When IoT Attacks:

Hacking A Linux-Powered Rifle

Who are we?

- Runa A. Sandvik
- Michael Auger

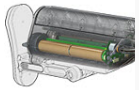
ZDNet STORAGE INNOVATION MOBILITY MORE NEWSLETTERS ALL WRITERS

The TrackingPoint 338TP, the Linux rifle that's accurate up to a mile

You'll find Linux everywhere, including in the most accurate rifles in the world.

By Steven J.

I grew up in rural
shoot. All I know
grew up in a gun
school at West V
Championship in
to shoot accurat
best. I was never



TC News Video Events Crunchbase Search

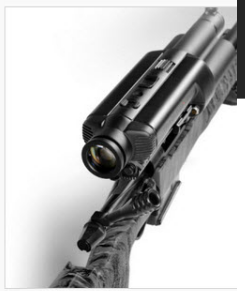
DISRUPT SF Y-Combinator's Sam Altman To Take The Stage At Disrupt SF Get $1,000 Off Tickets Now

guns linux

A Precision Guided Firearm Powered by Linux

Posted Apr 2, 2013 by Scott Merrill (@smerrill), Contributor

482 SHARES



technology about which I'm largel
products are entirely my fault. Th
interesting way to use Linux and
computing, social networking, an

Tracking Point was founded in 20

ars technica

Register Log in

MAIN MENU MY STORIES: 1 FORUMS SUBSCRIBE JOBS ARS CONSORTIUM

GEAR & GADGETS / PRODUCT NEWS & REVIEWS

$17,000 Linux-powered rifle brings "auto-aim" to the real world

Austin-based startup makes "Precision Guided Firearms" sporting a lot of tech.

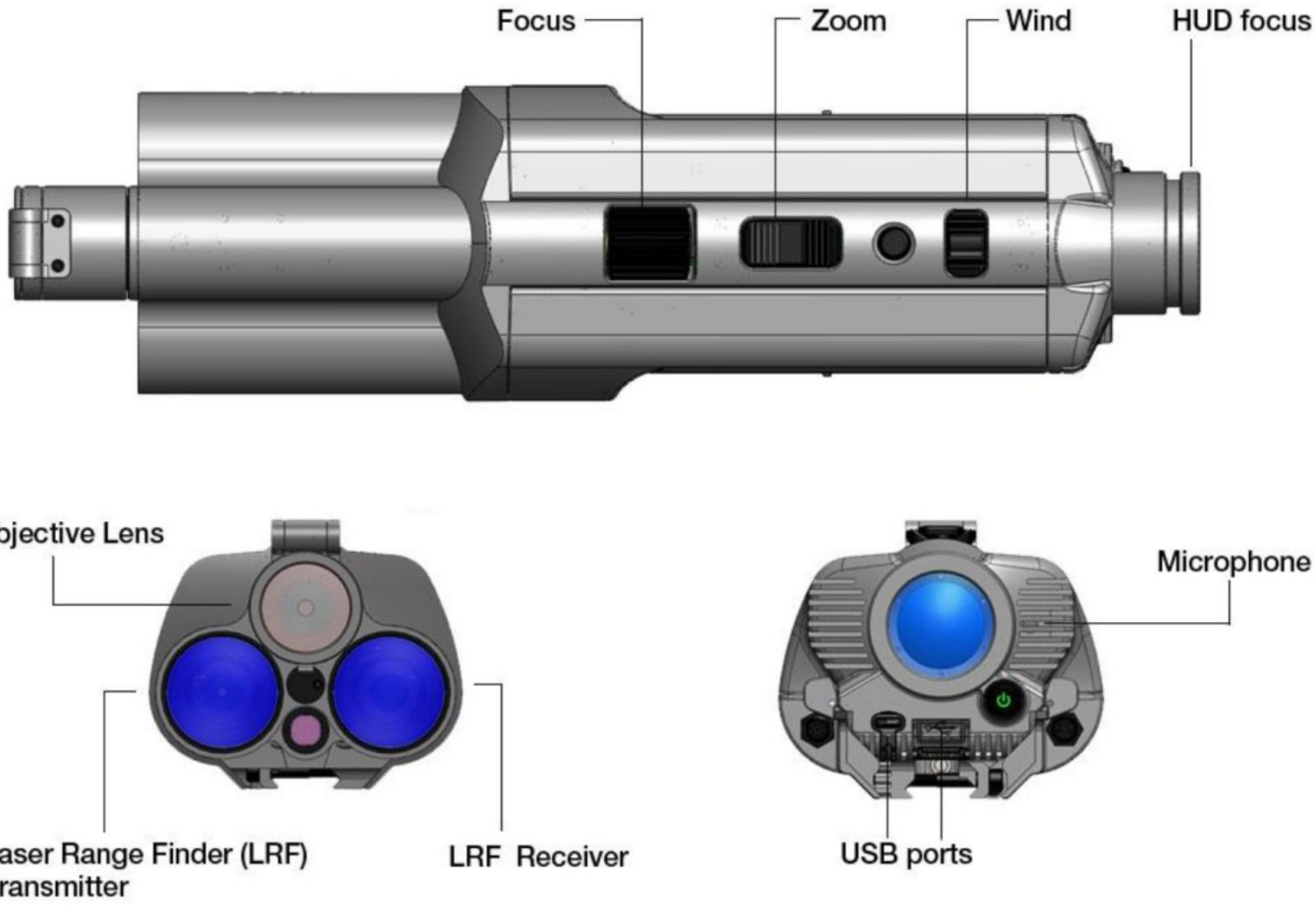
by Lee Hutchinson - Jan 9, 2013 3:45pm EST

LATEST FEATURE STORY

Why are we doing this?

- A gun with WiFi and fancy electronics… duh

Physical


Focus
Zoom
Wind
HUD focus
Objective Lens
Laser Range Finder (LRF) Transmitter
LRF Receiver
Microphone
USB ports

