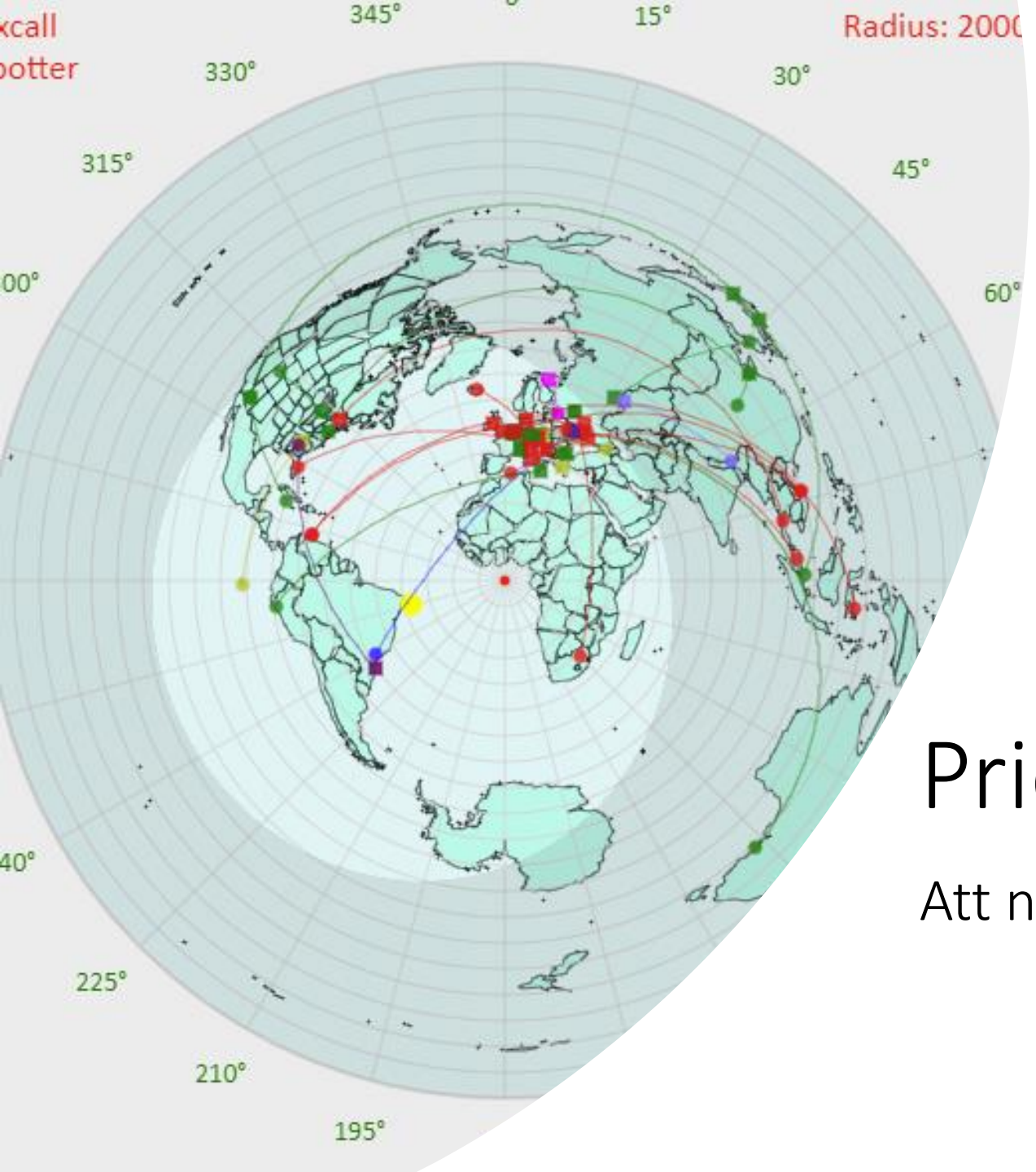
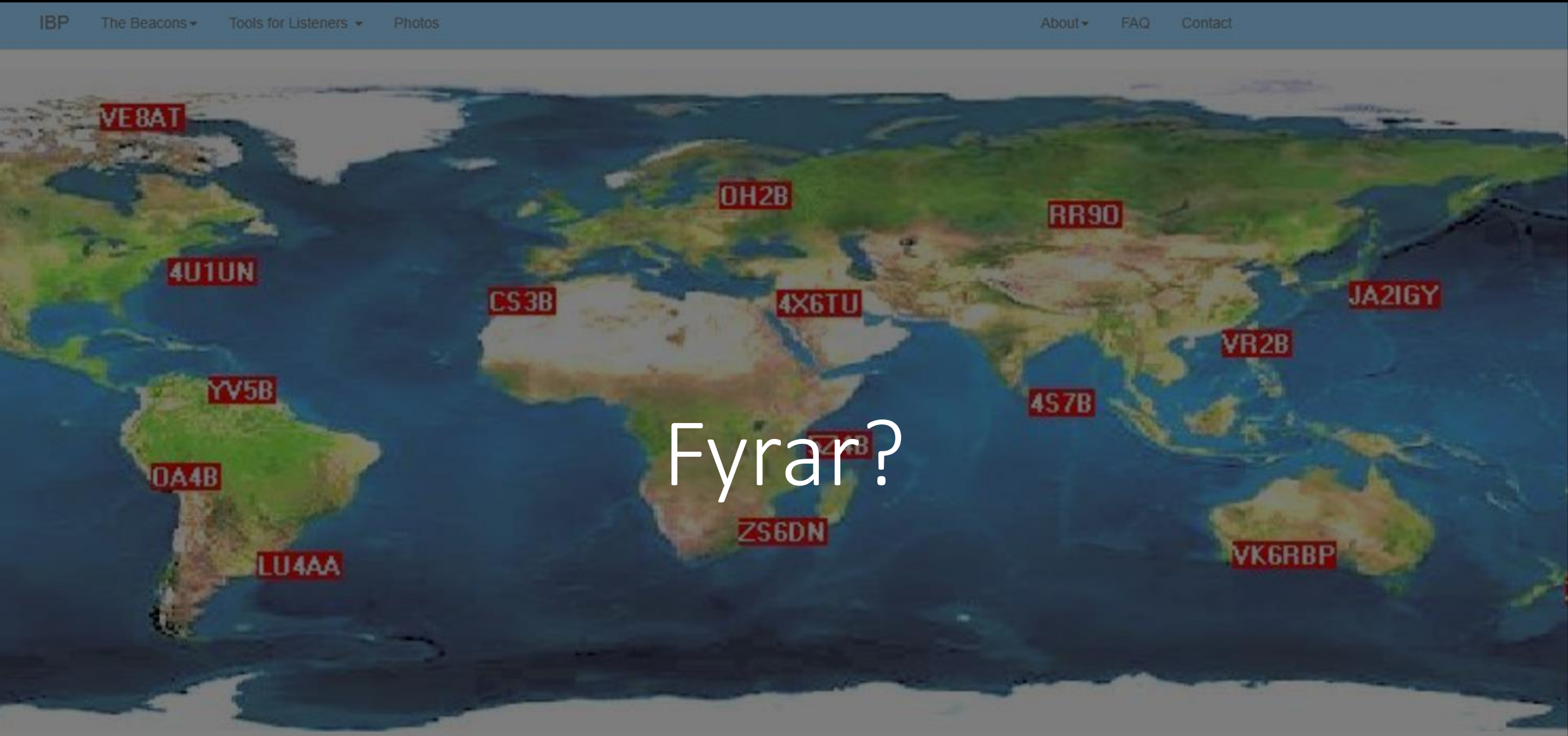



