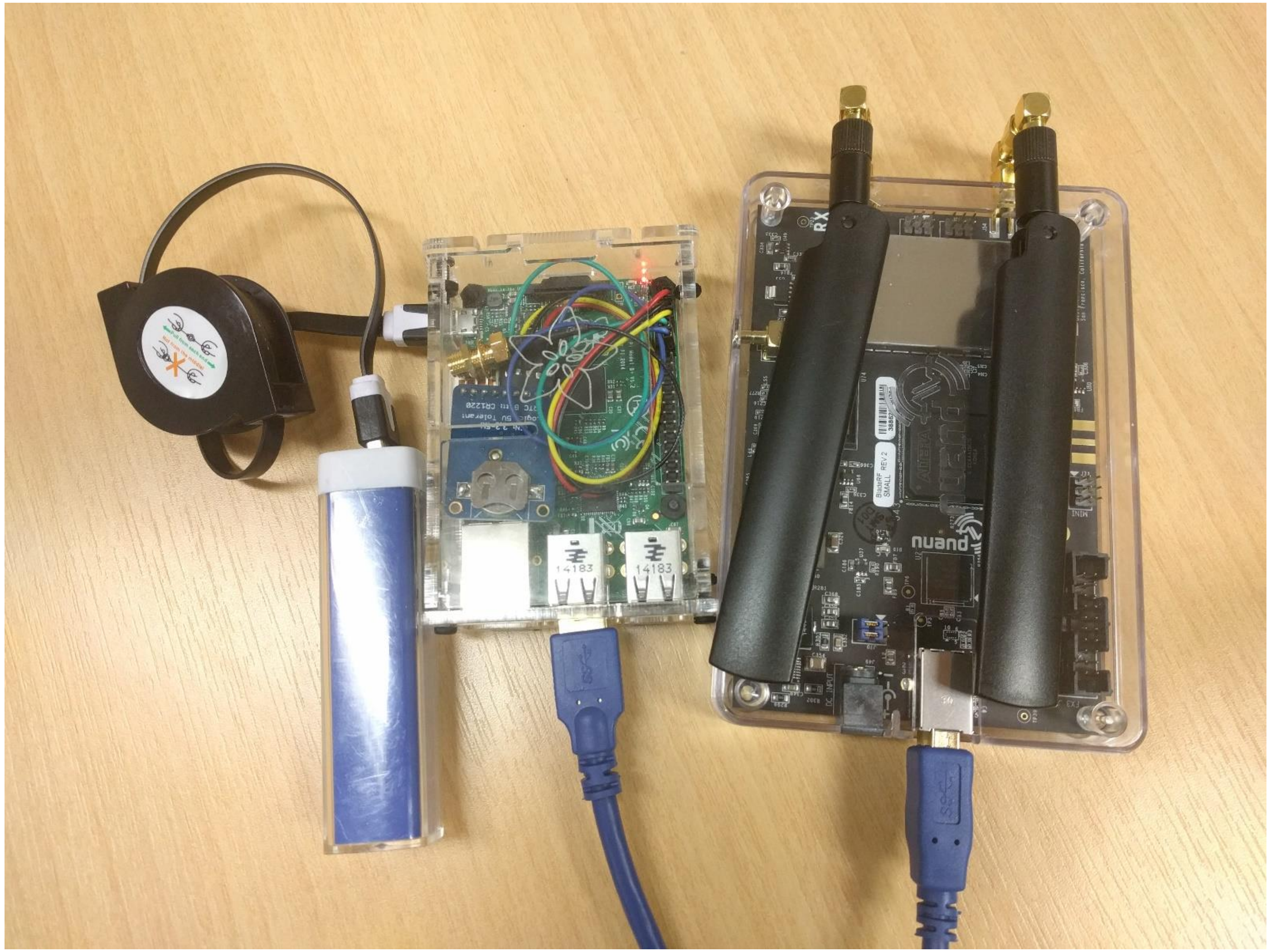

osqzss / gps-sdr-sim

Software-Defined GPS Signal Simulator

What we need

- A box
- An SDR with TX
  - I used a BladeRF
  - HackRF
  - USRP
- So less US$500 in hardware
- Also some aluminium foil to make a Faraday Cage
- So it is now party trick simple and cheap
  - This is the big game changer from the past

Setup



@amm0nra patented Faraday Cage

- Make sure you measure signal outside to ensure none is leaking
- Be careful

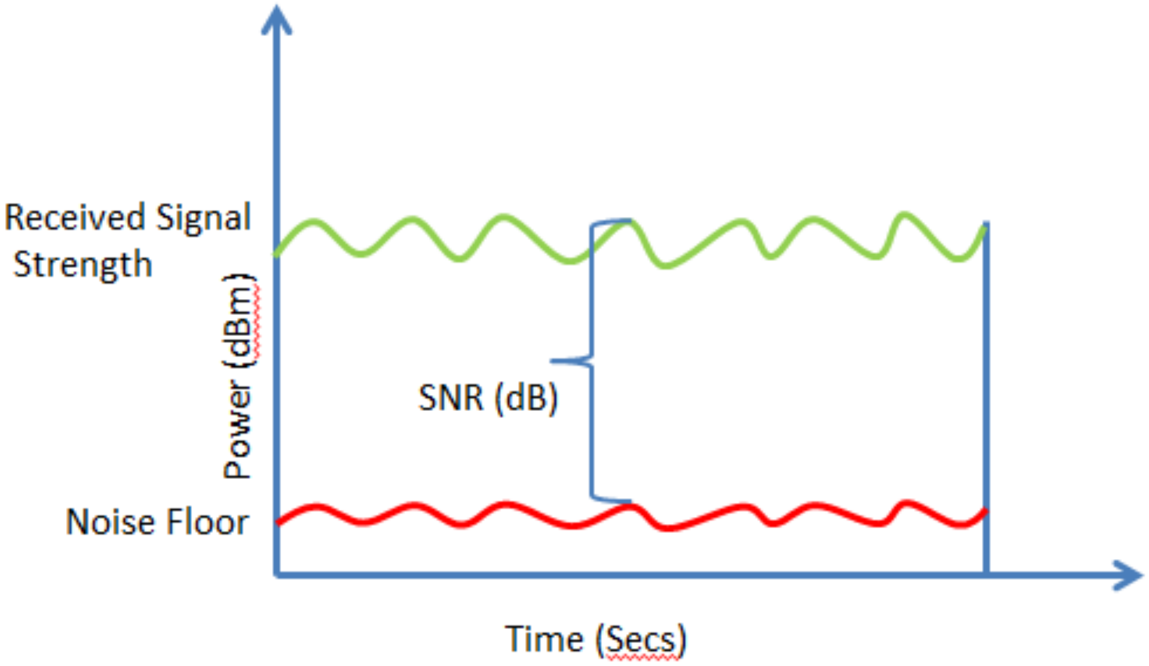
The Law

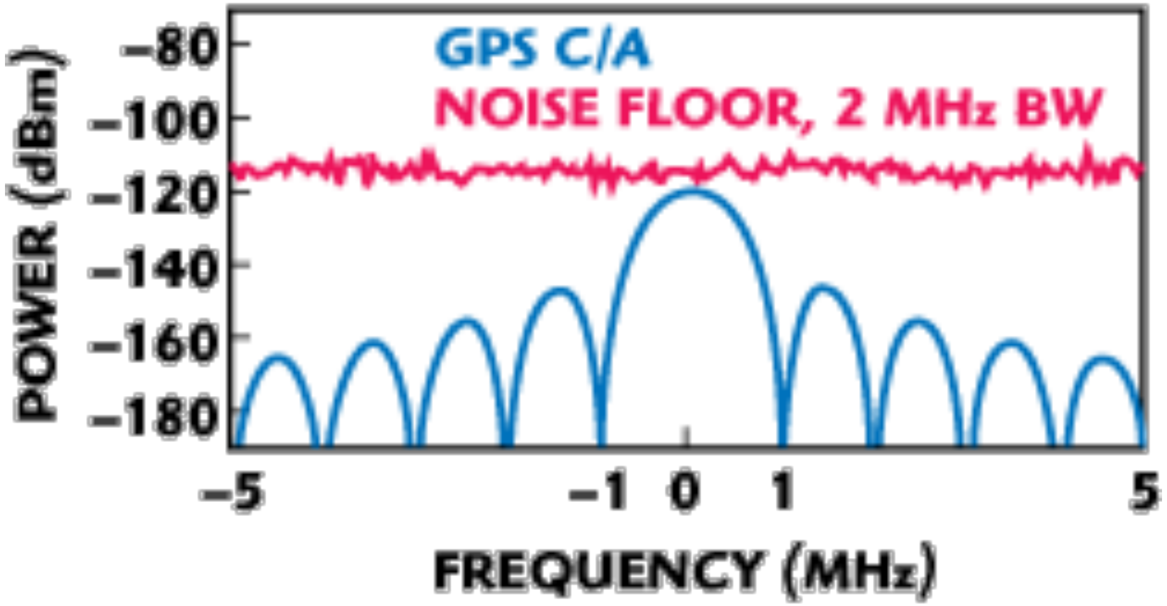
- INAL (I’m not a lawyer)
- GPS isn’t Open Spectrum
- So Faraday Cage
  - Keep all the juicy GPS goodness to yourself

Remember

- Your SDR kit is going to be closer to the device
  - So much stronger signal
  - Got to have line of sight though
- GPS Orbits ~20,000 km
  - So signals weak
  - Signal is weaker than the noise floor

Noise Floor

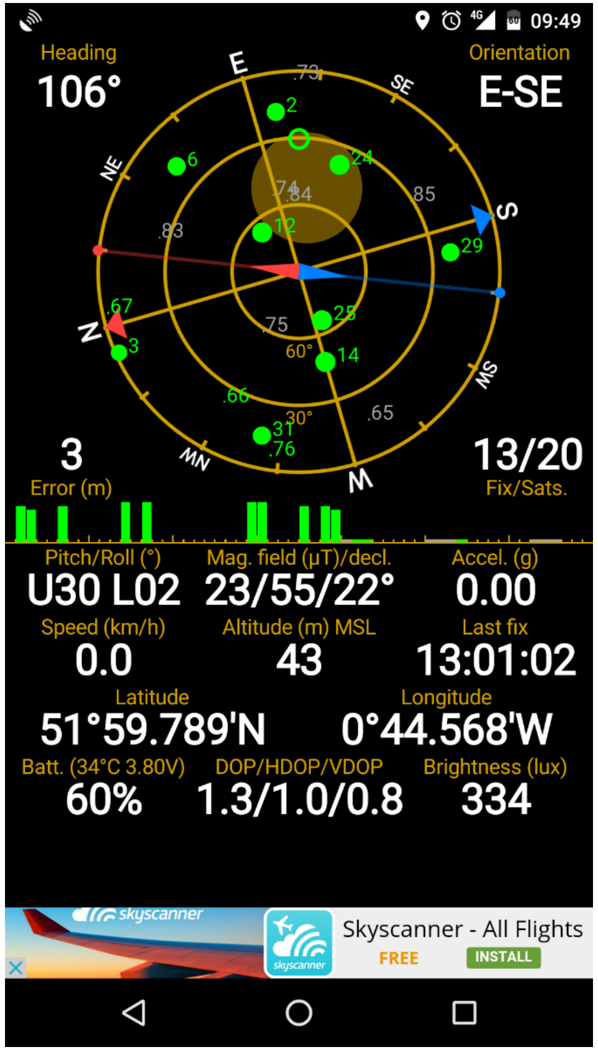

Received Signal Strength
Power (dBm)
SNR (dB)
Noise Floor
Time (Secs)


GPS C/A
NOISE FLOOR, 2 MHz BW
POWER (dBm)
–80
–100
–120
–140
–160
–180
–5
–1
0
1
5
FREQUENCY (MHz)

Right so what can we do?

- Got some simulator software and a bladeRF what could people get up to?