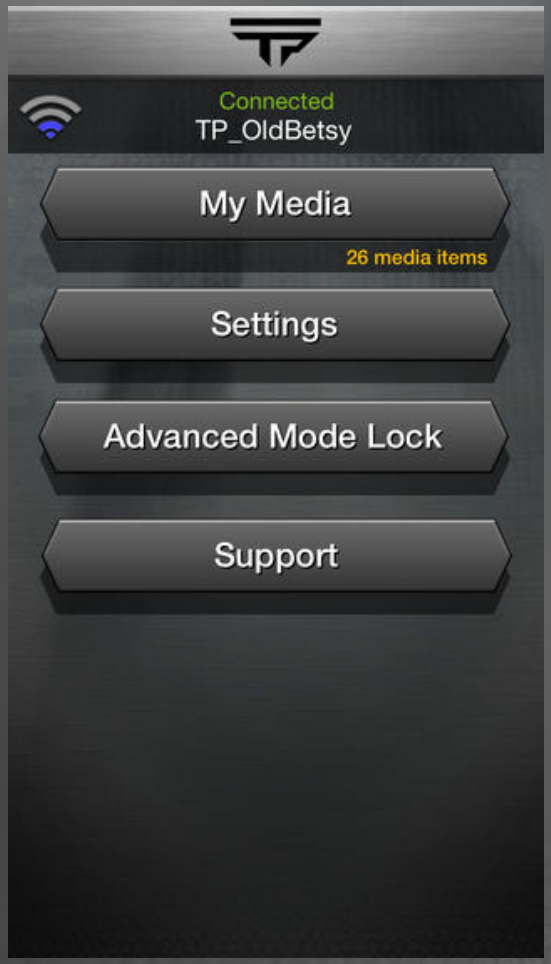

B
A
START


WIFI SERVER

```
Nmap scan report for 192.168.1.1
Host is up (0.0049s latency).
Not shown: 65533 filtered ports
PORT    STATE SERVICE VERSION
80/tcp  open  http    lighttpd
|_http-methods: OPTIONS GET HEAD POST
|_http-title: Site doesn't have a title (text/html).
554/tcp open  rtsp    GStreamer rtspd
|_rtsp-methods: ERROR: Script execution failed (use -d to debug)
Warning: OSScan results may be unreliable because we could not find at least...
Device type: storage-misc|general purpose|specialized|WAP|media device|phone
Running (JUST GUESSING): HP embedded (97%), Linux 2.6.X|3.X (95%)...
Aggressive OS guesses: HP P2000 G3 NAS device (97%), Linux 2.6.36 - 2.6.37 (95%)
```

Mobile Apps

TrackingPoint App



ShotView App

Public API

Mobile Apps

/clear_passcode/
/config/
/dateset/
/delete/
/dir/
/get_passcode/
/get_shot_data/
/gps/
/pkg-upload/
/progress/
/serial_num/
/service/
/set_factory_defaults/
/set_passcode/
/set_windage/
/unwatch/
/updatescope/
/version/

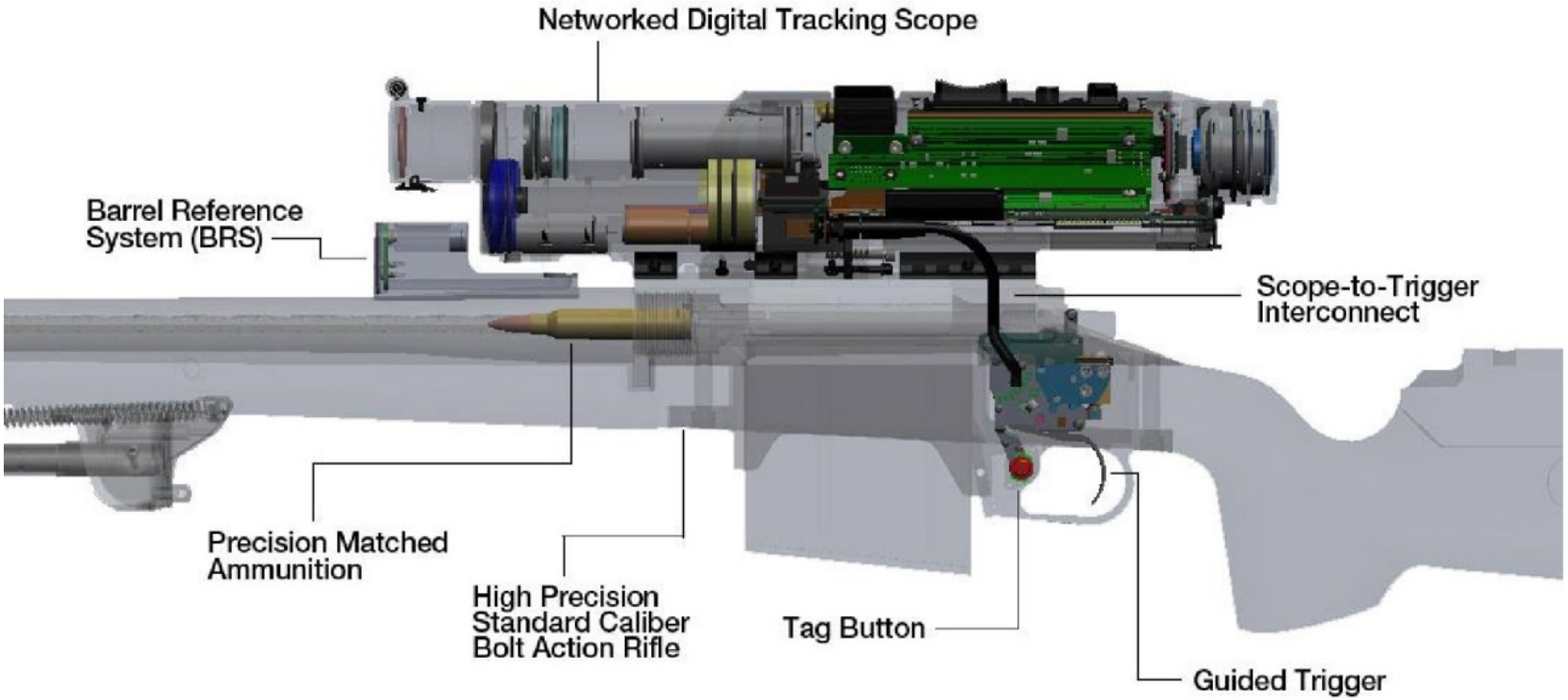
Config

/set_ammunition/
/set_imagestab/
/set_killzone/
/set_temperature/
/set_record_cooltime/
/set_recording/