# Prickar och bakvända fyrar

## Att navigera i amatörradions digitala skärgård

Björn Ekelund SM7IUN

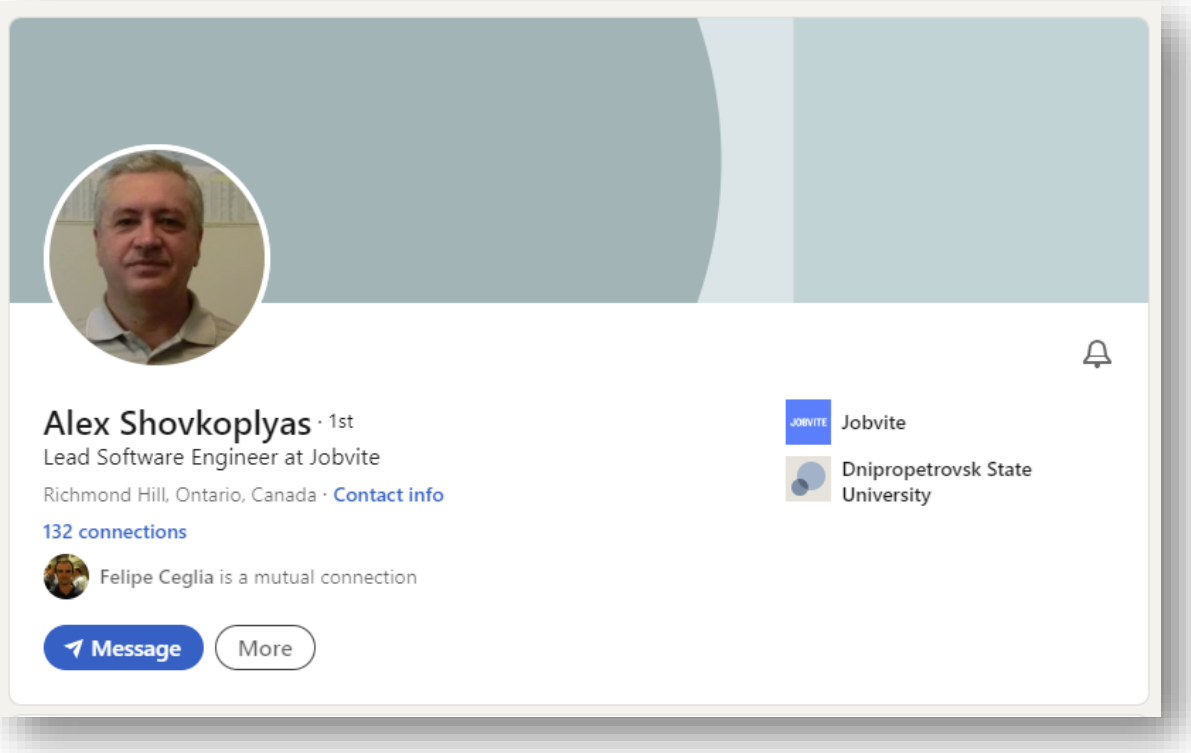

IBP
The Beacons
Tools for Listeners
Photos
About
FAQ
Contact
VE8AT
OH2B
RR9O
4U1UN
CS3B
4X6TU
JA2IGY
VR2B
YV5B
4S7B
Fyrar?
OA4B
ZS6DN
VK6RBP
LU4AA
NCDXF/IARU International Beacon Project
Transmission Schedule


Plan
Satellite
Mixte
Finland
Iceland
Canada
United States
Mexico
Venezuela
Algeria
Libya
Egypt
Mauritania
Niger
Chad
Sudan
Nigeria
Ethiopia
Kenya
Saudi Arabia
Iran
Iraq
Pakistan
Kazakhstan
Türkiye
Bakvända fyrar!
Données cartographiques ©2009 Europa Technologies
Google
/ 160m / 80m / 40m / 30m / 20m / 17m / 15m / 12m / 10m / 6m / 2m
world wide / zoom to US / zoom to Europe / zoom to North Atlantic

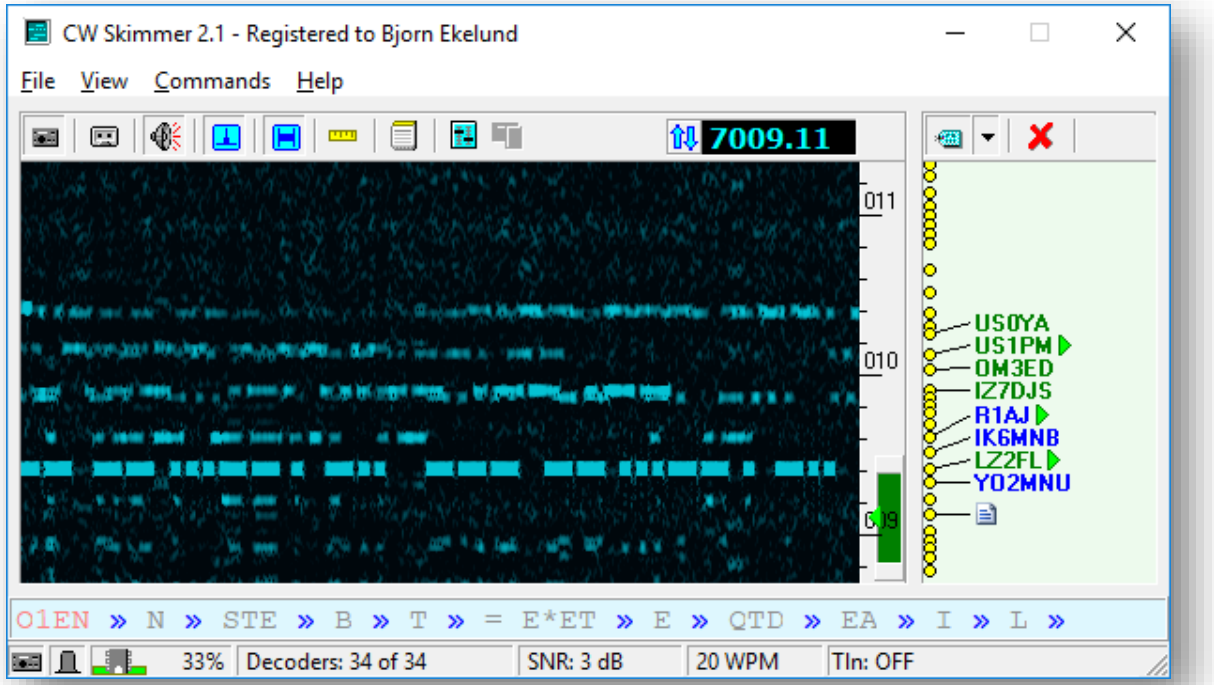
# Det startade med en briljant ingenjör

Alex Shovkoplyas, VE3NEA ex UR5EMI

”Canadian ham of the year” 2014



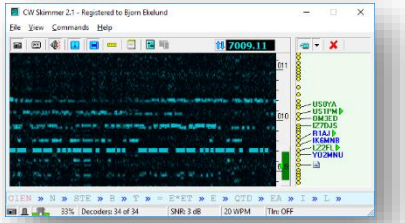

# Morseavkodaren ”CW Skimmer”




- Publicerad 2008 efter “sju års funderande”
- Baserad på Bayesisk statistik, en ”sorts” enkel AI
- Primärt tänkt att hantera pile-ups

# 2008: Planeterna stod på linje

Alex VE3NEA



Felipe PY1NB
(now CT7ANO)

DX WATCH

Dick W3OA

Nick F5VIH

Pete N4ZR

Phil N8VB


REVERSE BEACON NETWORK

welcome | main | dx spots | skimmers | downloads | about | contact us

Map | Satellite | Hybrid

Norwegian Sea
Greenland
Iceland
Sweden
Finland
Norway
United Kingdom
Ireland
Denmark
Poland
Belarus
Germany
Ukraine
Austria
France
Romania
Bay of Biscay
Italy
POWERED BY Google
Terms of Use