A trip to Bletchley Park?



09:49

Heading
106°

Orientation
E-SE

3
Error (m)

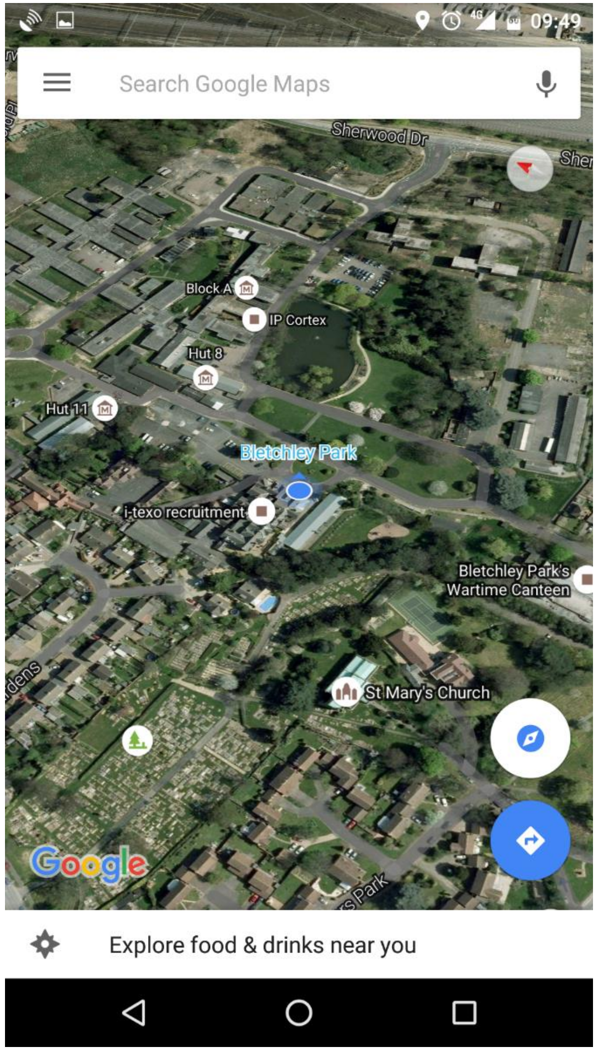
13/20
Fix/Sats.

Pitch/Roll (°)	Mag. field (μT)/decl.	Accel. (g)
U30 L02	23/55/22°	0.00

Speed (km/h)	Altitude (m) MSL	Last fix
0.0	43	13:01:02

Latitude	Longitude
51°59.789'N	0°44.568'W

Batt. (34°C 3.80V)	DOP/HDOP/VDOP	Brightness (lux)
60%	1.3/1.0/0.8	334



How does the tool work?

- Two methods, first one two steps
- 1. Generate the data for broadcast
  - About 1GB per minute
  - Static location or a series of locations to make a path
  - Has an Almanac file which has satellite locations
  - Uses Almanac to select what satellites are required for that location at that time
- 2. Broadcast the data

How does the tool work?

- Generate in real time
- Need a fast enough computer
- 1. Generate and broadcast
- In author’s words this is an experimental feature

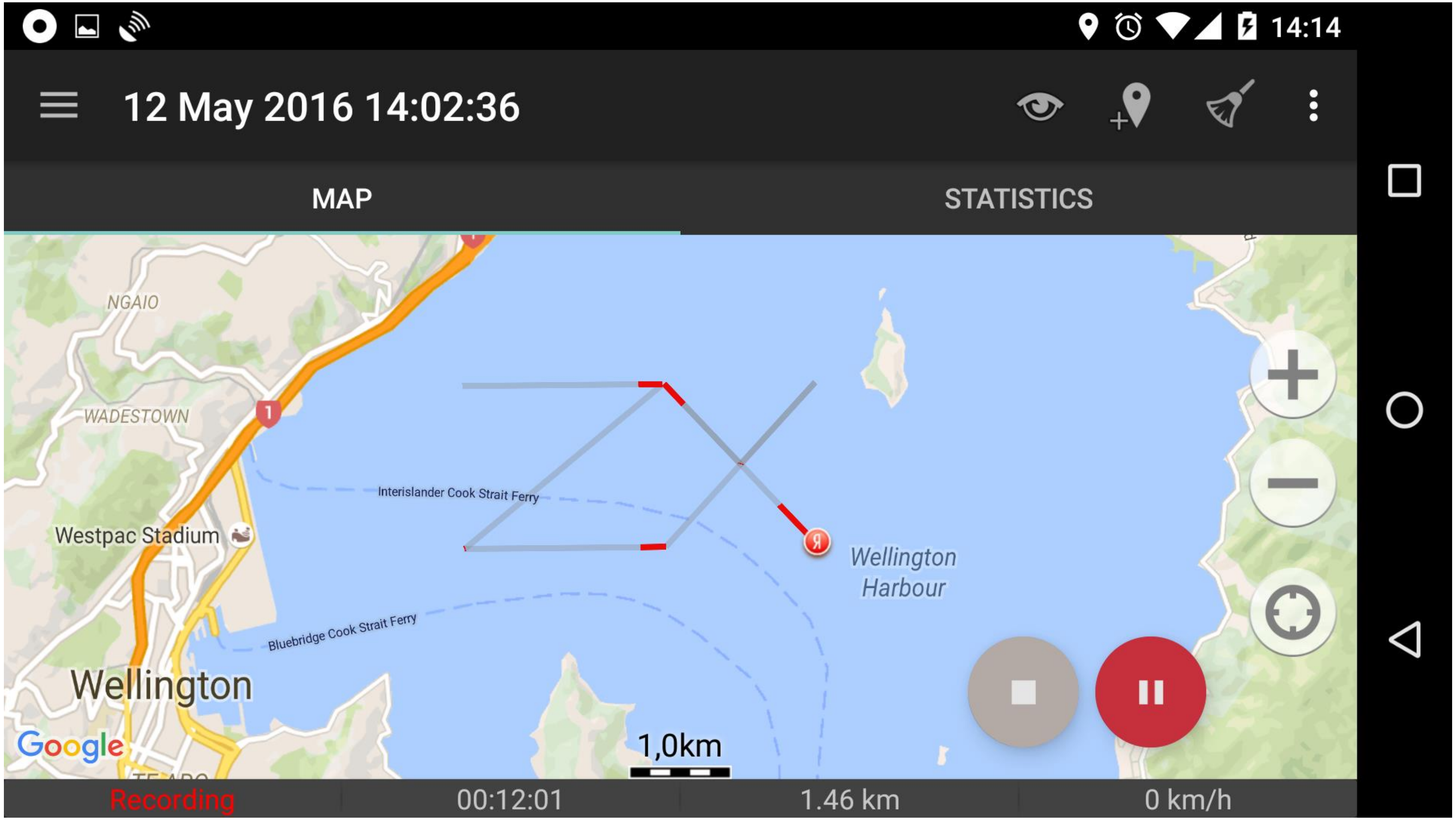
Limitations of tool

- By default only 5 mins of transmit data
  - Need to change a value in code for longer
  - Approx. 1GB a minute hence the limit
- Pi3 about three times slower than real time, so must be precomputed
  - Pi3 there is a file size limit
    - <4GB from my experience, so 4-5 minutes of broadcast per file
    - Can just chain a series of pre computed files together

Generate a Path

- To do the path give the generator a series of locations at 10Hz
- Can’t just give a series of lat/long in a csv ☹
  - ECEF Vectors or
  - NMEA Data rows
  - There are convertors online ☺

A Path



14:14

12 May 2016 14:02:36

Recording | 00:12:01 | 1.46 km | 0 km/h

So what can we do?

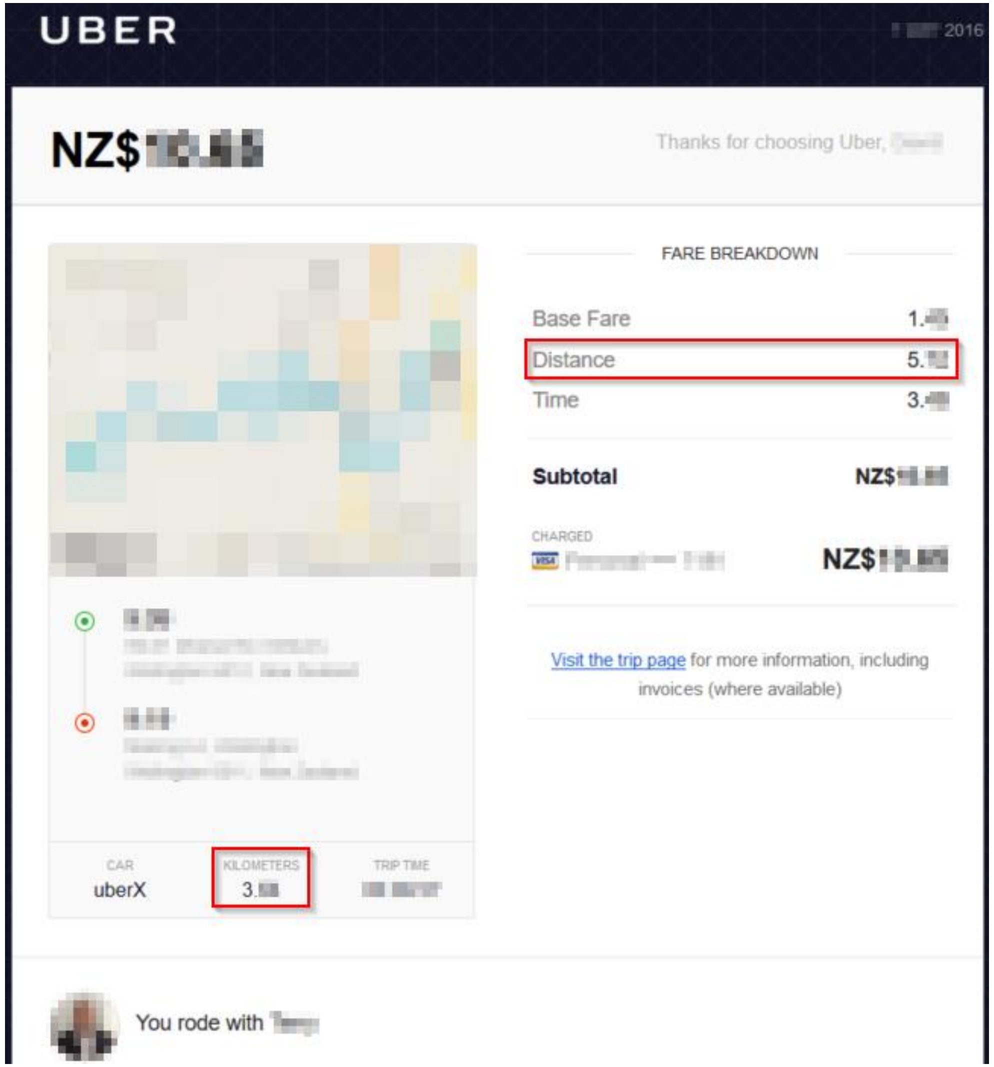
- with GPS spoofing

$$$

- Keep an armoured van on track as you take it to your secret underground lair
  - Have a track following its normal route while drive it somewhere else

ACM
CURRENCY MANAGEMENT
THIS VEHICLE PROTECTED BY GPS SATELLITE & CAMERA SURVEILLANCE
THIS VEHICLE PROTECTED BY GPS SATELLITE & CAMERA SURVEILLANCE

Uber trip with no distance?