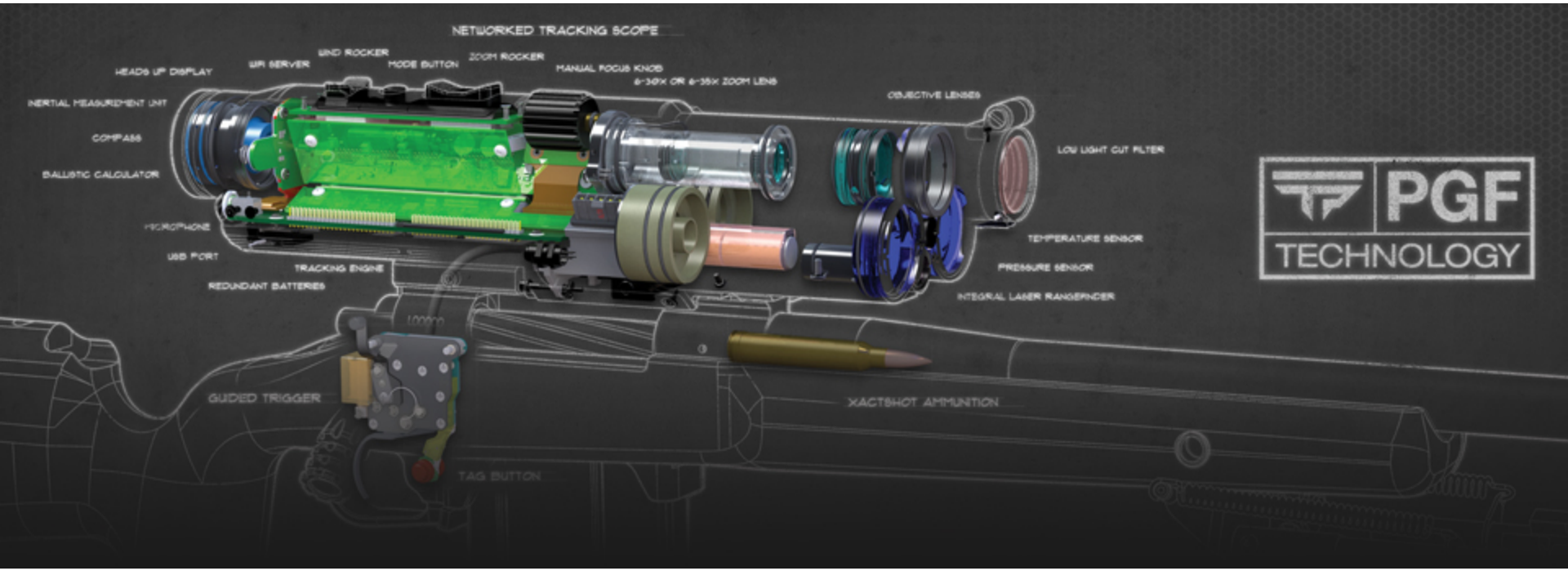
Initial Findings

- SSID contains the serial number, can’t be changed
- WPA2 key can’t be changed
- VLC or anything can stream the scope view
- Advanced mode lock is only a 4 digit pin and can be brute forced
- API is un-authenticated
- API settings can be modified regardless of advanced mode lock