/ 160m / 80m / 40m / 30m / 20m / 17m / 15m / 12m / 10m / 6m / 2m

world wide / zoom to US / zoom to Europe / zoom to North Atlantic

show/hide my last filters

showing spots for DX call: LA3ZA

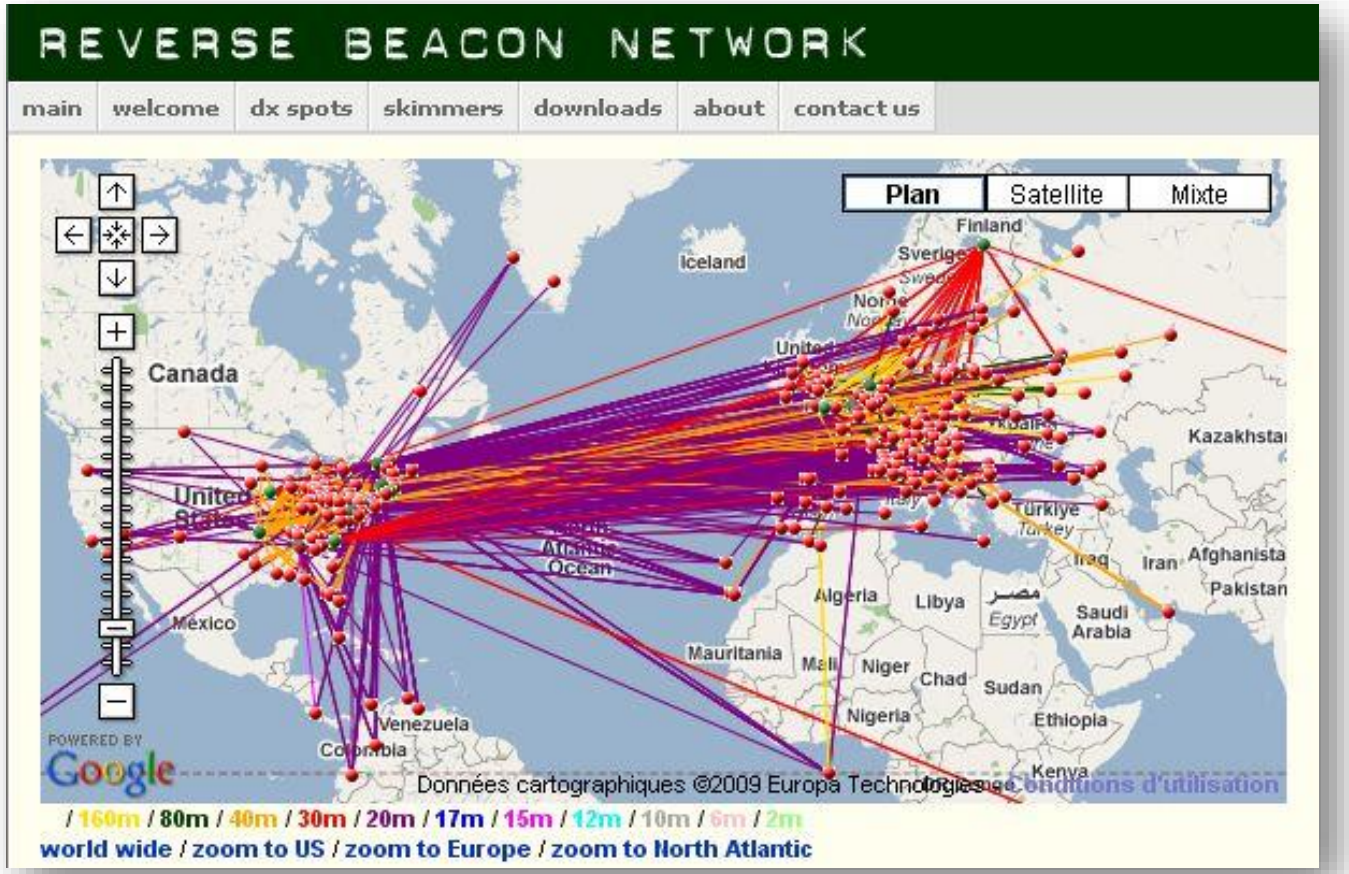
search spot by callsign

rows to show: 50

| de | dx | freq | cq/dx | snr | speed | time |
|---|---|---|---|---|---|---|
| DL0LBS | LA3ZA | 3534.4 | CW CQ [LoTW] | 19 dB | 16 wpm | 2031z 22 Apr |
| DL1EMY | LA3ZA | 3534.3 | CW CQ [LoTW] | 29 dB | 15 wpm | 2028z 22 Apr |
| DR1A | LA3ZA | 3534.3 | CW CQ [LoTW] | 23 dB | 15 wpm | 2028z 22 Apr |
| LA5EKA | LA3ZA | 3534.3 | CW CQ [LoTW] | 16 dB | 15 wpm | 2016z 22 Apr |
| DF7GB | LA3ZA | 3534.3 | CW CQ [LoTW] | 19 dB | 15 wpm | 2016z 22 Apr |

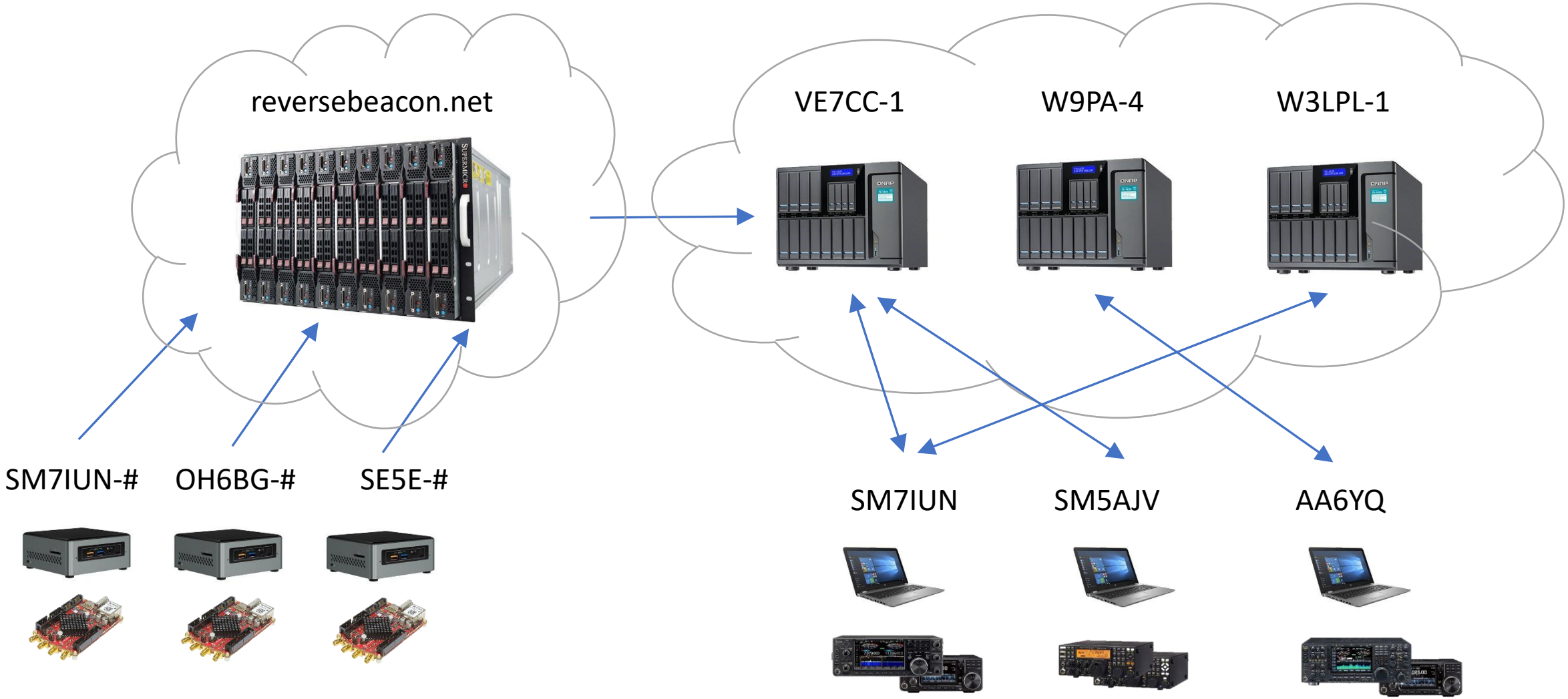
# The Reverse Beacon network

- Ett globalt nätverk av robotmottagare, ”skimmers”
- Över 200 “skimmers” som lyssnar dygnet runt
- Global täckning men flest mottagare i EU och NA