UBER

[redacted] 2016

NZ$[redacted]

Thanks for choosing Uber, [redacted]

FARE BREAKDOWN

Base Fare	1.[redacted]
Distance	5.[redacted]
Time	3.[redacted]
Subtotal	**NZ$**[redacted]
CHARGED [redacted]	**NZ$**[redacted]

Visit the trip page for more information, including invoices (where available)

[redacted]

[redacted]

CAR	KILOMETERS	TRIP TIME
uberX	3.[redacted]	[redacted]

You rode with [redacted]

Queenstown Airport Approach

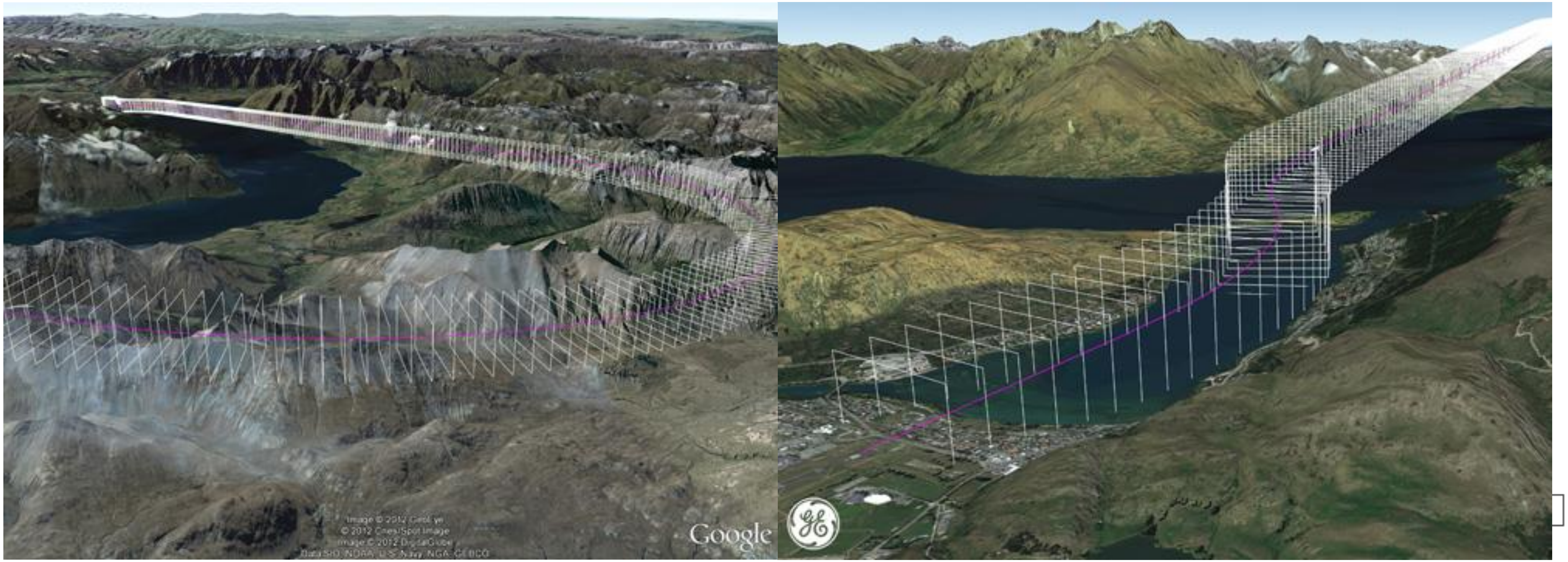


Image © 2012 GeoEye
© 2012 Cnes/Spot Image
Image © 2012 DigitalGlobe
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Google

Planes

- For places like Queenstown planes have Required Navigation Performance Authorisation Required (RNP AR)
  - When not visual conditions
- As approach is through valleys
  - Can’t use ground based instrument landing systems
- If go off course going to hit the ground

Can we use this to change time?

- NTPd will take GPS over serial out of the box
- The NTP boxes also use NTPd behind the UI
  - NTPd uses it own license, so easy to spot in manuals etc

NTP

- If you move time too much >5min NTPd shutdown
- No log messages as to why
- When starting NTP you get "Time has been changed"
  - And NTP will accept the GPS even if it differs greatly from the local clock

If we turn the logging up

- With debugging enabled
  - Feb 24 02:36:21 ntpgps ntpd[2009]: 0.0.0.0 0417 07 panic_stop +2006 s; set clock manually within 1000 s.
  - Feb 24 02:36:21 ntpgps ntpd[2009]: 0.0.0.0 041d 0d kern kernel time sync disabled

Would a Sys Admin notice?

- If NTPd crashes but starts via watchdog or a manual restart
    - Will people look deeper?
    - Will people check the time is correct?

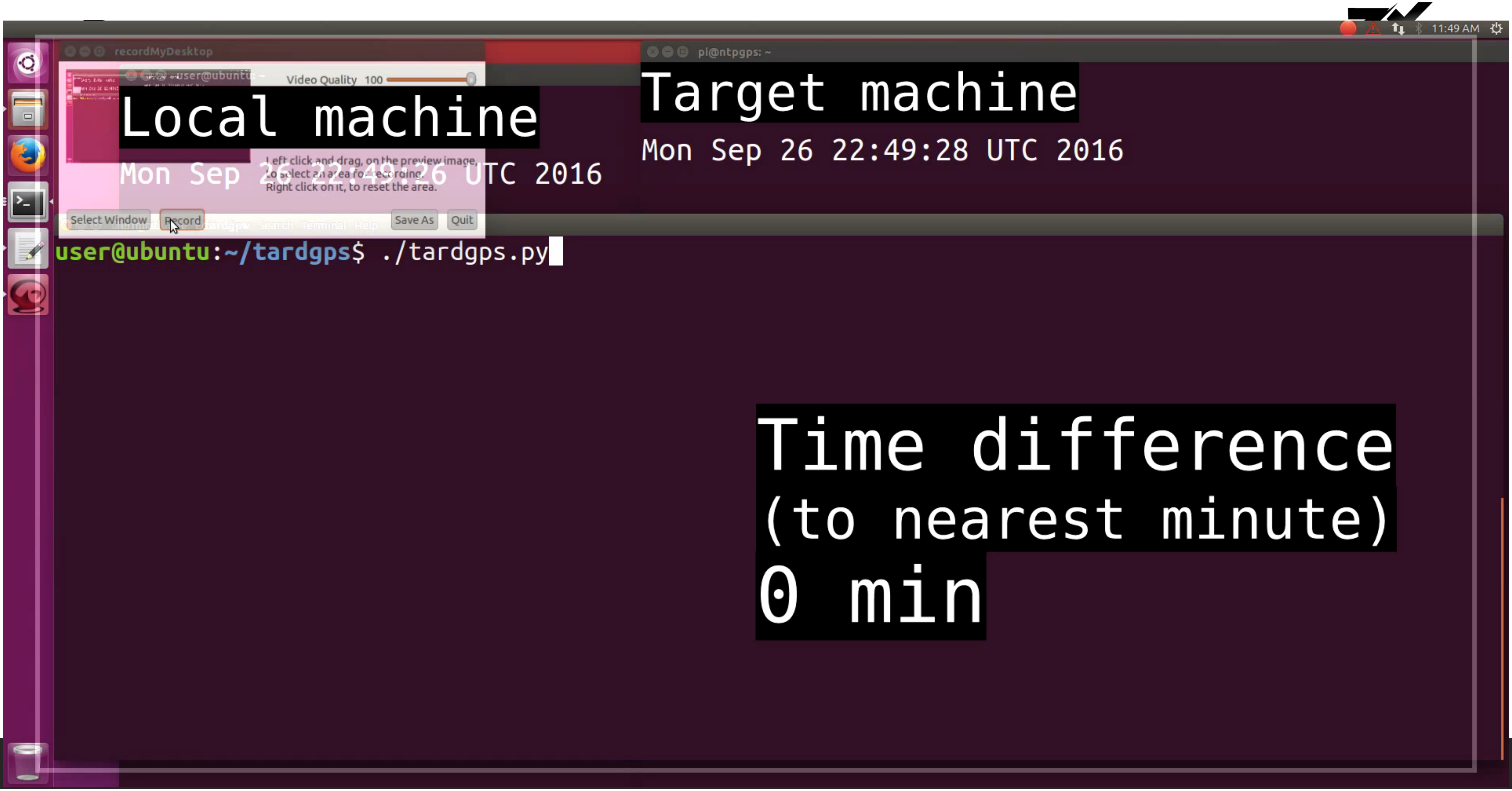
So how can we move time?

- We can’t do big jumps in time
- We will have to change time in steps

Introducing TardGPS

- Python Script
- Wraps the real time version of the GPS Simulator
- Moves time back in steps
  - So as not to crash NTPd

- Talked in more detail at Kiwicon 2016
- Slides:
  - https://zxsecurity.co.nz/presentations/201611_Kiwicon-ZXSecurity_GPSSpoofing_LetsDoTheTimewarpAgain.pdf
- Code:
  - https://github.com/zxsecurity/tardgps


recordMyDesktop
Video Quality 100
Left click and drag, on the preview image, to select an area for recording. Right click on it, to reset the area.
Select Window
Record
Save As
Quit
pi@ntpgps: ~
11:49 AM

Local machine

Mon Sep 26 22:49:26 UTC 2016

Target machine

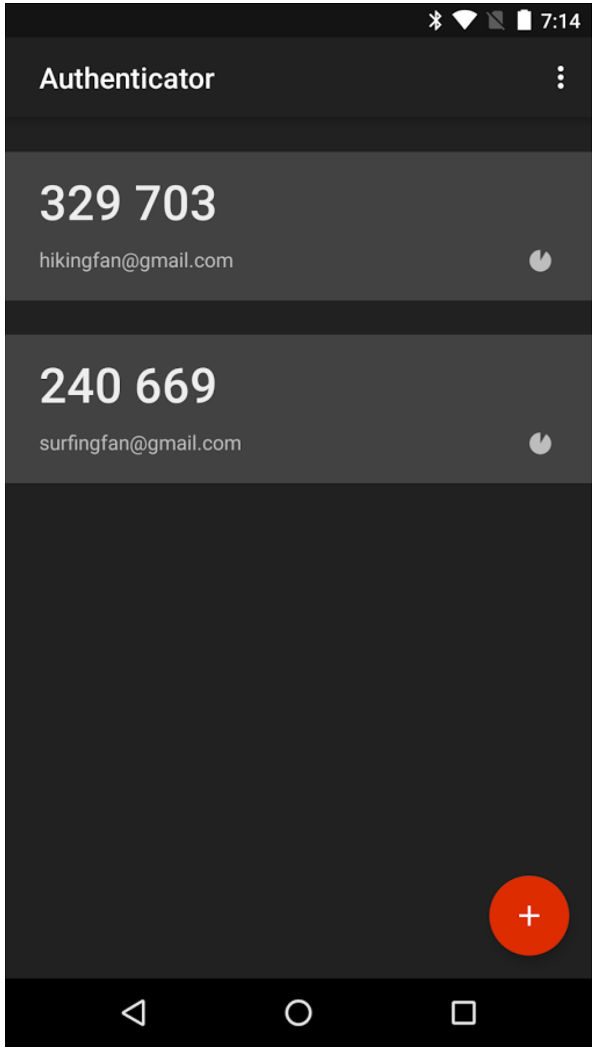
Mon Sep 26 22:49:28 UTC 2016

```
user@ubuntu:~/tardgps$ ./tardgps.py
```