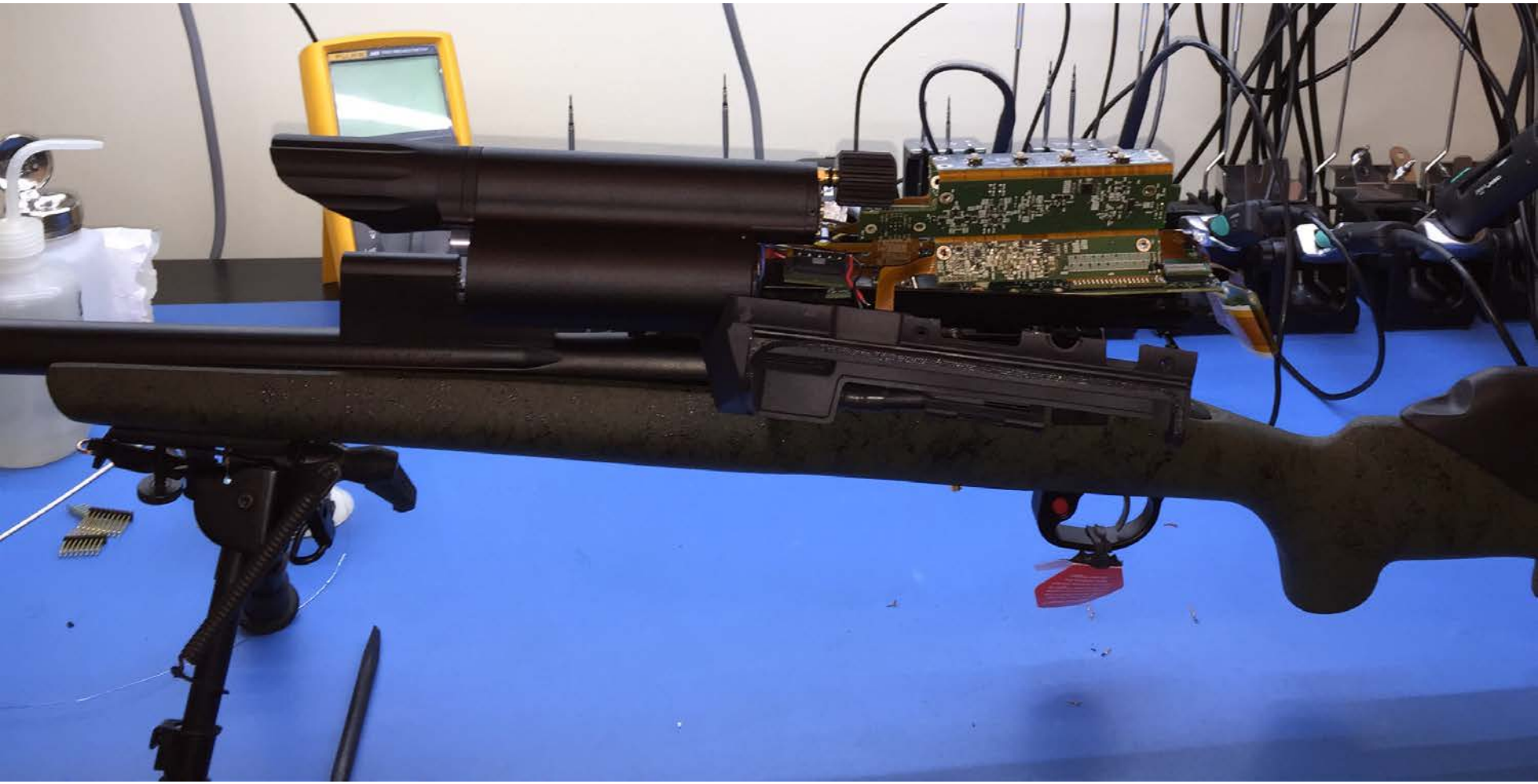
Courtesy of TrackingPoint's Website



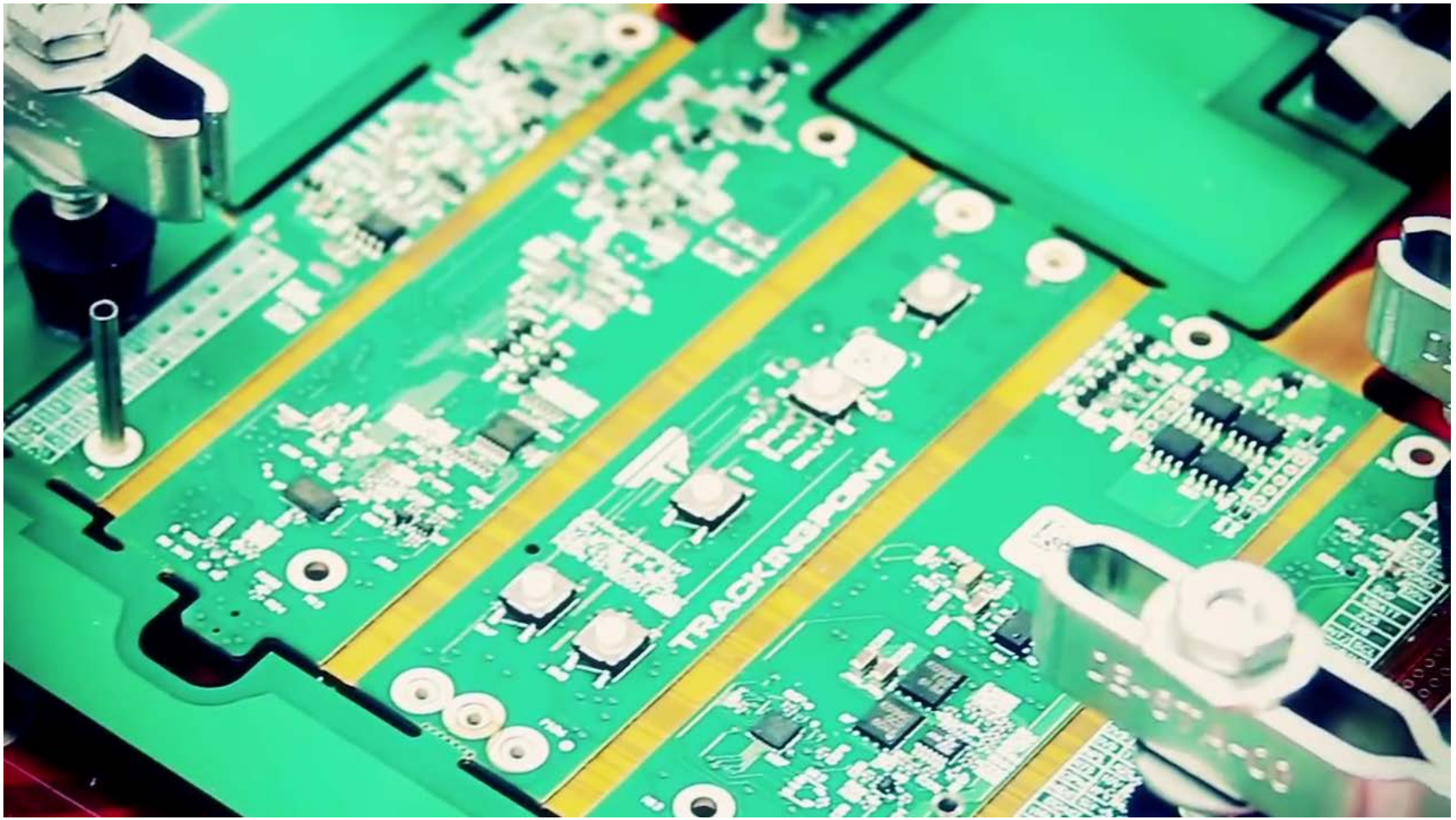
Courtesy of TrackingPoint's Website



Tearing it open

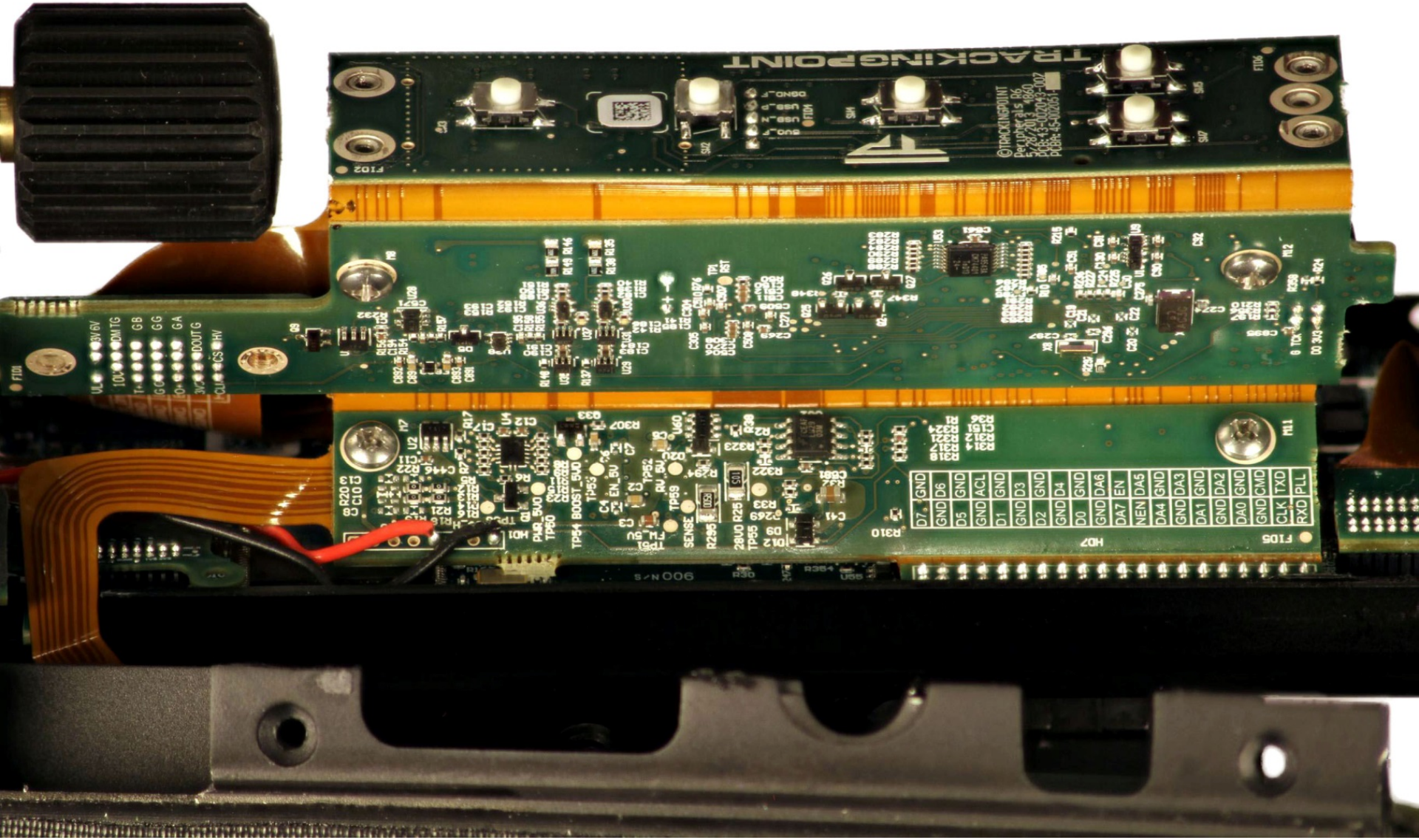


Courtesy of TrackingPoint's YouTube