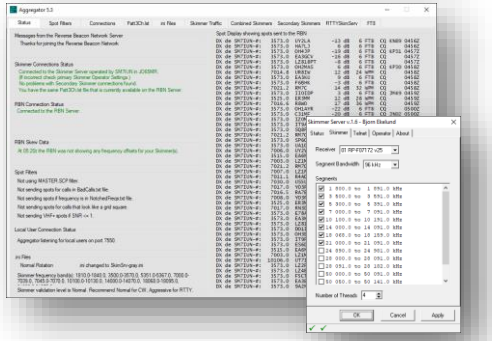

http://www.reversebeacon.net

# RBN och klustret



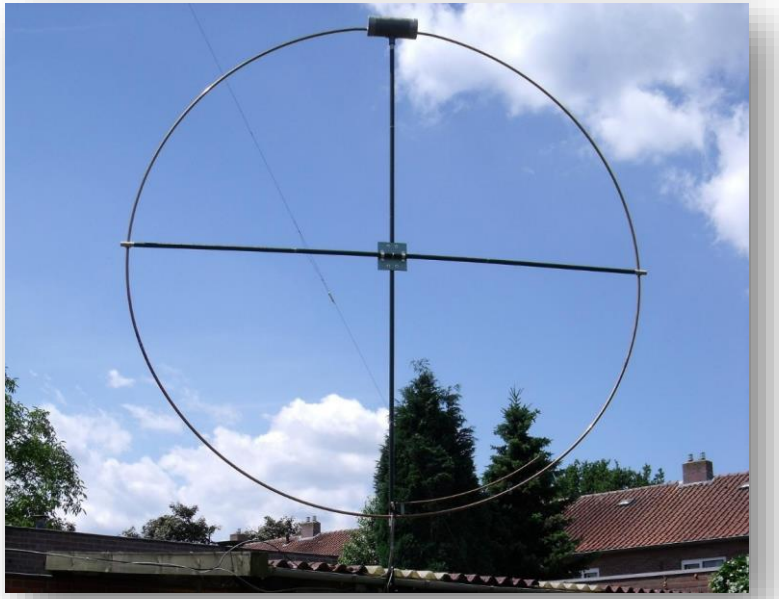
# En skimmers beståndsdelar


```
for i in people.data.users:
    response = client.api.statuses.user_timeline.get(screen_name=i.scre
    print 'Got', len(response.data), 'tweets from', i.screen_name
    if len(response.data) != 0:
        ltdate = response.data[0]['created_at']
        ltdate2 = datetime.strptime(ltdate,'%a %b %d %H:%M:%S +0000 %Y'
        today = datetime.now()
        howlong = (today-ltdate2).days
        if howlong < daywindow:
            print i.screen_name, 'has tweeted in the past' , daywindow,
            totaltweets += len(response.data)
            for j in response.data:
                if j.entities.urls:
                    for k in j.entities.urls:
                        newurl = k['expanded_url']
                        urlset.add((newurl, j.user.screen_name))
        else:
            print i.screen_name, 'has not tweeted in the past', daywinde
```



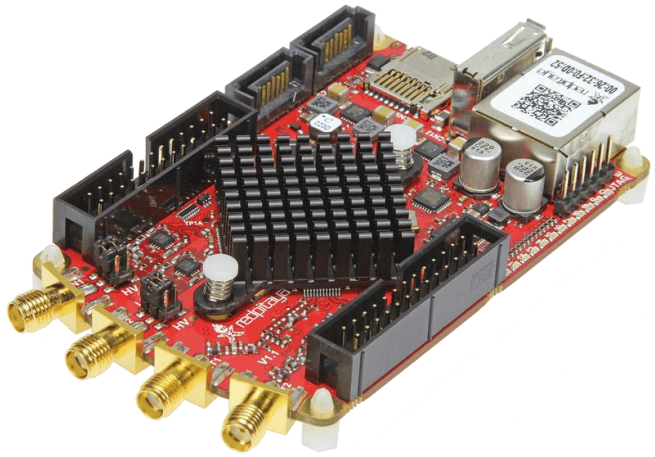
# #1 Antenn

- Skall vara
  - Bredbandig
  - Alltid ansluten
  - Vara immun mot lokala störkällor eller placerad i en störfri miljö
- Behöver inte
  - Fungera för sändning
  - Vara särskilt effektiv, SNR är viktigare än RSSI
  - Vara stor



# #2 Mottagare

- Behöver
  - Ha en digital kvadraturutgång samplad vid 48, 96, eller 196kHz
  - Producera radiodata i QS1R- eller HPSDR-format via Ethernet
  - Täcka hela kortvågen, helst 1.8 till 52MHz
  - Ha stöd för ett flertal mottagarinstanser
  - Vara frekvensstabil