Time difference
(to nearest minute)
0 min

Timebased One Time Password

- TOTP
- E.g. Google Auth
- A new token every 30 seconds



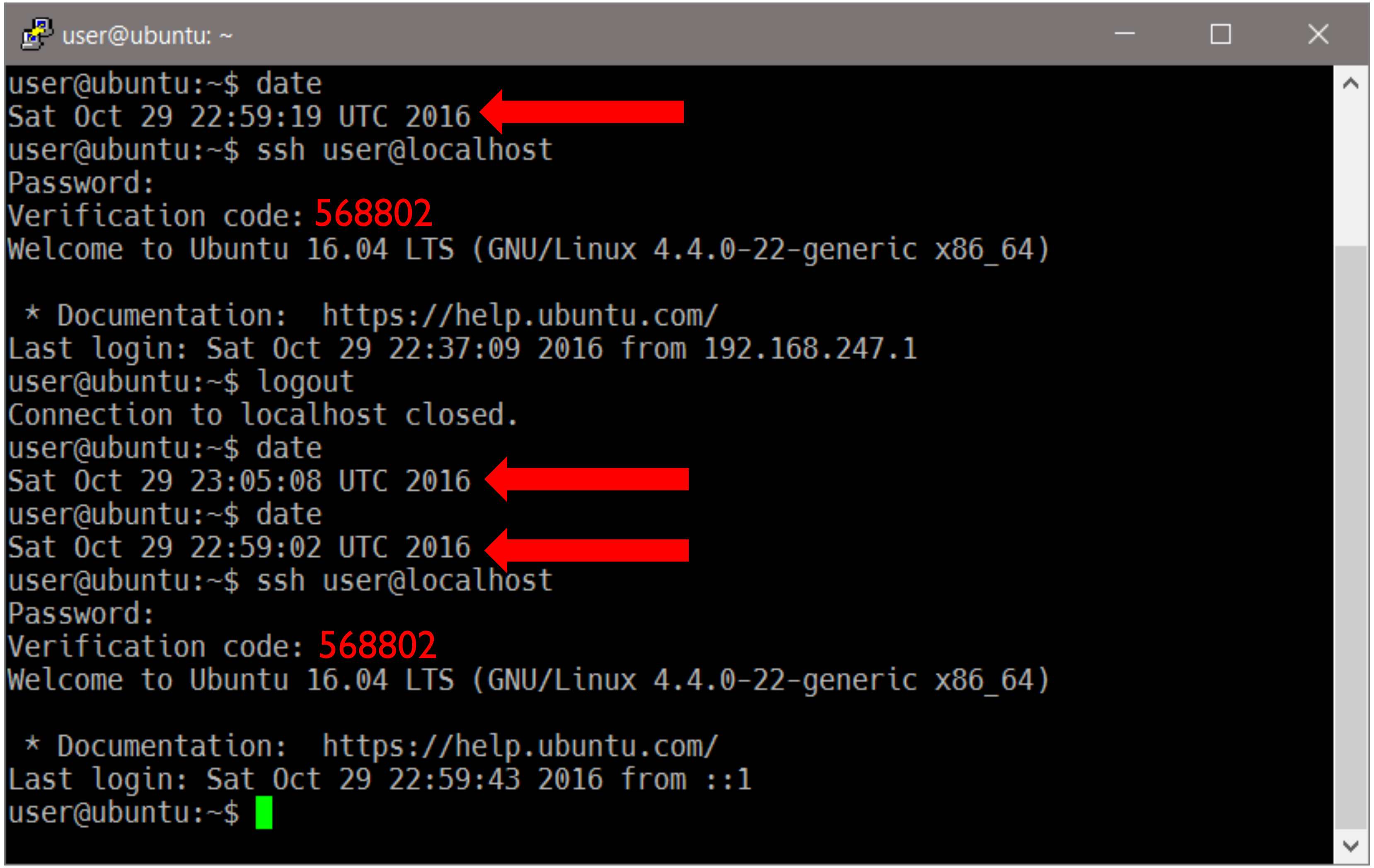
7:14

Authenticator

329 703
hikingfan@gmail.com

240 669
surfingfan@gmail.com

TOTP



```
user@ubuntu:~$ date
Sat Oct 29 22:59:19 UTC 2016
user@ubuntu:~$ ssh user@localhost
Password:
Verification code: 568802
Welcome to Ubuntu 16.04 LTS (GNU/Linux 4.4.0-22-generic x86_64)

 * Documentation:  https://help.ubuntu.com/
Last login: Sat Oct 29 22:37:09 2016 from 192.168.247.1
user@ubuntu:~$ logout
Connection to localhost closed.
user@ubuntu:~$ date
Sat Oct 29 23:05:08 UTC 2016
user@ubuntu:~$ date
Sat Oct 29 22:59:02 UTC 2016
user@ubuntu:~$ ssh user@localhost
Password:
Verification code: 568802
Welcome to Ubuntu 16.04 LTS (GNU/Linux 4.4.0-22-generic x86_64)

 * Documentation:  https://help.ubuntu.com/
Last login: Sat Oct 29 22:59:43 2016 from ::1
user@ubuntu:~$
```

Setting up TOTP for SSH

- *Do you want to disallow multiple uses of the same authentication token? This restricts you to one login about every 30s, but it increases your chances to notice or even prevent man-in-the-middle attacks (y/n)*

Other TOTP Implementations

- Had a look around
- There was a big mix of option for TOTP reuse
  - Defaults for both (allow and not allow)
  - Not always text describing what option means
- Some didn’t implement the don’t reuse feature

What to look for in a TOTP

- Make sure there is a setting related to reuse
- Make sure it is set to not allow reuse

Library	Default No Reuse	No Default	Default Reuse
Google Auth libpam		X	
Two Factor Authentication (Wordpress Plugin)	X		
OATHAuth (MediaWiki Plugin)	X		

Also other 2FA solutions

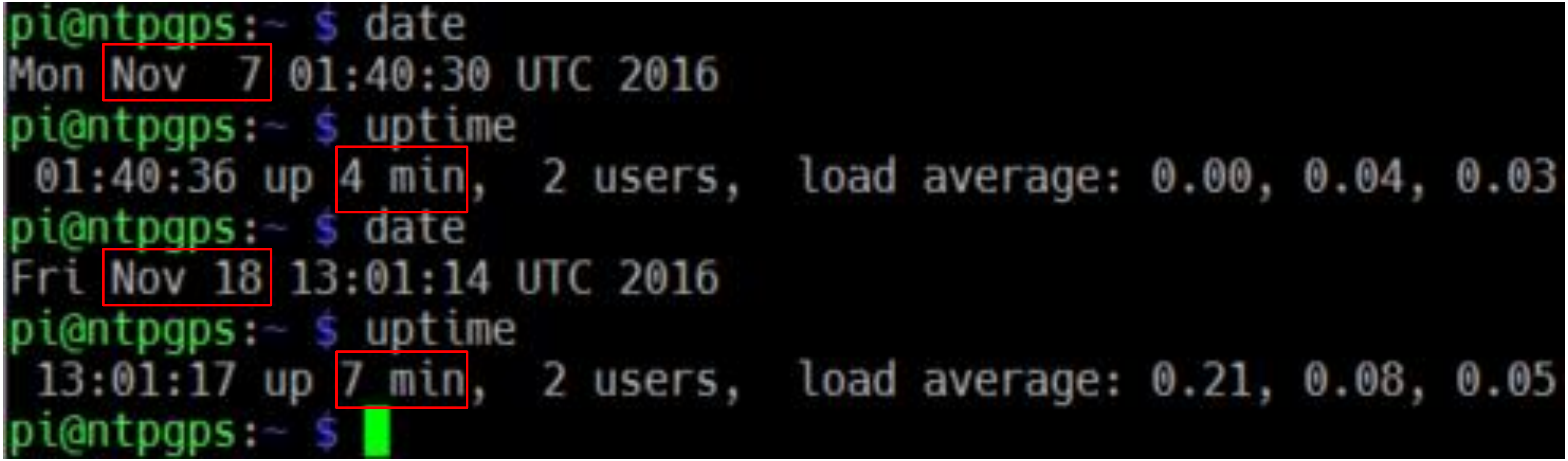
- HOTP - HMAC-based one-time password
  - Also in Google Auth
- U2F
  - One token can be used on many sites
  - One user can subscribe more than one token

- Friends don't let friends SMS
  - NIST is recommending deprecation

SUDO

- SUDO counts time in a different way, using OS Clock Ticks
  - so you can’t roll back time and bypass sudo password check timeout
  - sudoer file *`timestamp_timeout=X`*
- Uptime works in a similar way

Uptime during jump



```
pi@ntpgps:~ $ date
Mon Nov  7 01:40:30 UTC 2016
pi@ntpgps:~ $ uptime
 01:40:36 up 4 min,  2 users,  load average: 0.00, 0.04, 0.03
pi@ntpgps:~ $ date
Fri Nov 18 13:01:14 UTC 2016
pi@ntpgps:~ $ uptime
 13:01:17 up 7 min,  2 users,  load average: 0.21, 0.08, 0.05
pi@ntpgps:~ $
```

Forensics

- Incident Response becomes interesting when your logging starts showing:
  - Nov 18 13:45:43 important-server: Hacker logs out
  - Nov 18 13:46:54 important-server: Hacker performs l33t hack
  - Nov 18 13:47:47 important-server: Hacker logs in
- Through time manipulation or cron running: date set ‘some random time’
- Also if move time forward could make logs roll and purge
  - If no central logging

Physical Access

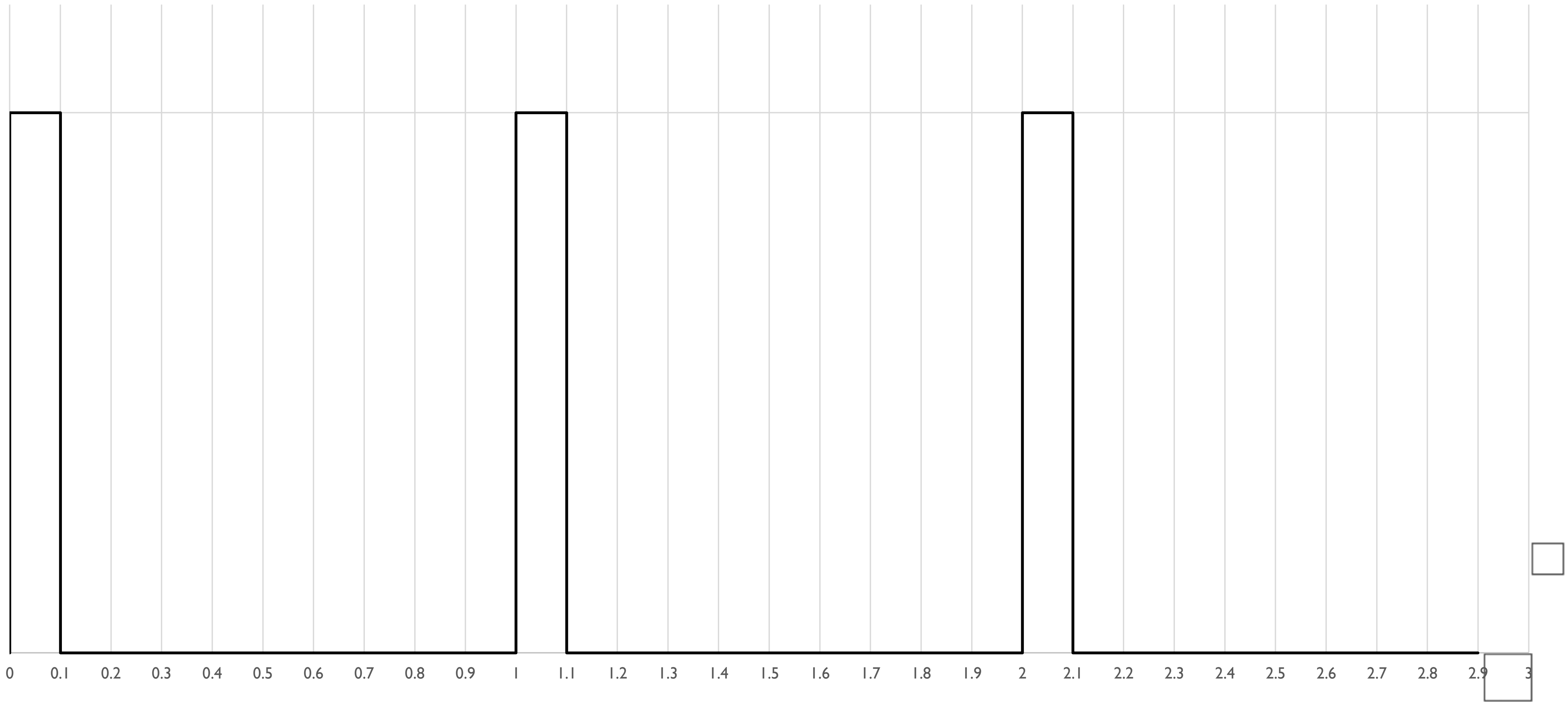
- What can we do if we have access to the data centre roof?
- GPS unit with aerial on roof serial down
- GPS unit in server and radio down wire from roof
  - Attach transmitter to wire with attenuator