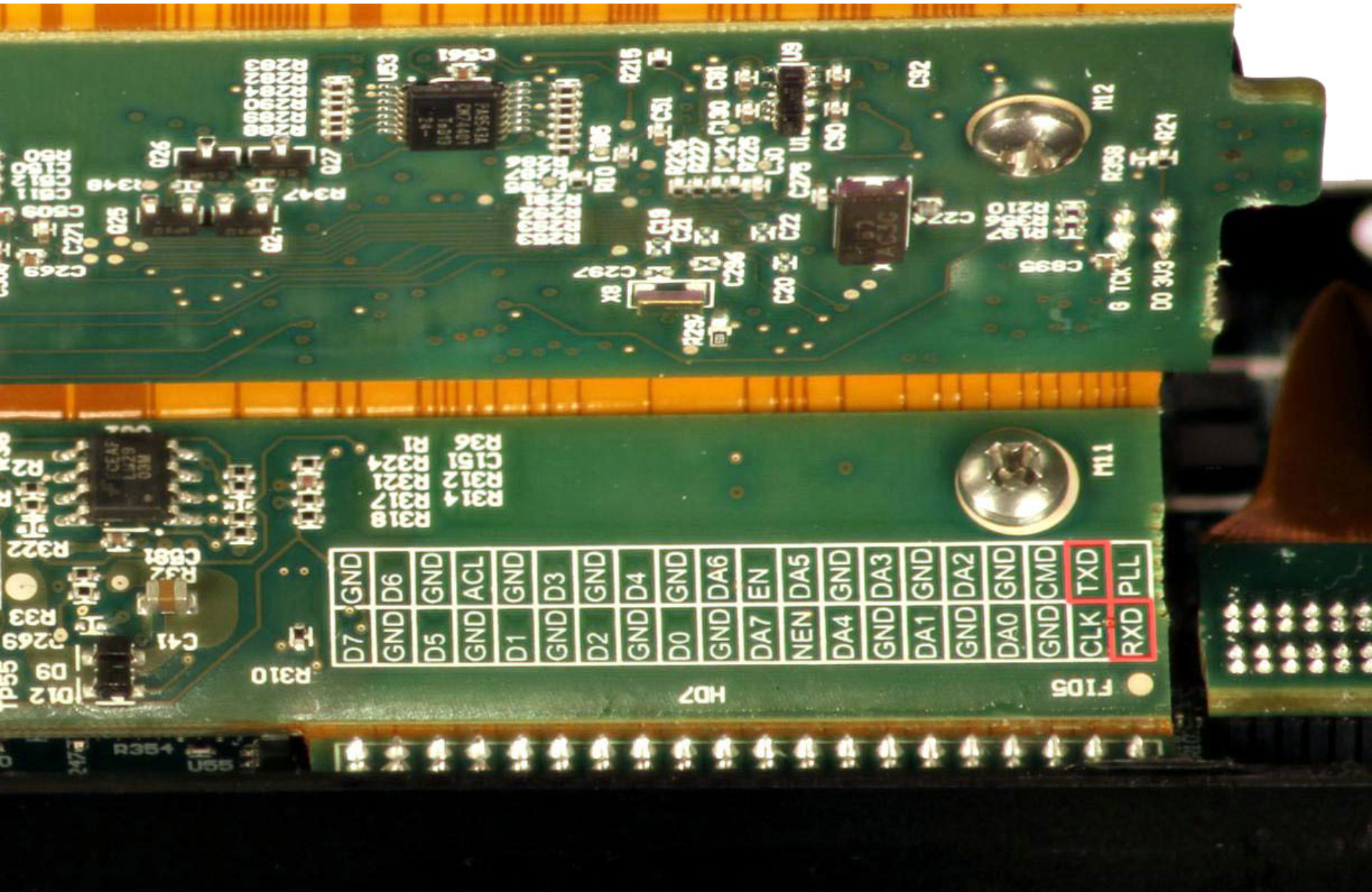



TRACKINGPOINT

Close Up



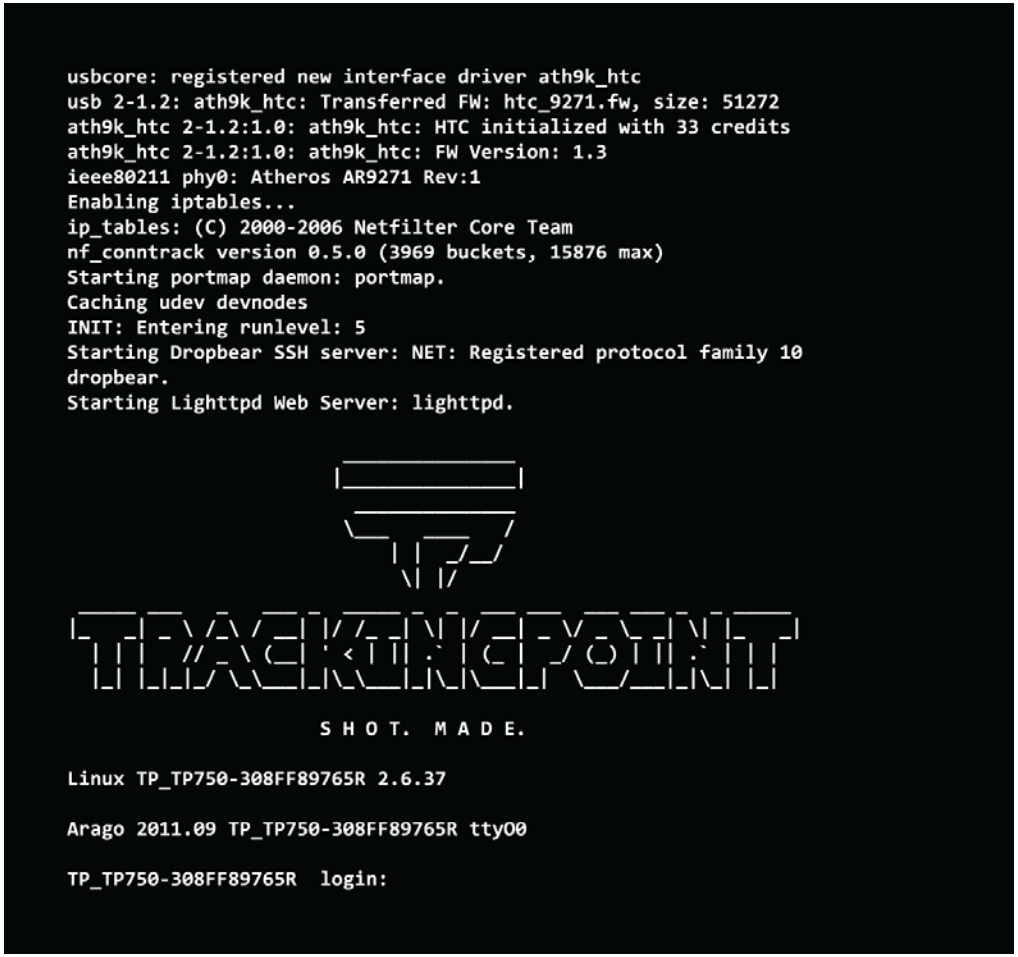
UART


D7 GND
GND D6
D5 GND
GND ACL
D1 GND
GND D3
D2 GND
GND D4
D0 GND
GND DA6
DA7 EN
NEN DA5
DA4 GND
GND DA3
DA1 GND
GND DA2
DA0 GND
GND CMD
CLK TXD
RXD PLL
HD7
FID5
M11
M12

Woot!