- Behöver inte
  - Knappar och vred
  - En audiokedja

# SDR-mottagare

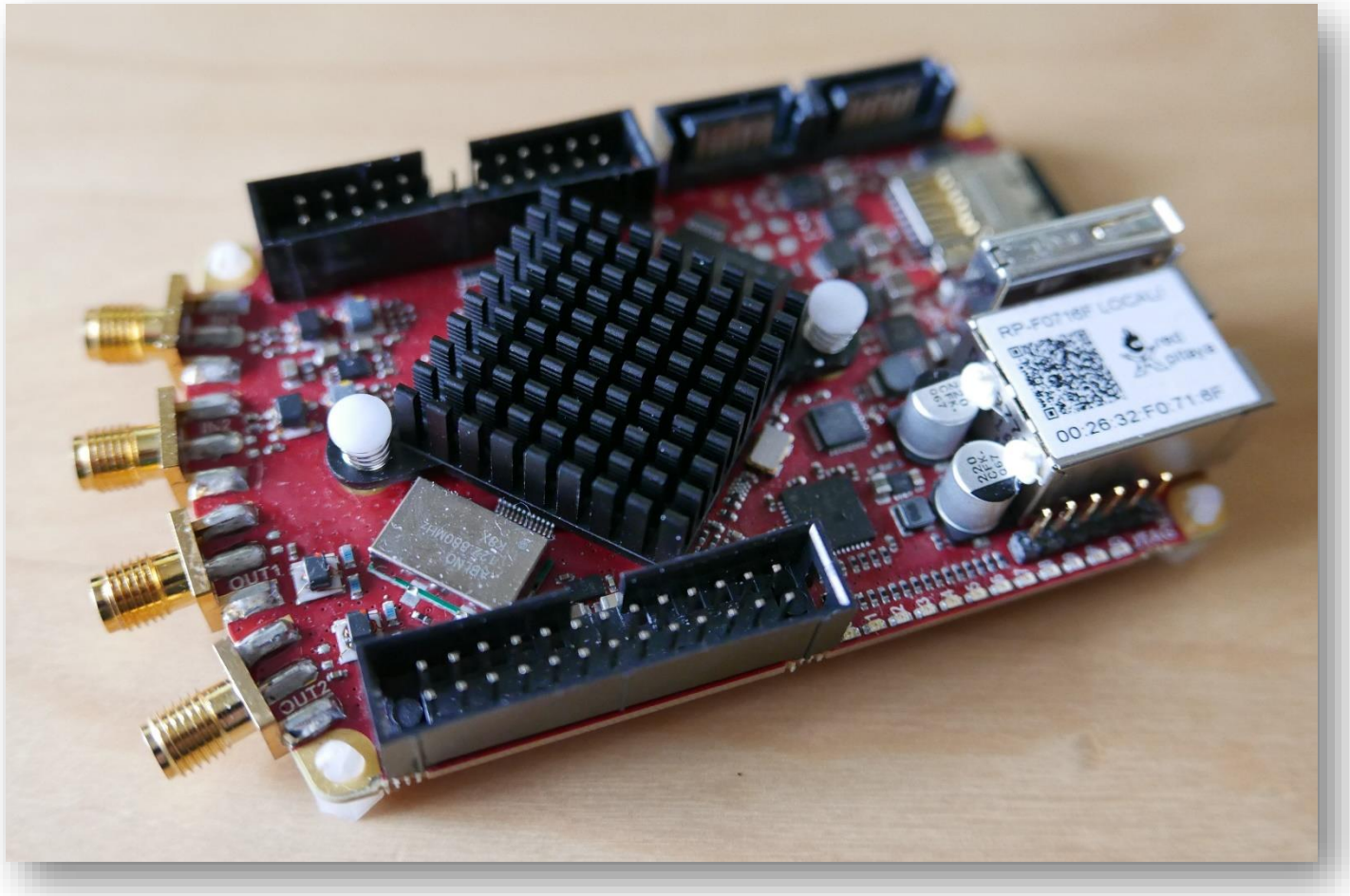




# “The Raspberry Pi of DSP”

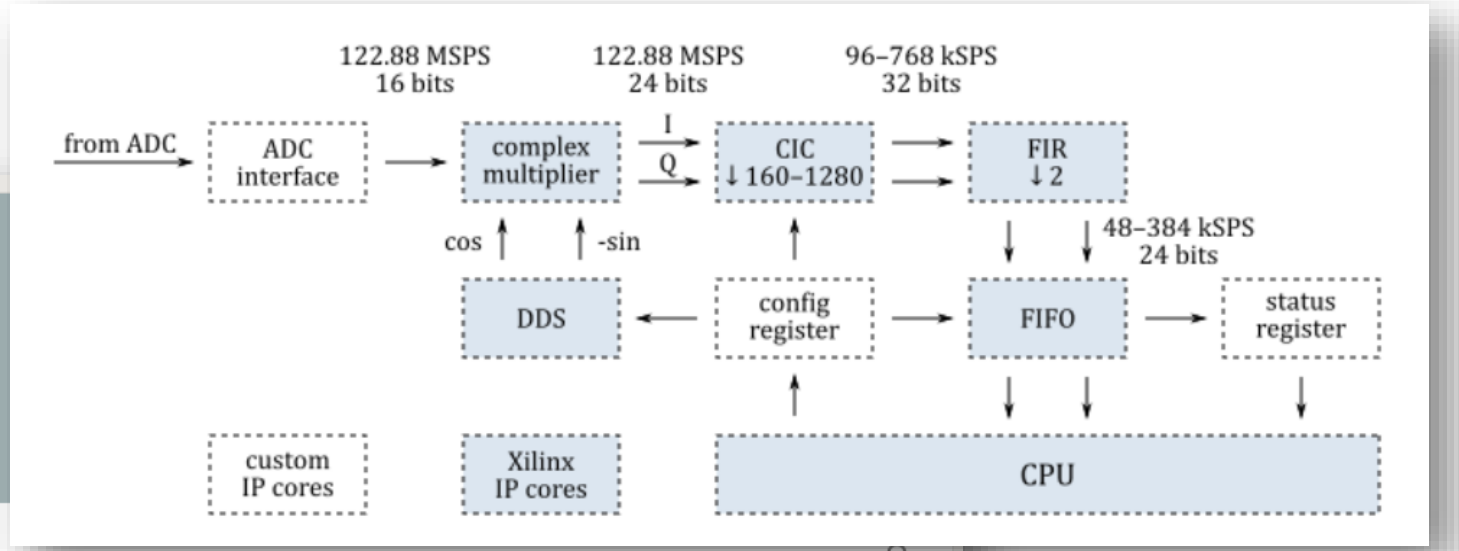
## Red Pitaya 122.88-16

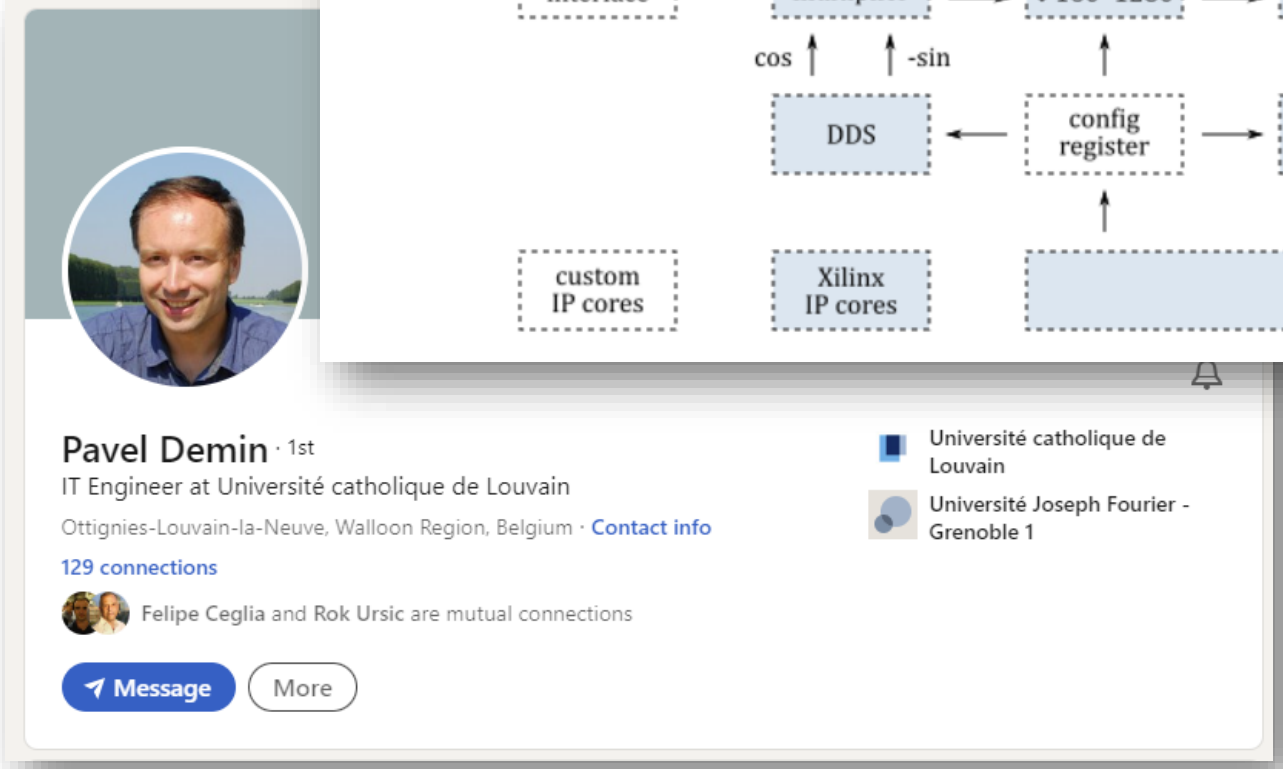
- Byggd på Xilinx Zynq 7020
- FPGA med 85,000 logiska celler
- 220 programmerbara DSP segment
- Prestanda på 276 GMAC/s
- 667MHz Cortex A9 MPcore med Neon and CoreSight co-processorer
- Två 122.88MHz 16 bit ADC/DAC
- Fyra 100kHz ADC/DAC
- 16 GPIO
- ABLNO XO <50fs jitter