- Use server 127.0.20.0
  - ntpd then knows to look at /dev/gps0 and /dev/pps0 for import

Serial

- NMEA Data – Serial Data (/dev/gps0)
  - $GPGGA,062237.000,4117.4155,S,17445.3752,E,1,9,0.97,177.1,M,19.0,M,,*4A
  - $GPRMC,062237.000,A,4117.4155,S,17445.3752,E,0.16,262.97,120217,,,A*7E
  - Hour, Minute, Second, Day, Month, Year
- Pulse Per Second – PPS (/dev/pps0)

Pulse Per Second - PPS



PPS

- Doesn’t contain time value
- It indicates where a second starts
- Less processing on the GPS Receiver so comes through in a more timely manner
  - Rising edge can be in micro or nano second accuracy

NTP Setup

- I had NTPd running on a raspberry pi
- GPS receiver view UART on GPIO pins
- One wire was for PPS

How to spoof PPS

- Link the PPS pin to another GPIO pin
- Set that pin high and low as applicable

So what happens

- If run PPS with a different timing the NEMA data will keep correcting
- So will keep pulling it back
- So within ±1 second
- Maybe an issue in finance, telecoms and energy
  - Where fractions of a second count

Can we just remove the NMEA data?

- If pull serial NTPd Tx wire
- Stops the source in NTPd, even if getting PPS signal
- So can’t manipulate time just through PPS manipulation

So got to replicate the NMEA data as well

- So wrote a tool for that

- Introducing NMEAdesync
- Is on Github now:
  - https://github.com/zxsecurity/NMEAdesync

NMEAdesync

- Similar in concept to tardgps
- Though changing the data in the NMEA data rather than GPS Signal

- Adjust the time
- Adjust how fast a second is
- Also does the PPS generation

- Offers more control than tardgps
  - No GPS signal tom foolery

NMEAdesync under the hood

- Python Script
  - stdout $GPRMC and $GPGGA
  - PPS high/low on pin
  - Loop
- socat stdout to /dev/pts/X
- Symlink /dev/pts/X to /dev/gps0
- ntpd takes it from there

NMEAdesync running

- I could get similar behaviour as tardgps
- But simpler to execute as don’t have the radio aspect
- Though will require physical access to the roof of the building

How can we detect this?

- GPS Signal Spoofing

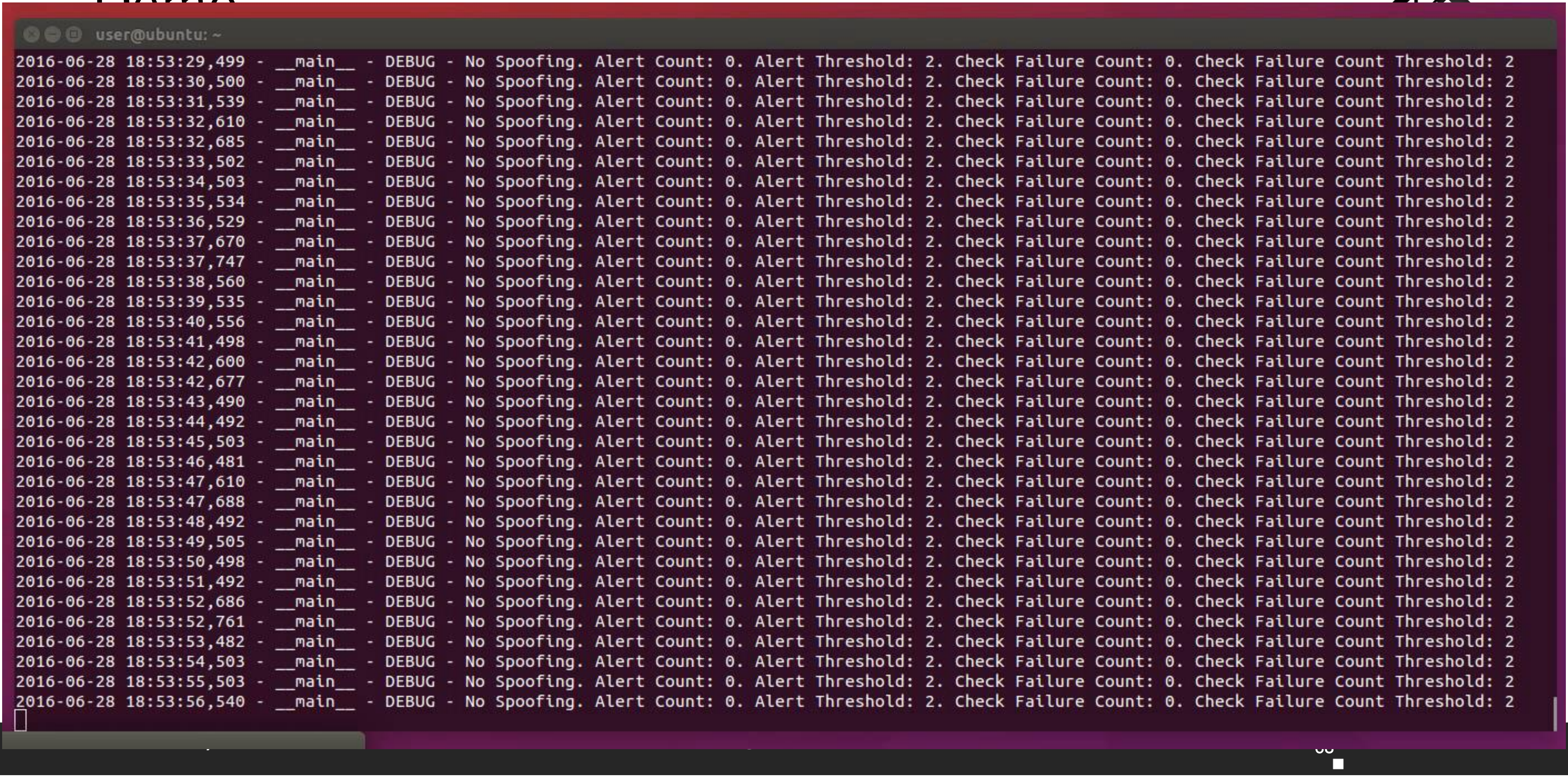
GPSnitch

- Talked in more detail at Unrestcon 2016
- Slides on ZX Security's Site:
  - https://zxsecurity.co.nz/events.html
- Code on ZX Security's Github:
  - https://github.com/zxsecurity/gpsnitch

What does GPSnitch Do?

- Time offset
- SNR Values
- SNR Range
- Location Stationary

Demo



```
2016-06-28 18:53:29,499 - __main__ - DEBUG - No Spoofing. Alert Count: 0. Alert Threshold: 2. Check Failure Count: 0. Check Failure Count Threshold: 2
2016-06-28 18:53:30,500 - __main__ - DEBUG - No Spoofing. Alert Count: 0. Alert Threshold: 2. Check Failure Count: 0. Check Failure Count Threshold: 2
2016-06-28 18:53:31,539 - __main__ - DEBUG - No Spoofing. Alert Count: 0. Alert Threshold: 2. Check Failure Count: 0. Check Failure Count Threshold: 2
2016-06-28 18:53:32,610 - __main__ - DEBUG - No Spoofing. Alert Count: 0. Alert Threshold: 2. Check Failure Count: 0. Check Failure Count Threshold: 2
2016-06-28 18:53:32,685 - __main__ - DEBUG - No Spoofing. Alert Count: 0. Alert Threshold: 2. Check Failure Count: 0. Check Failure Count Threshold: 2
2016-06-28 18:53:33,502 - __main__ - DEBUG - No Spoofing. Alert Count: 0. Alert Threshold: 2. Check Failure Count: 0. Check Failure Count Threshold: 2
2016-06-28 18:53:34,503 - __main__ - DEBUG - No Spoofing. Alert Count: 0. Alert Threshold: 2. Check Failure Count: 0. Check Failure Count Threshold: 2
2016-06-28 18:53:35,534 - __main__ - DEBUG - No Spoofing. Alert Count: 0. Alert Threshold: 2. Check Failure Count: 0. Check Failure Count Threshold: 2
2016-06-28 18:53:36,529 - __main__ - DEBUG - No Spoofing. Alert Count: 0. Alert Threshold: 2. Check Failure Count: 0. Check Failure Count Threshold: 2
2016-06-28 18:53:37,670 - __main__ - DEBUG - No Spoofing. Alert Count: 0. Alert Threshold: 2. Check Failure Count: 0. Check Failure Count Threshold: 2
2016-06-28 18:53:37,747 - __main__ - DEBUG - No Spoofing. Alert Count: 0. Alert Threshold: 2. Check Failure Count: 0. Check Failure Count Threshold: 2
2016-06-28 18:53:38,560 - __main__ - DEBUG - No Spoofing. Alert Count: 0. Alert Threshold: 2. Check Failure Count: 0. Check Failure Count Threshold: 2
2016-06-28 18:53:39,535 - __main__ - DEBUG - No Spoofing. Alert Count: 0. Alert Threshold: 2. Check Failure Count: 0. Check Failure Count Threshold: 2
2016-06-28 18:53:40,556 - __main__ - DEBUG - No Spoofing. Alert Count: 0. Alert Threshold: 2. Check Failure Count: 0. Check Failure Count Threshold: 2
2016-06-28 18:53:41,498 - __main__ - DEBUG - No Spoofing. Alert Count: 0. Alert Threshold: 2. Check Failure Count: 0. Check Failure Count Threshold: 2
2016-06-28 18:53:42,600 - __main__ - DEBUG - No Spoofing. Alert Count: 0. Alert Threshold: 2. Check Failure Count: 0. Check Failure Count Threshold: 2
2016-06-28 18:53:42,677 - __main__ - DEBUG - No Spoofing. Alert Count: 0. Alert Threshold: 2. Check Failure Count: 0. Check Failure Count Threshold: 2
2016-06-28 18:53:43,490 - __main__ - DEBUG - No Spoofing. Alert Count: 0. Alert Threshold: 2. Check Failure Count: 0. Check Failure Count Threshold: 2
2016-06-28 18:53:44,492 - __main__ - DEBUG - No Spoofing. Alert Count: 0. Alert Threshold: 2. Check Failure Count: 0. Check Failure Count Threshold: 2
2016-06-28 18:53:45,503 - __main__ - DEBUG - No Spoofing. Alert Count: 0. Alert Threshold: 2. Check Failure Count: 0. Check Failure Count Threshold: 2
2016-06-28 18:53:46,481 - __main__ - DEBUG - No Spoofing. Alert Count: 0. Alert Threshold: 2. Check Failure Count: 0. Check Failure Count Threshold: 2
2016-06-28 18:53:47,610 - __main__ - DEBUG - No Spoofing. Alert Count: 0. Alert Threshold: 2. Check Failure Count: 0. Check Failure Count Threshold: 2
2016-06-28 18:53:47,688 - __main__ - DEBUG - No Spoofing. Alert Count: 0. Alert Threshold: 2. Check Failure Count: 0. Check Failure Count Threshold: 2
2016-06-28 18:53:48,492 - __main__ - DEBUG - No Spoofing. Alert Count: 0. Alert Threshold: 2. Check Failure Count: 0. Check Failure Count Threshold: 2
2016-06-28 18:53:49,505 - __main__ - DEBUG - No Spoofing. Alert Count: 0. Alert Threshold: 2. Check Failure Count: 0. Check Failure Count Threshold: 2
2016-06-28 18:53:50,498 - __main__ - DEBUG - No Spoofing. Alert Count: 0. Alert Threshold: 2. Check Failure Count: 0. Check Failure Count Threshold: 2
2016-06-28 18:53:51,492 - __main__ - DEBUG - No Spoofing. Alert Count: 0. Alert Threshold: 2. Check Failure Count: 0. Check Failure Count Threshold: 2
2016-06-28 18:53:52,686 - __main__ - DEBUG - No Spoofing. Alert Count: 0. Alert Threshold: 2. Check Failure Count: 0. Check Failure Count Threshold: 2
2016-06-28 18:53:52,761 - __main__ - DEBUG - No Spoofing. Alert Count: 0. Alert Threshold: 2. Check Failure Count: 0. Check Failure Count Threshold: 2
2016-06-28 18:53:53,482 - __main__ - DEBUG - No Spoofing. Alert Count: 0. Alert Threshold: 2. Check Failure Count: 0. Check Failure Count Threshold: 2
2016-06-28 18:53:54,503 - __main__ - DEBUG - No Spoofing. Alert Count: 0. Alert Threshold: 2. Check Failure Count: 0. Check Failure Count Threshold: 2
2016-06-28 18:53:55,503 - __main__ - DEBUG - No Spoofing. Alert Count: 0. Alert Threshold: 2. Check Failure Count: 0. Check Failure Count Threshold: 2
2016-06-28 18:53:56,540 - __main__ - DEBUG - No Spoofing. Alert Count: 0. Alert Threshold: 2. Check Failure Count: 0. Check Failure Count Threshold: 2
```