U-Boot 2010.06-00300-gfb2cb26 (Jul 10 2013 - 17:39:57)
TI8148-GP rev 2.1
ARM clk: 600MHz
DDR clk: 400MHz
I2C: ready
DRAM: 512 MiB
Flash: 16 MiB
TTTTTT RRRR AA CCC K K III N N GGG PPPP OOO III N N TTTTTT
TT R R A A C K K I NN N G P P O O I NN N TT
TT RRRR AAAA C KK I N N N G GG PPPP O O I N N N TT
TT R R A A C K K I N NN G G P O O I N NN TT
TT R RR A A CCC K K III N N GGG P OOO III N N TT
S H O T. M A D E!
MMC: OMAP SD/MMC: 0
Net: MAC:7c:66:9d:41:8:88 Dev:cpsw
Hit any key to stop autoboot: 0
Booting side 2
Booting kernel from Legacy Image at 08360000 ...
Image Name: Linux-2.6.37
Image Type: ARM Linux Kernel Image (uncompressed)
Data Size: 2314892 Bytes = 2.2 MiB
Load Address: 80008000
Entry Point: 80008000
Loading Kernel Image ... OK
OK
Starting kernel ...

Well played TrackingPoint…



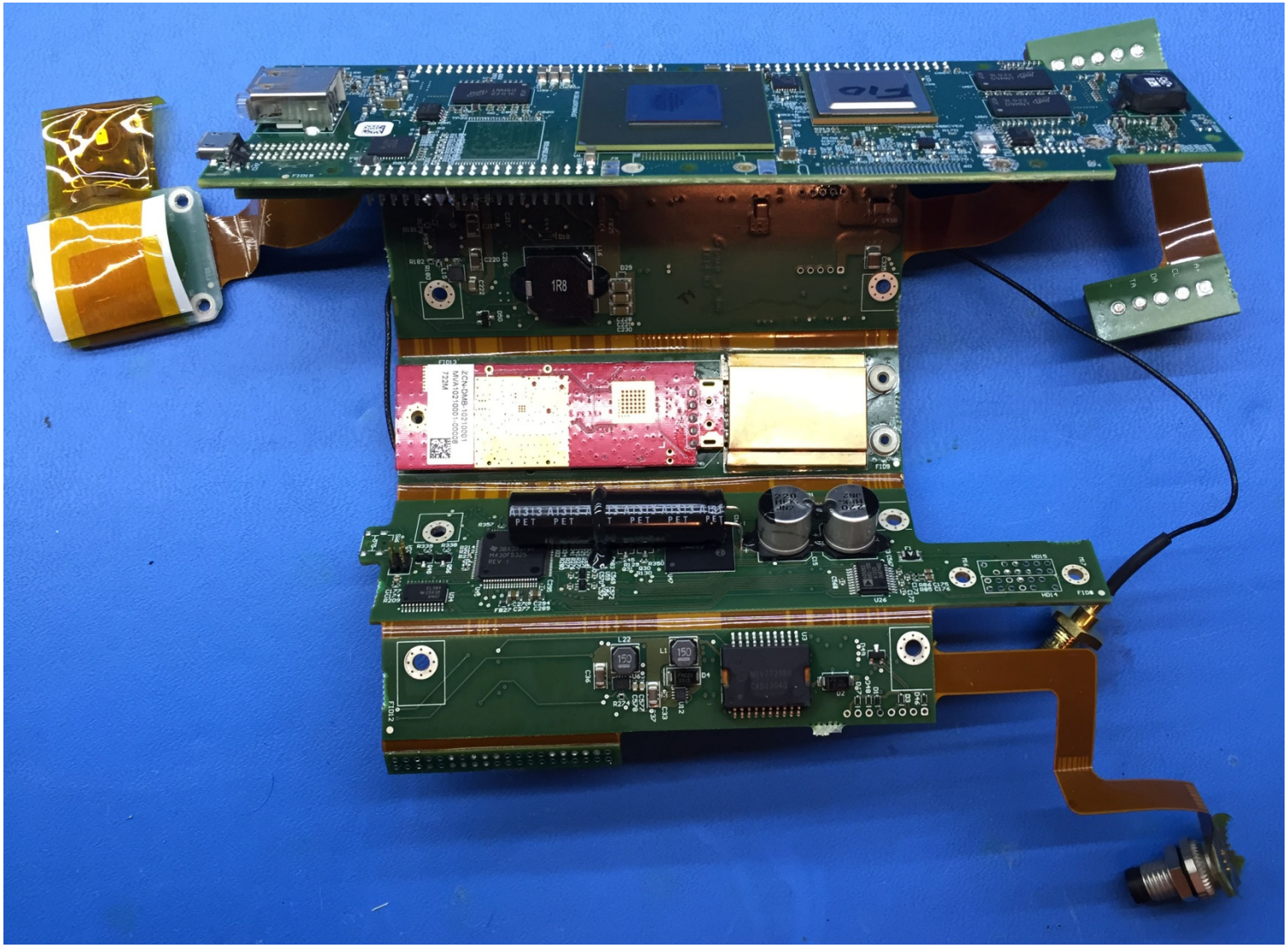
…well played


S H O T. M A D E.
Linux TP_TP750-308FF89765R 2.6.37
Arago 2011.09 TP_TP750-308FF89765R tty00
TP_TP750-308FF89765R login:

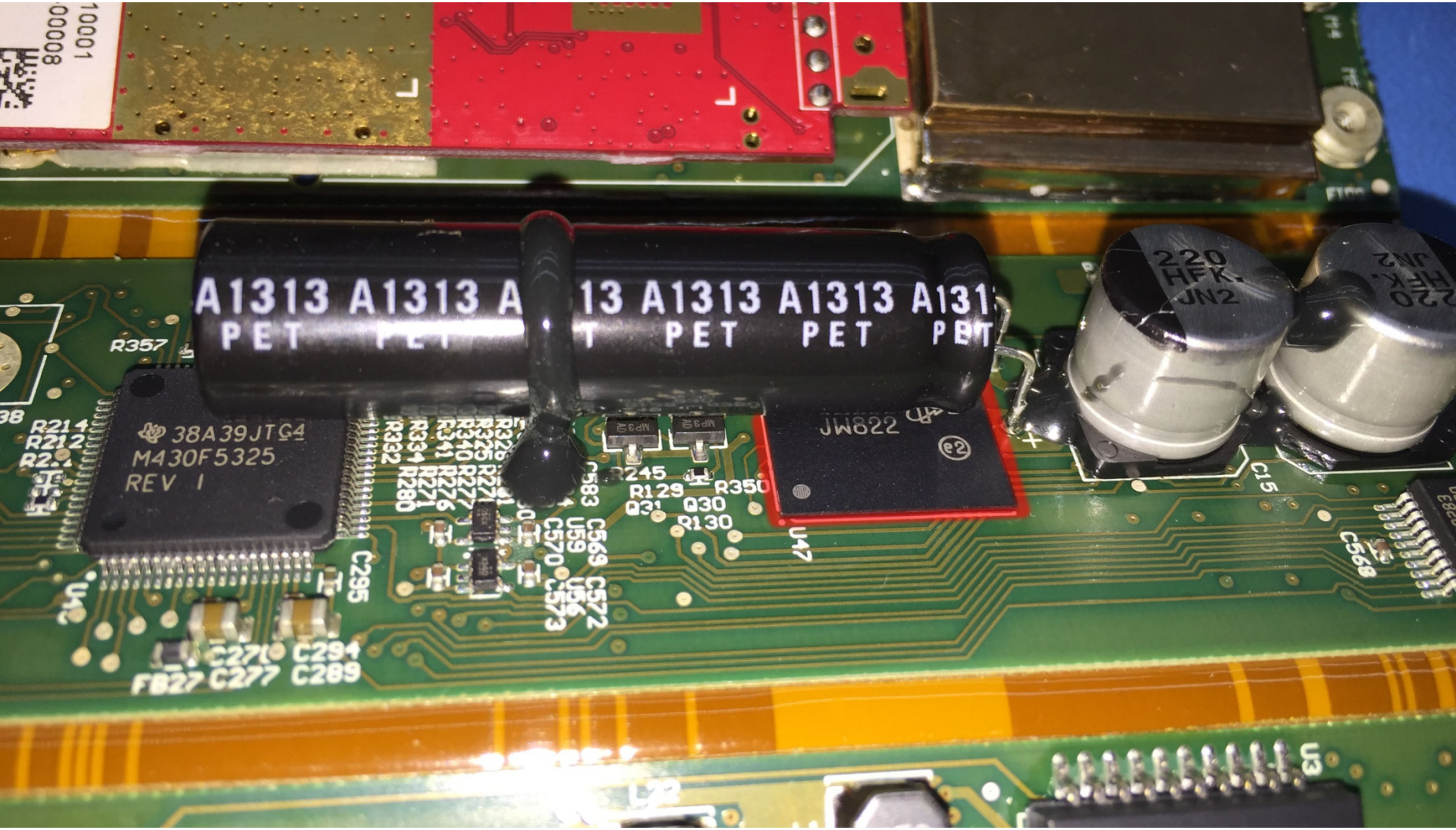
TrackingPoint wins!