https://redpitaya.com/sdrlab-122-16

# Pavel Demin @ KU Leuven

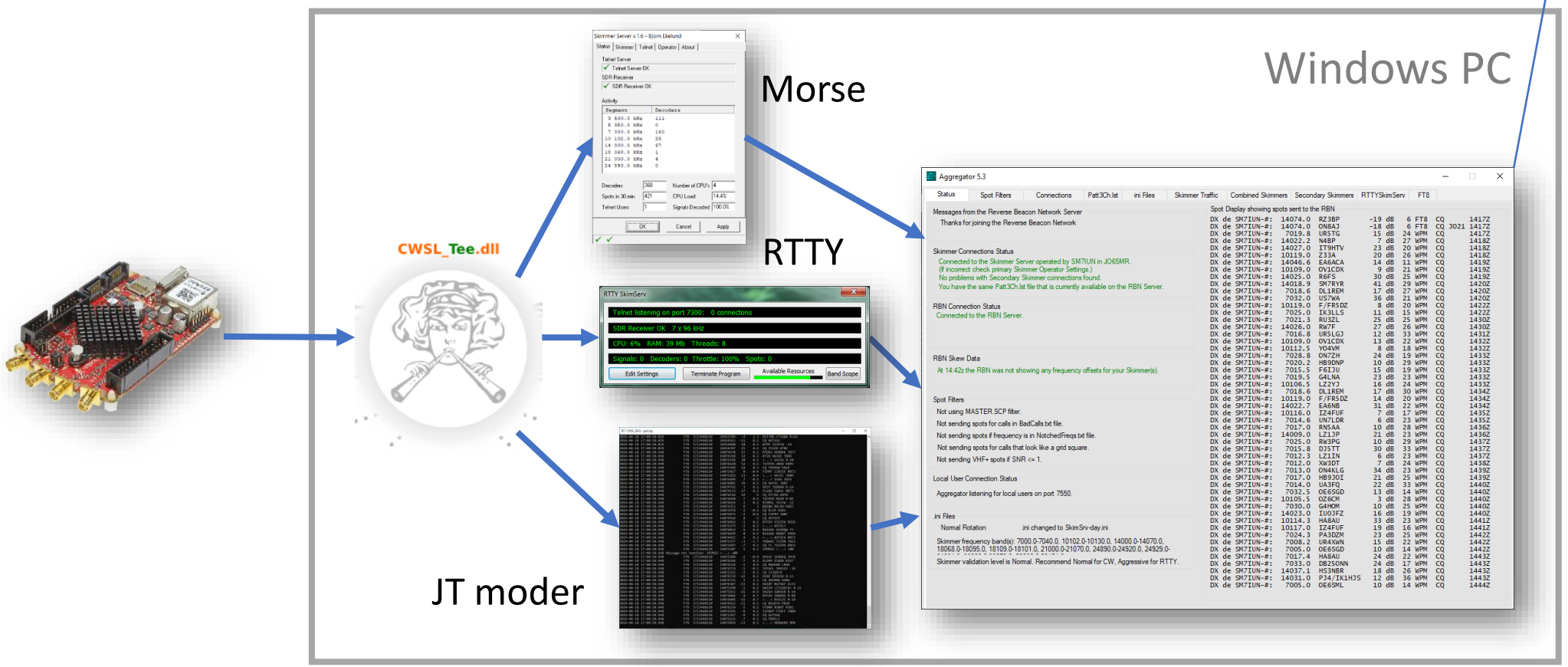



1. List of components
2. Links
3. Development machine
4. LED blinker
5. SDR receiver
6. SDR transceiver
7. SDR transceiver compatible with HPSDR
8. SDR receiver compatible with HPSDR
9. Embedded SDR transceiver
10. Wideband SDR transceiver
11. Multiband WSPR transceiver
12. Multiband FT8 transceiver
13. Pulsed Nuclear Magnetic Resonance
14. Multichannel Pulse Height Analyzer
15. Scanning system
16. Vector Network Analyzer
17. Alpine with pre-built applications

http://pavel-demin.github.io/red-pitaya-notes

# Skimmernodens programvara



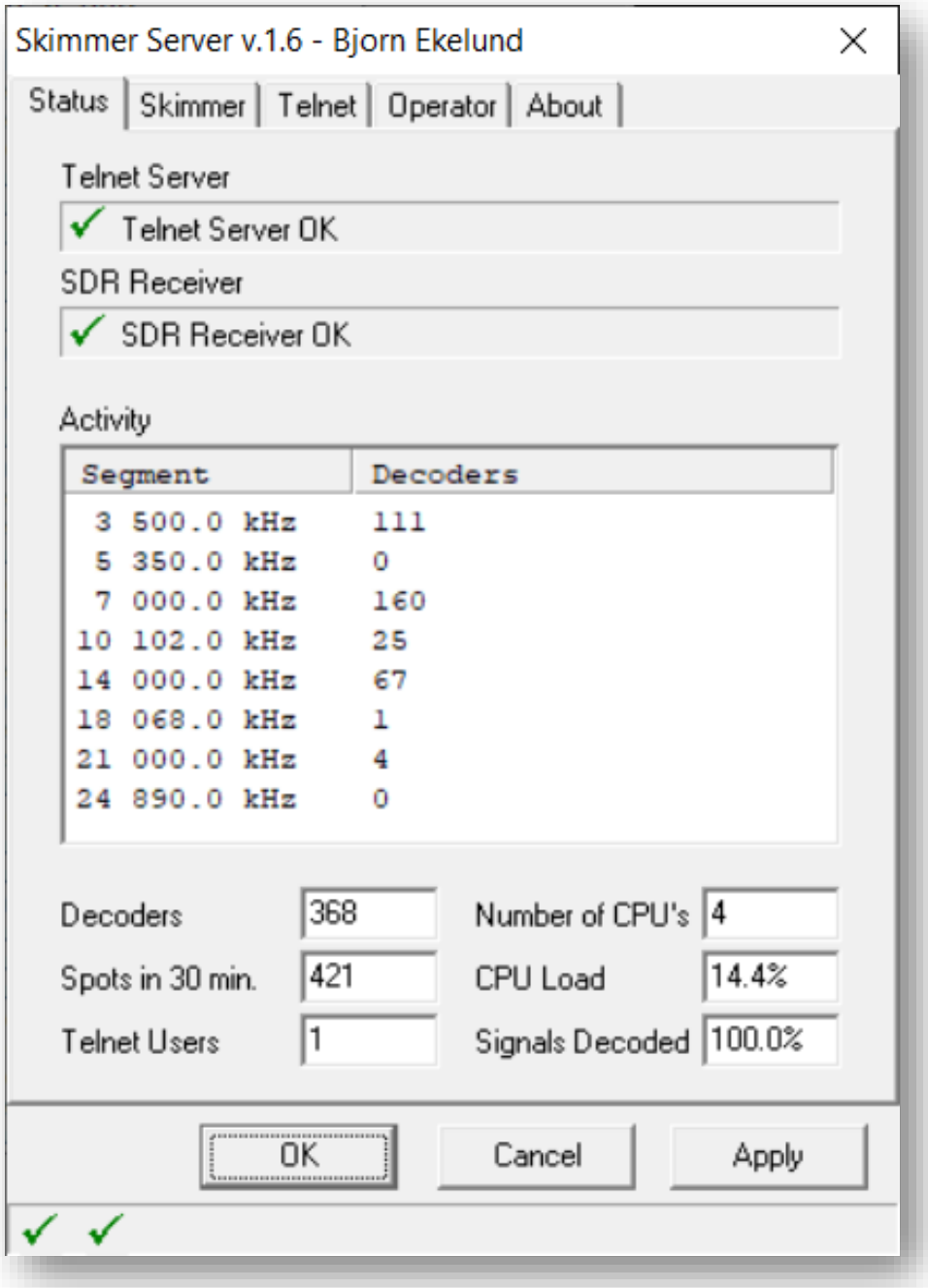
# CW Skimmer Server

- En ”inbyggd” version av CW Skimmer
- Telnet gränssnitt till RBN Aggregator eller en klusternod