Useful for

- NTP Servers
- Also GPS units wanting to know location

NTP Setups to avoid GPS Spoofing

- 3+ Upstream
  - Allows for bad ticker detection and removal
- Multiple Types of upstream
  - I.e. don’t pick 3 GPS based ones
  - GPS, Atomic
- Don’t pick just one upstream provider
  - Rouge admin problem
  - Maybe one overseas so gives you a coarse sanity check of time

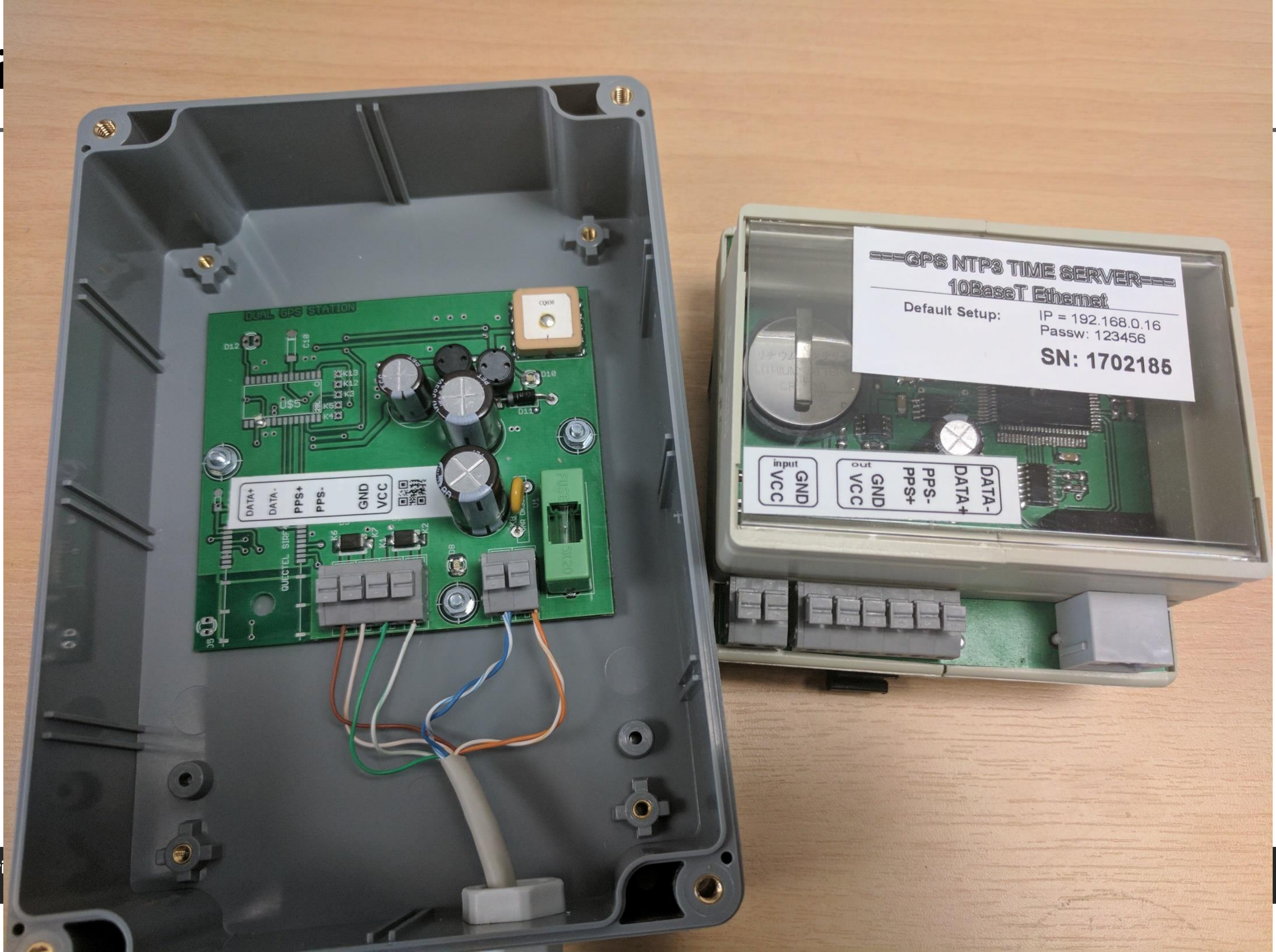
“Air gapped” networks

- But GPS is travelling across the air…
- Consider atomic, caesium, rubidium

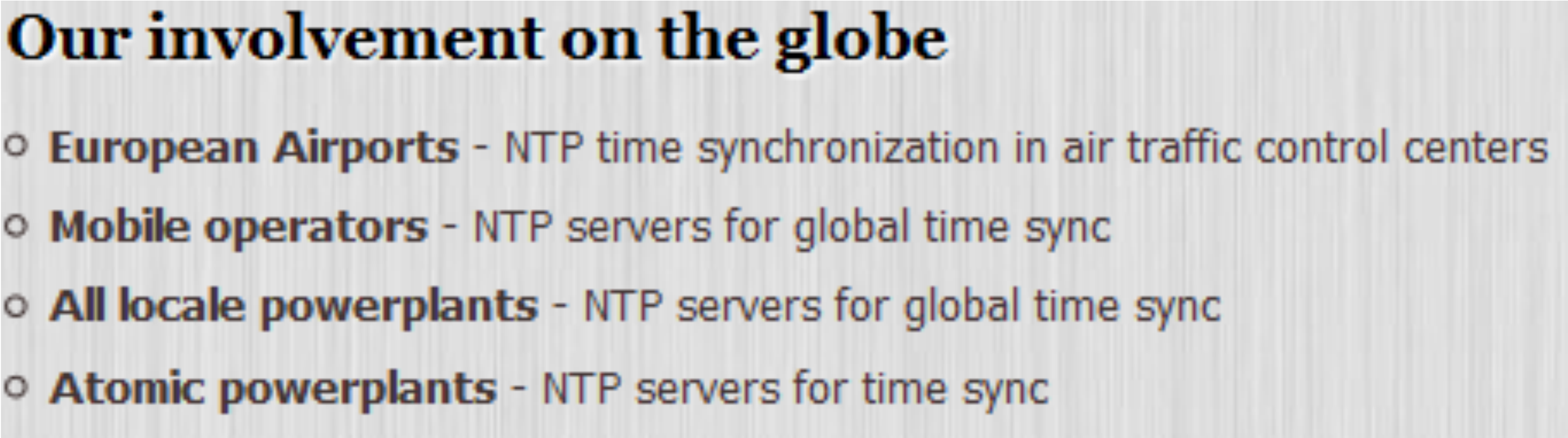
Changes for NTPd or NTP Server

- Incorporate GPSnitch
- Additional logging for when daemon shuts down due to a time jump
- On daemon restart after a large time jump occurs, prompt user to accept time jump

Devi


DUAL GPS STATION
DATA+
DATA-
PPS+
PPS-
GND
VCC
QUECTEL SIRF
FUSE
===GPS NTP3 TIME SERVER===
10BaseT Ethernet
Default Setup:
IP = 192.168.0.16
Passw: 123456
SN: 1702185
input
GND
VCC
out
GND
VCC
PPS-
PPS+
DATA-
DATA+

Their clients



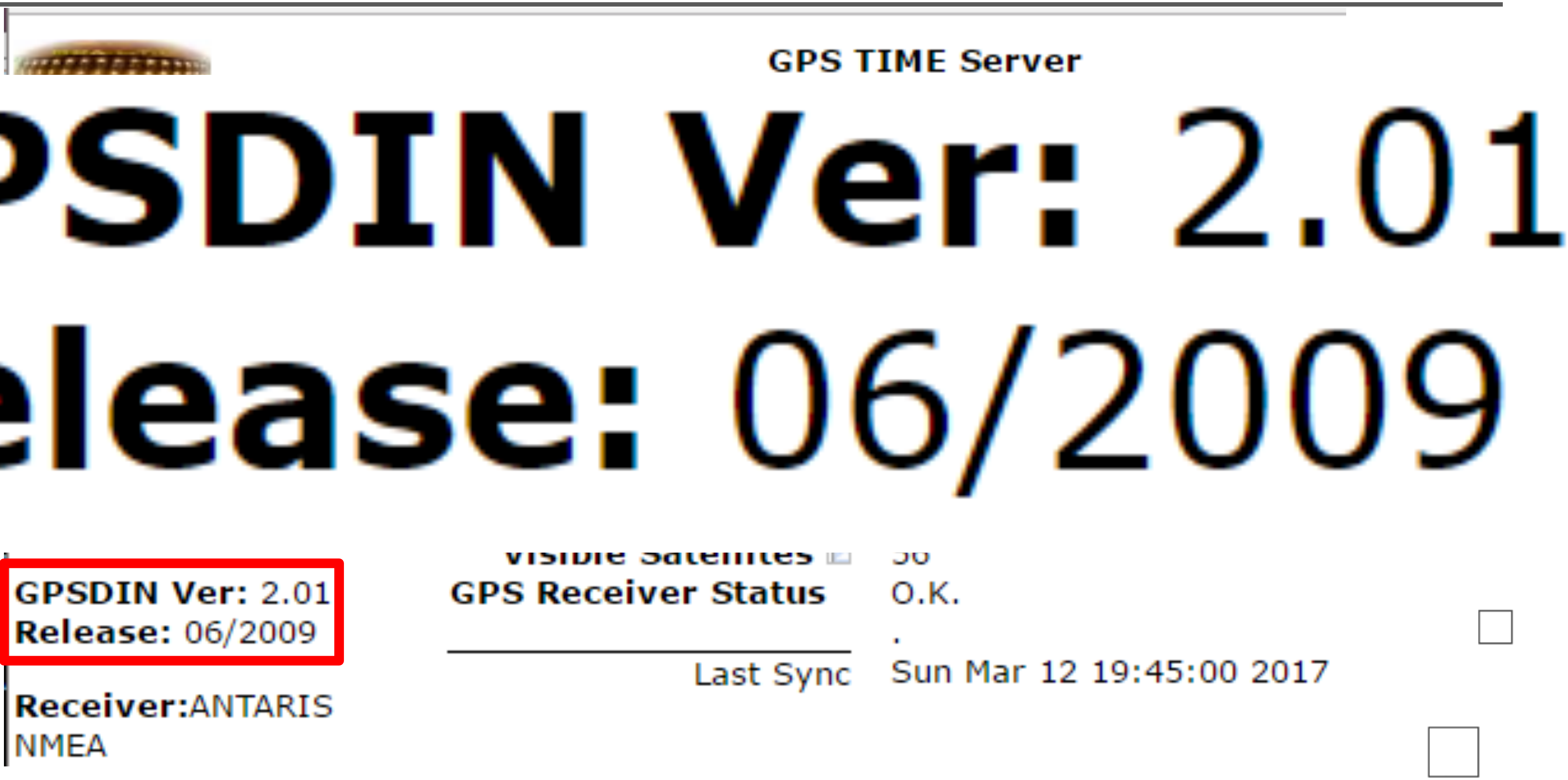
Our involvement on the globe

- **European Airports** - NTP time synchronization in air traffic control centers
- **Mobile operators** - NTP servers for global time sync
- **All locale powerplants** - NTP servers for global time sync
- **Atomic powerplants** - NTP servers for time sync

So what did it do?