- Validating API input
- GPG signed and encrypted updates
- Password Protected Console

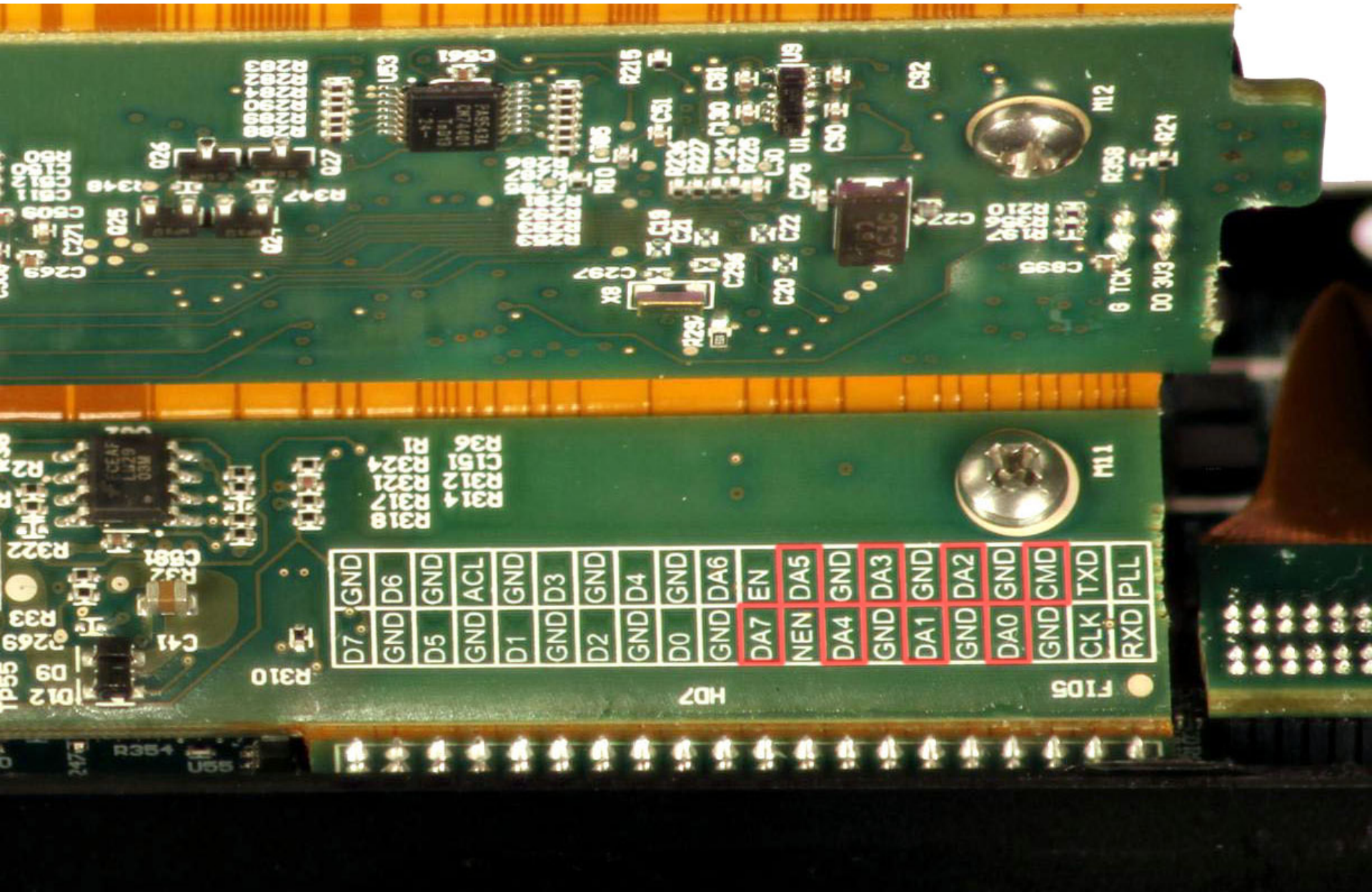
Let’s get destructive!