- 8 × 92kHz segment motsvarar 10-20% last på en 2GHz Core i5 processor

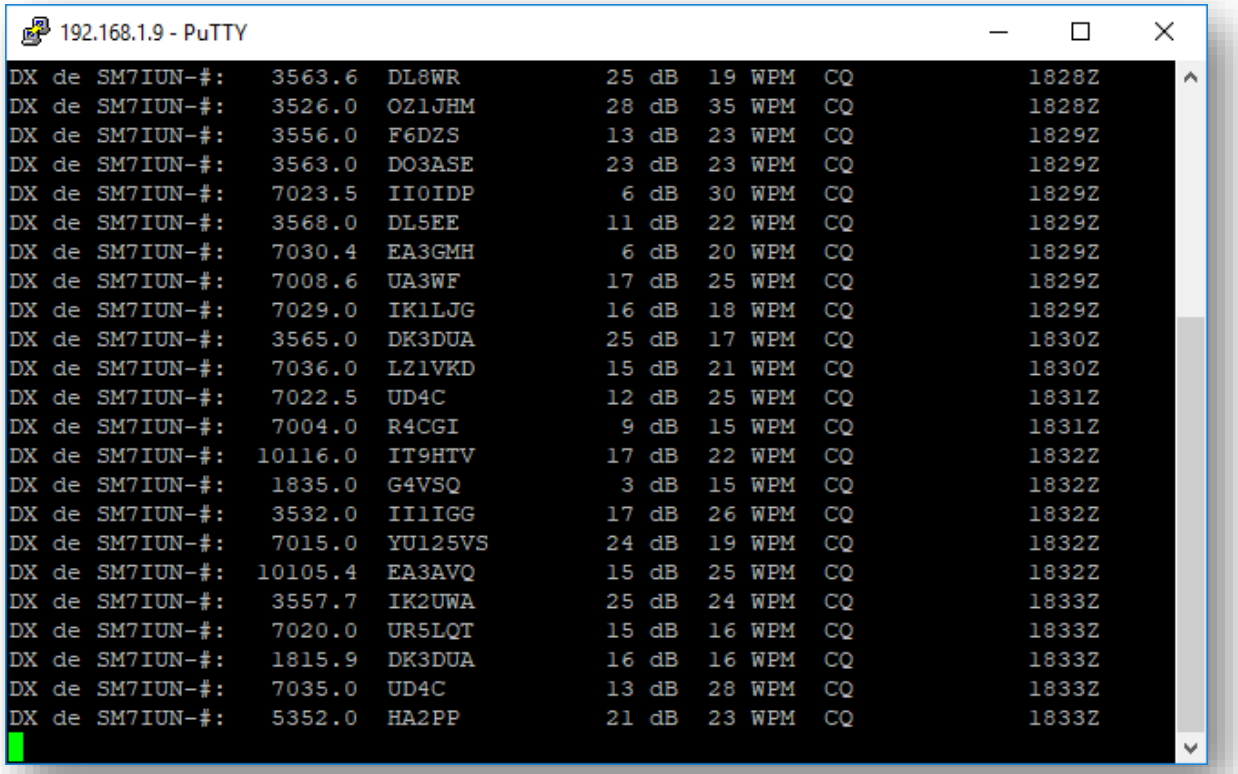
- Kostar 75 USD

http://www.dxatlas.com/SkimServer



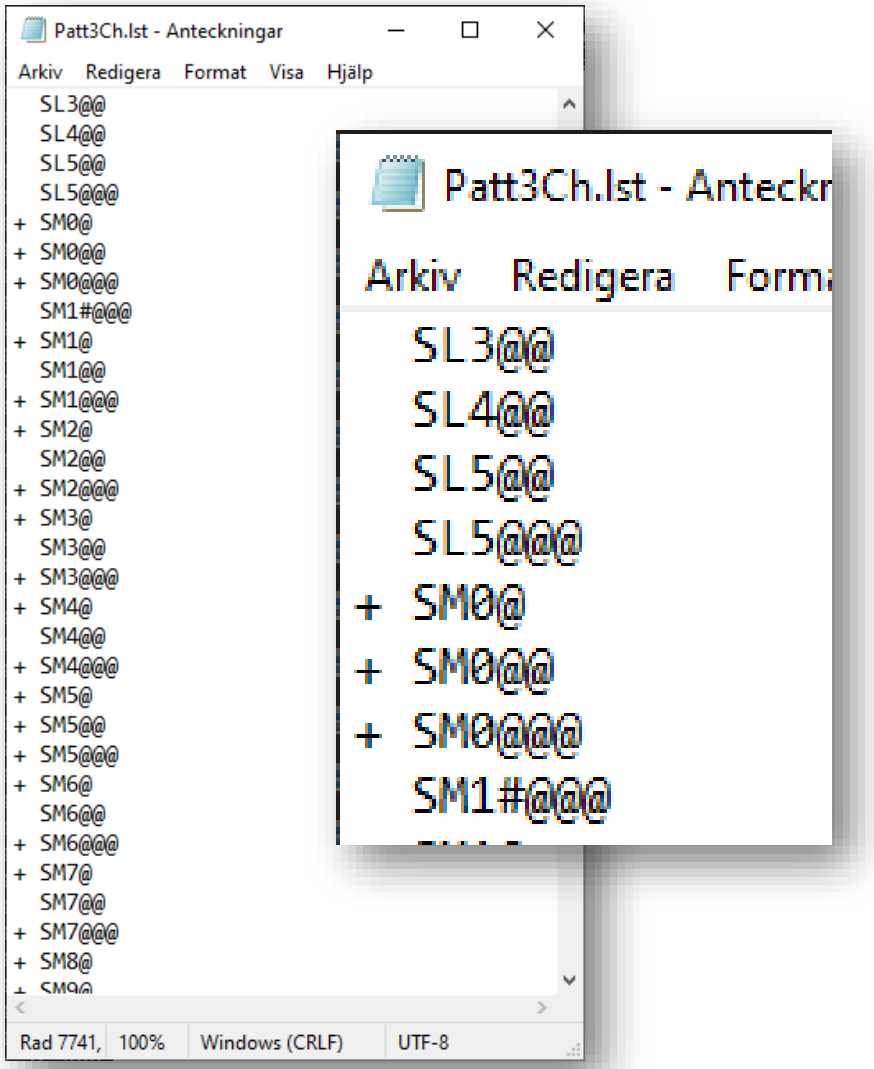
# CW Skimmer Server

Producerar ett Telnetflöde med frekvens, avkodad anropssignal, SNR, sändningshastighet och tidpunkt




- Normalt rapporterar CW Skimmer Server endast stationer som ropar CQ men en del (LID) skimmerägare väljer att rapportera alla hörda call.

# Mönsterdatabasen Patt3ch.lst




- @ = valfri bokstav
- # = valfri siffra
- + = aktiv station
- SL7FRO ❌
- SM0HEV ✅
- ”Watch list” för prioriterade call

Udda call för dxpedition eller contest?
Kontakta **Pete N4ZR pete.n4zr@gmail.com**

https://www.reversebeacon.net/pages/patt3ch.lst+36

# Vem blir spottad?

- Lyssnar på flera tusen 50Hz ”kanaler”
- 256 tecken långt minne
- Nyckelord: CQ QRZ TEST NA SS FD UP
- Känslig för QSD
- 10 minuters repetitionscykel

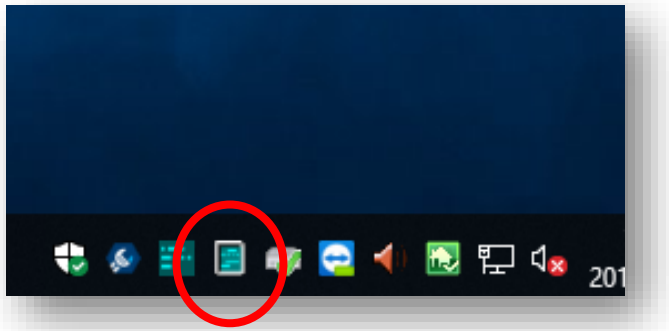
- CWT SM7IUN ✗
- CQ CWT SM7IUN ✓
- WSEM RM2D ✗