- If jumped time a large amount back or forward
- It just worked
  - Didn’t need TardGPS

Version date on software

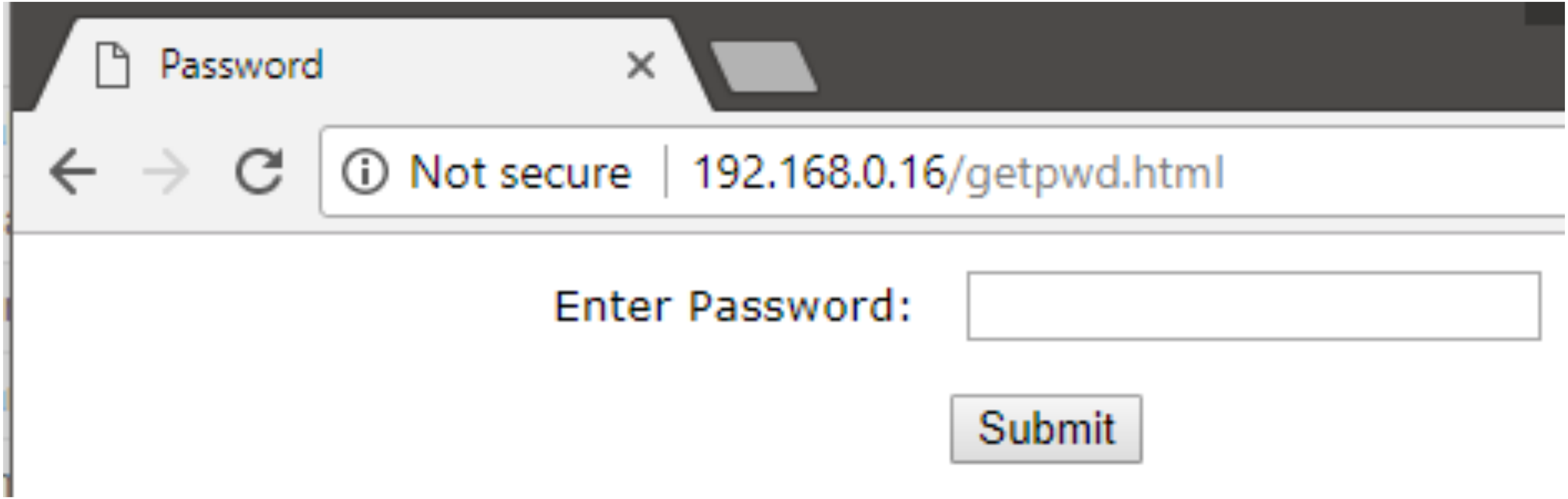


GPS TIME Server

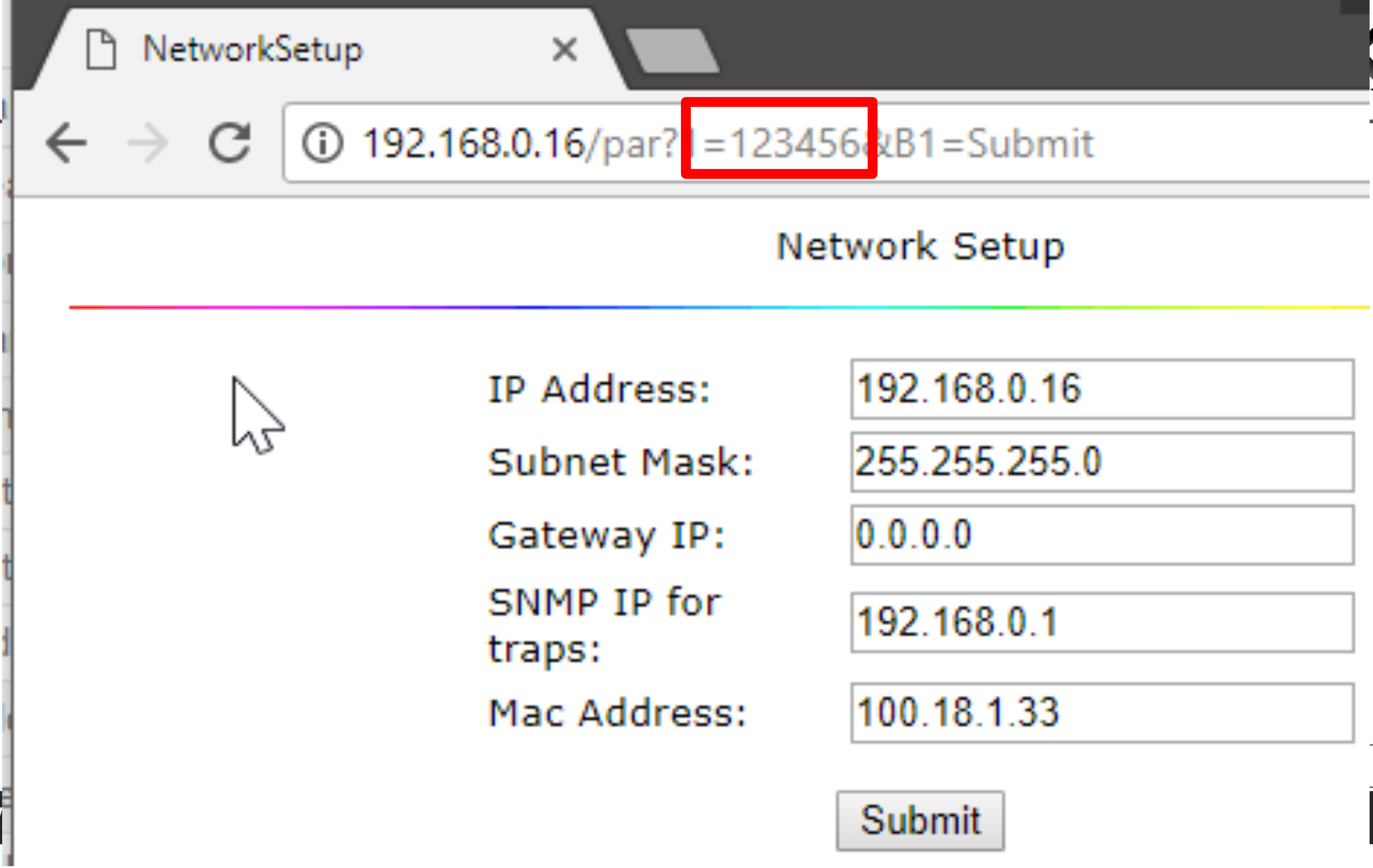
GPSDIN Ver: 2.01

Release: 06/2009

		Visible Satellites	36
GPSDIN Ver: 2.01 **Release:** 06/2009		**GPS Receiver Status**	O.K. .
Receiver:ANTARIS NMEA		Last Sync	Sun Mar 12 19:45:00 2017



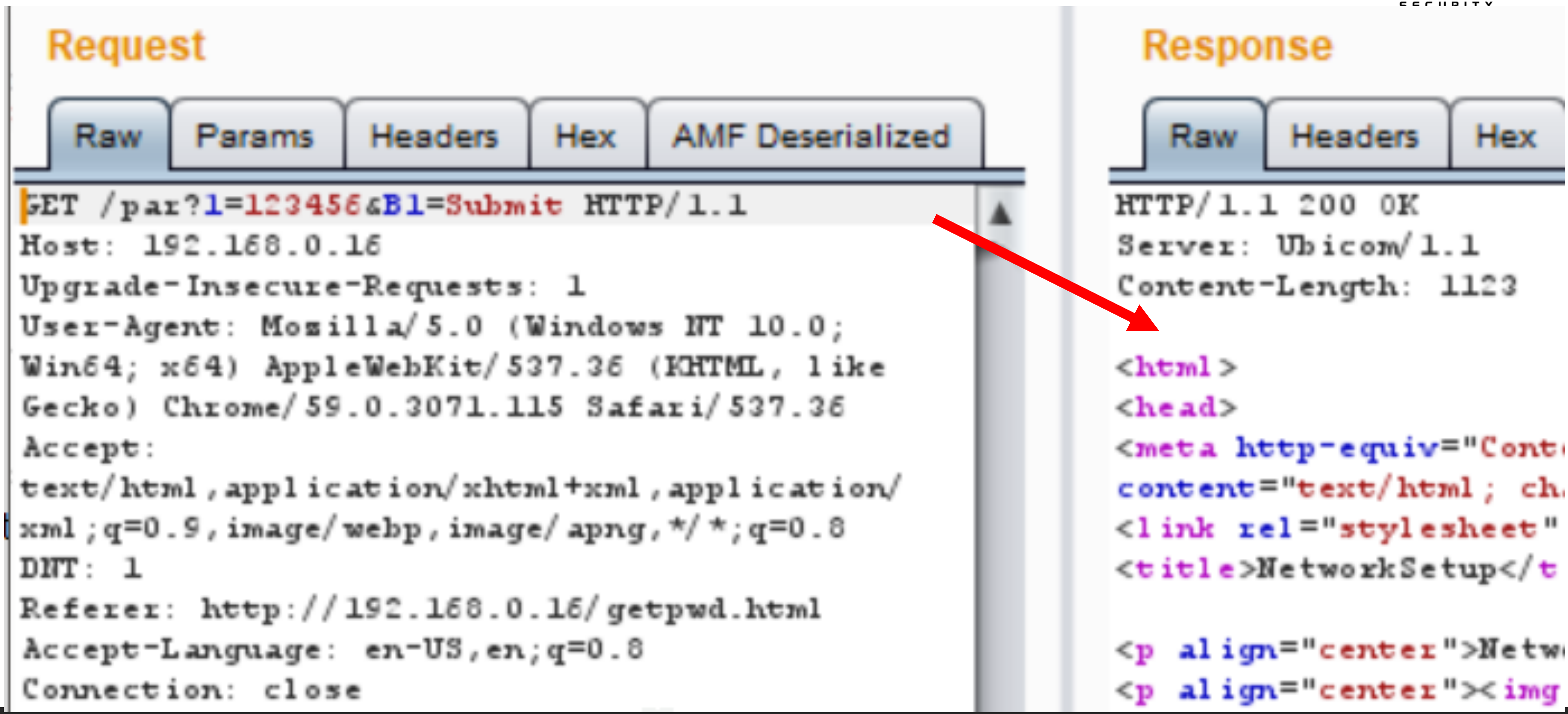
Enter Password:



192.168.0.16/par?l=123456&B1=Submit

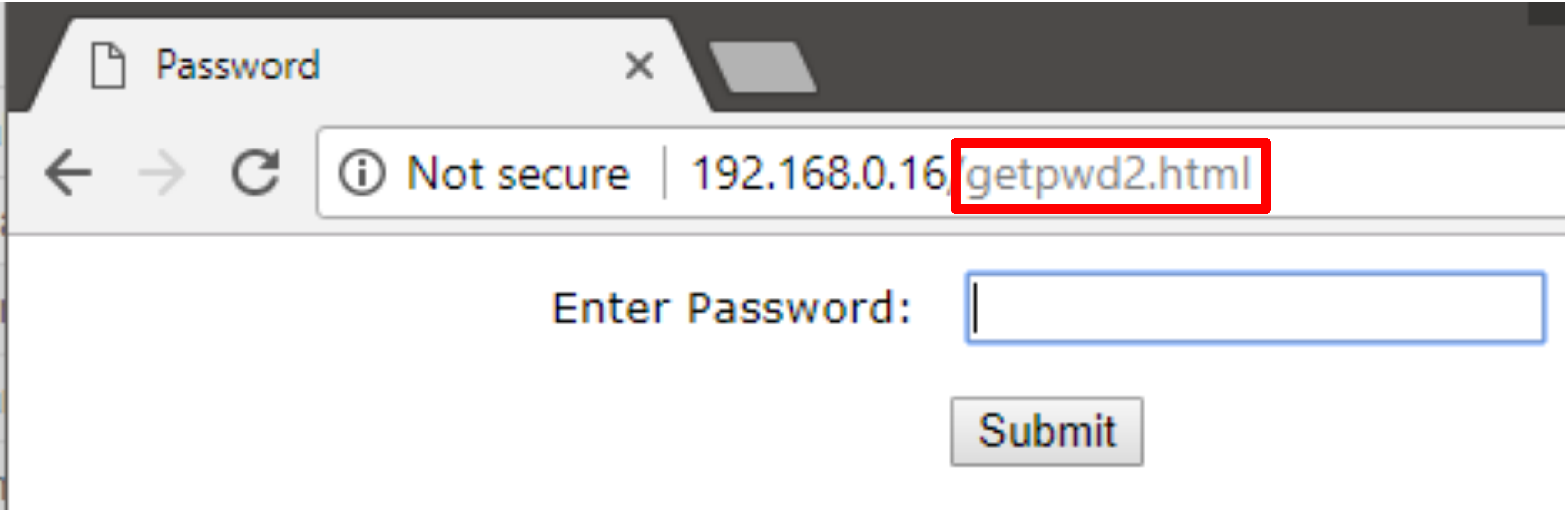
Network Setup

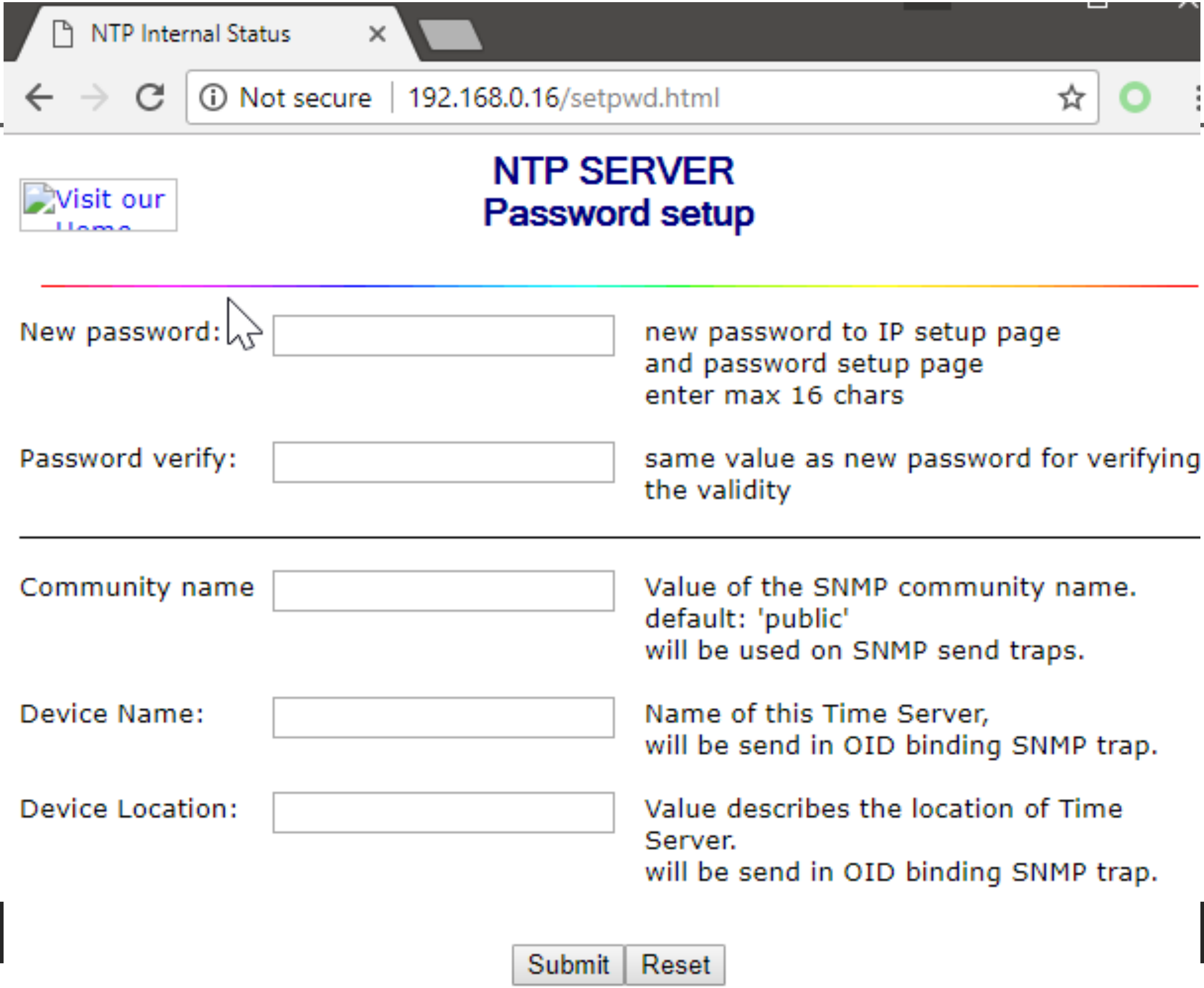
IP Address:	192.168.0.16
Subnet Mask:	255.255.255.0
Gateway IP:	0.0.0.0
SNMP IP for traps:	192.168.0.1
Mac Address:	100.18.1.33



```
GET /par?l=123456&B1=Submit HTTP/1.1
Host: 192.168.0.16
Upgrade-Insecure-Requests: 1
User-Agent: Mozilla/5.0 (Windows NT 10.0;
Win64; x64) AppleWebKit/537.36 (KHTML, like
Gecko) Chrome/59.0.3071.115 Safari/537.36
Accept:
text/html,application/xhtml+xml,application/
xml;q=0.9,image/webp,image/apng,*/*;q=0.8
DNT: 1
Referer: http://192.168.0.16/getpwd.html
Accept-Language: en-US,en;q=0.8
Connection: close
```

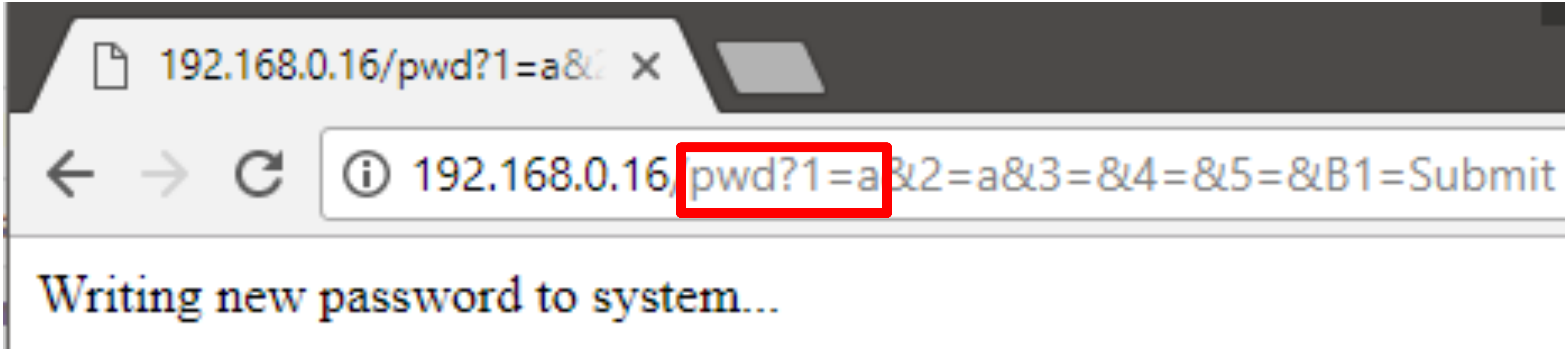
```
HTTP/1.1 200 OK
Server: Ubicom/1.1
Content-Length: 1123

<html>
<head>
<meta http-equiv="Cont
content="text/html; ch
<link rel="stylesheet"
<title>NetworkSetup</t

<p align="center">Netw
<p align="center"><img
```


Password
Not secure
192.168.0.16/getpwd2.html
Enter Password:
Submit



NTP SERVER
Password setup

New password:		new password to IP setup page and password setup page enter max 16 chars
Password verify:		same value as new password for verifying the validity
Community name		Value of the SNMP community name. default: 'public' will be used on SNMP send traps.
Device Name:		Name of this Time Server, will be send in OID binding SNMP trap.
Device Location:		Value describes the location of Time Server. will be send in OID binding SNMP trap.



192.168.0.16/pwd?1=a&2=a&3=&4=&5=&B1=Submit

Writing new password to system...

NMEA Snitch

- https://github.com/zxsecurity/NMEAsnitch
- Records the NMEA sentences
- Looks at the ratios and sentences per second

Thanks

- bladeRF – Awesome customer service and great kit
- Takuji Ebinuma – for GitHub code
- @amm0nra – General SDR stuff and Ideas
- @bogan & ZX Security – encouragement, kit, time
- Fincham – GPS NTP Kit
- Unicorn Team – Ideas from their work
- Everyone else who has suggested ideas / given input
- BSidesCBR – For having me
- You – For hanging around and having a listen
- GPSd – Daemon to do the GPS stuff
- GPS3 – Python Library for GPSd

Thanks

GPSnitch

- Slides: https://zxsecurity.co.nz/presentations/201607_Unrestcon-ZXSecurity_GPSSpoofing.pdf
- Code: https://github.com/zxsecurity/gpsnitch

GPSnitch

- Slides: https://zxsecurity.co.nz/presentations/201607_Unrestcon-ZXSecurity_GPSSpoofing.pdf
- Code: https://github.com/zxsecurity/gpsnitch

tardgps

- Code: https://github.com/zxsecurity/tardgps

How To

- Code
  - https://github.com/osqzss/gps-sdr-sim/
  - https://github.com/osqzss/bladeGPS
  - https://github.com/keith-citrenbaum/bladeGPS - Fork of bladeGPS for Linux
- Blog
  - http://en.wooyun.io/2016/02/04/41.html
- Lat Long Alt to ECEF
  - http://www.sysense.com/products/ecef_lla_converter/index.html

Libraries Used

- GPS3 Python Library
  - https://github.com/wadda/gps3
- GPSd Daemon
  - http://www.catb.org/gpsd/

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- http://www.securityweek.com/ntp-servers-exposed-long-distance-wireless-attacks
- http://www.gps.gov/multimedia/images/constellation.jpg

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- https://upload.wikimedia.org/wikipedia/commons/4/49/GPS_Block_IIIA.jpg
- http://www.synchbueno.com/components/com_jshopping/files/img_products/full_1-131121210043Y1.jpg
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- https://www.yubico.com/wp-content/uploads/2015/04/YubiKey-4-1000-2016-444x444.png
- http://www.gpsntp.com/about/
- https://upload.wikimedia.org/wikipedia/commons/4/4a/GPS_roof_antenna_dsc06160.jpg

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