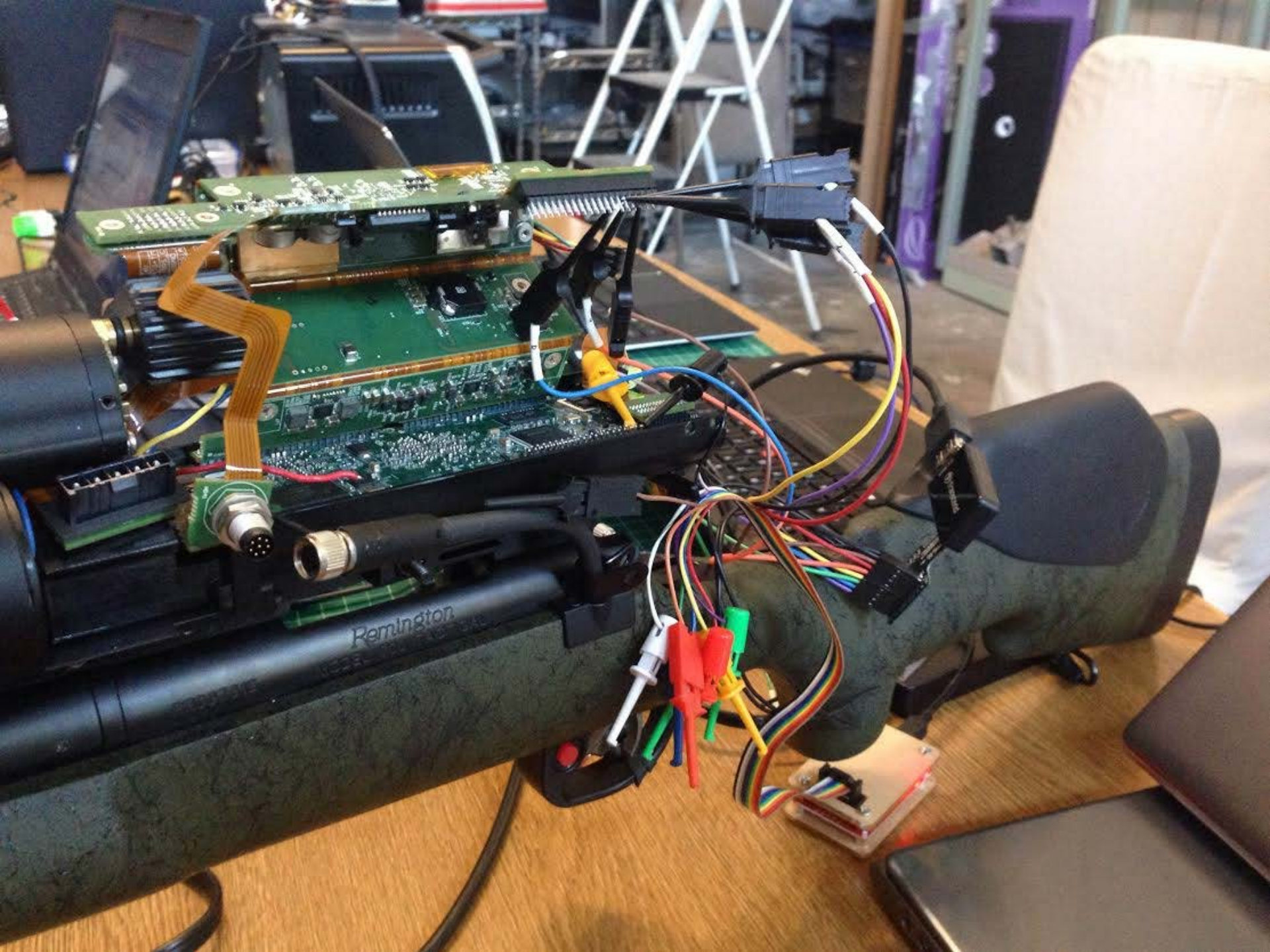
The Real Filesystem



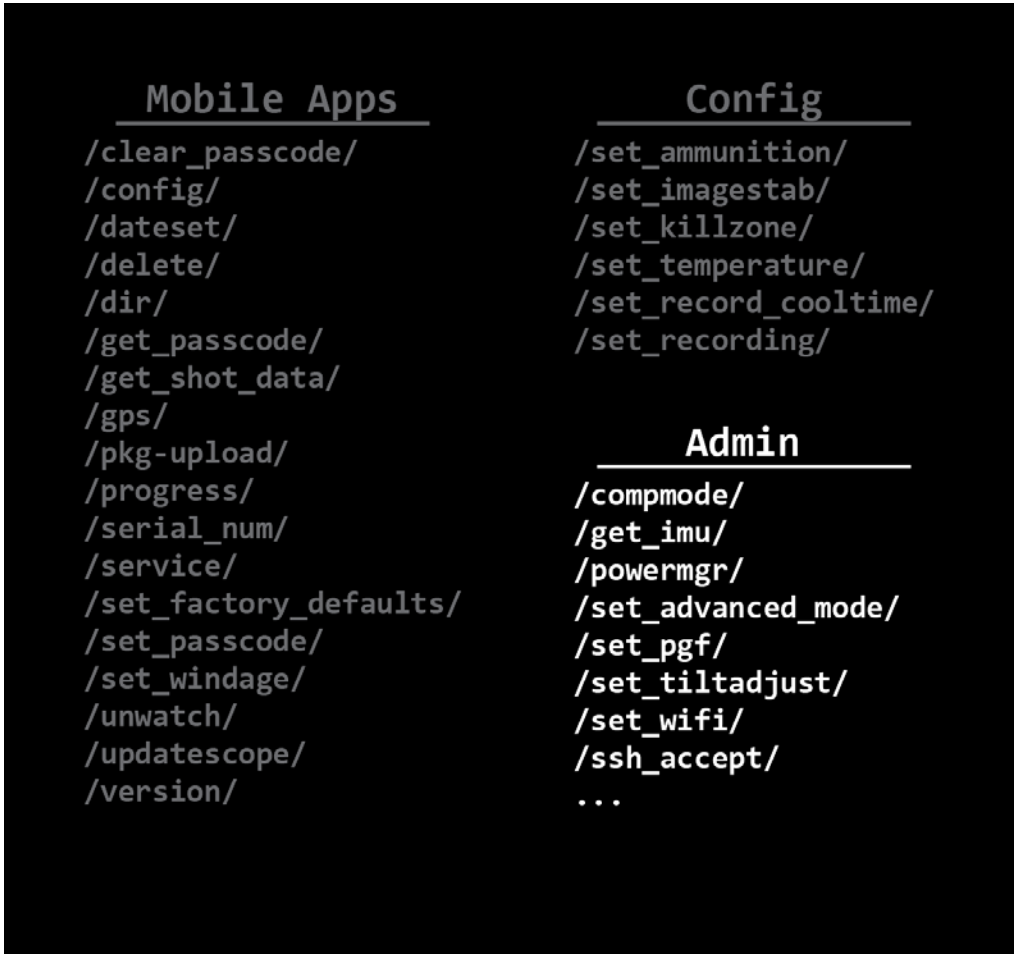
Had only we known!




RS2G0433A0


Remington

Admin API


Mobile Apps
/clear_passcode/
/config/
/dateset/
/delete/
/dir/
/get_passcode/
/get_shot_data/
/gps/
/pkg-upload/
/progress/
/serial_num/
/service/
/set_factory_defaults/
/set_passcode/
/set_windage/
/unwatch/
/updatescope/
/version/
Config
/set_ammunition/
/set_imagestab/
/set_killzone/
/set_temperature/
/set_record_cooltime/
/set_recording/
Admin
/compmode/
/get_imu/
/powermgr/
/set_advanced_mode/
/set_pgf/
/set_tiltadjust/
/set_wifi/
/ssh_accept/
...

Demo: Got root?

Demo: You missed!

Findings

- Admin API is un-authenticated
- Un-authenticated access to core system functions
- Any GPG key in trust DB can encrypt and sign updates

Takeaways

- Small attack surface and a lot was done right:
  - USB ports are disabled during boot
  - Media is deleted from scope once downloaded
  - WPA2 is in use, even if the key cannot be changed
  - API settings are validated on the backend
  - Password protected console and single user mode
  - GPG signed and encrypted software updates

Thanks!

- Travis Goodspeed
- Babak Javadi -- The CORE Group
- Mickey Shkatov -- Intel Advanced Threat Research
- Joe FitzPatrick
- Jesse
- Kenny
- ^H -- Portland's Hackerspace