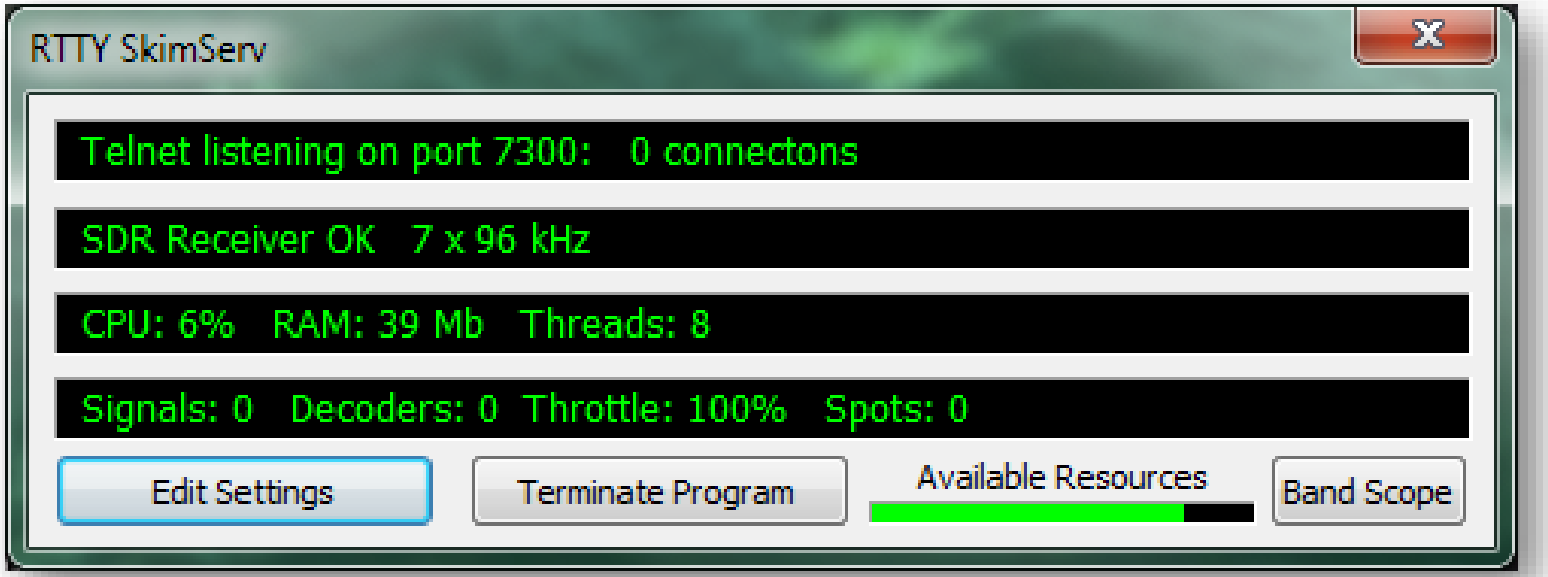
**Number of Repetitions Required to be Spotted**

| **Pattern File/Validation** | Minimal | Normal | Aggressive | Paranoid* |
|---|---|---|---|---|
| Watch list | 1 | 1 | 2 | 2 |
| + in pattern file | 2 | 2 | 4 | - |
| No + but in file | 2 | 3 | 4 | - |
| Not in file | 2 | 5 | - | - |
| Not ITU prefix | - | - | - | - |

# RTTY Skimmer Server

- En RTTY-version av CW Skimmer Server med ett Telnet gränssnitt till RBN
- CPU-krävande
- Kostar 50 USD

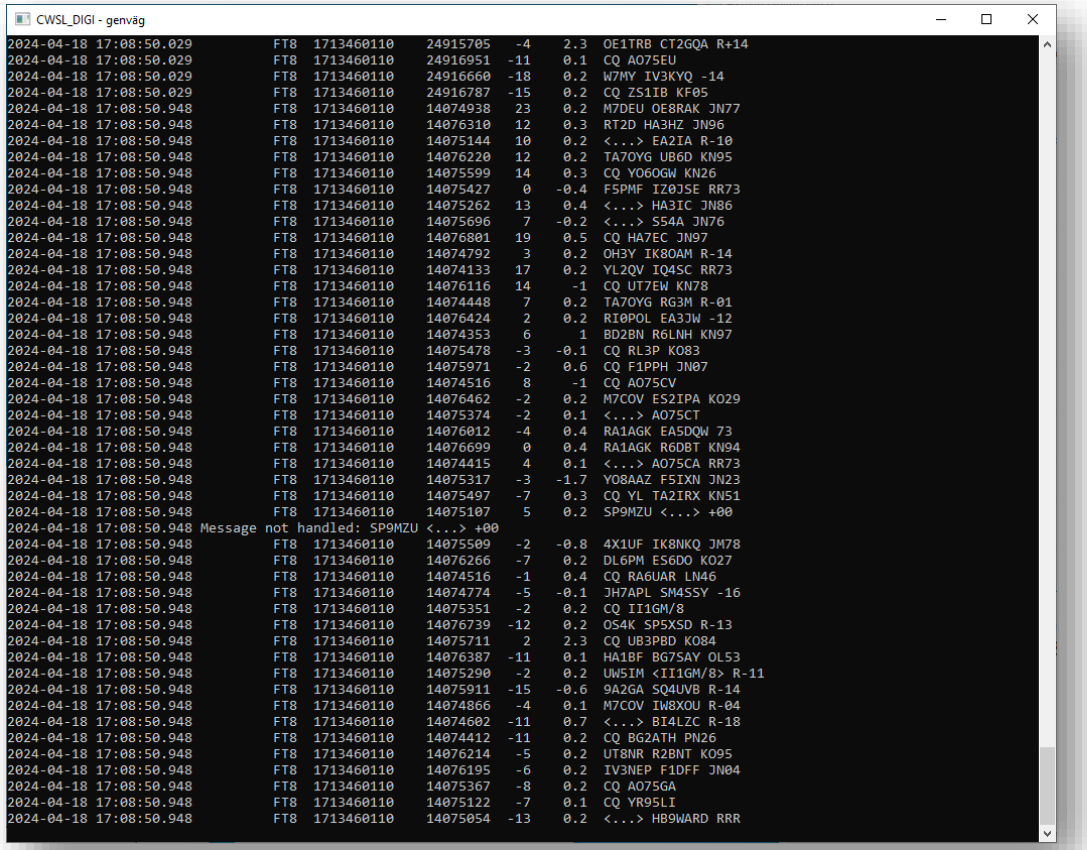





http://www.dxatlas.com/SkimServer

# CWSL_DIGI

Avkodar alla trafiksätt som stöds av WSJT-X: FT8, FT4, JT65, JS8Call, WSPR, etc.



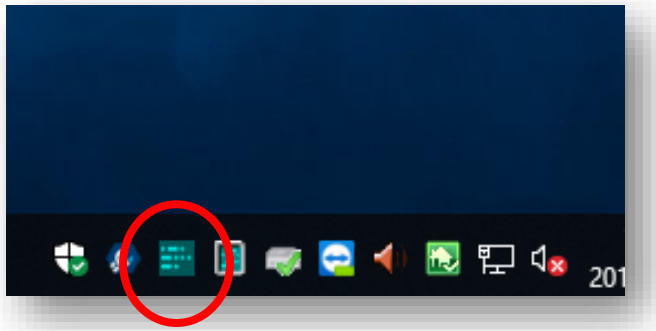

- Producerar spottar via UDP på samma sätt som WSJT-X och MSHV
- Kan köra ett godtyckligt antal avkodare men det **kostar processorkraft**
- Rapporterar **alla hörda stationer**

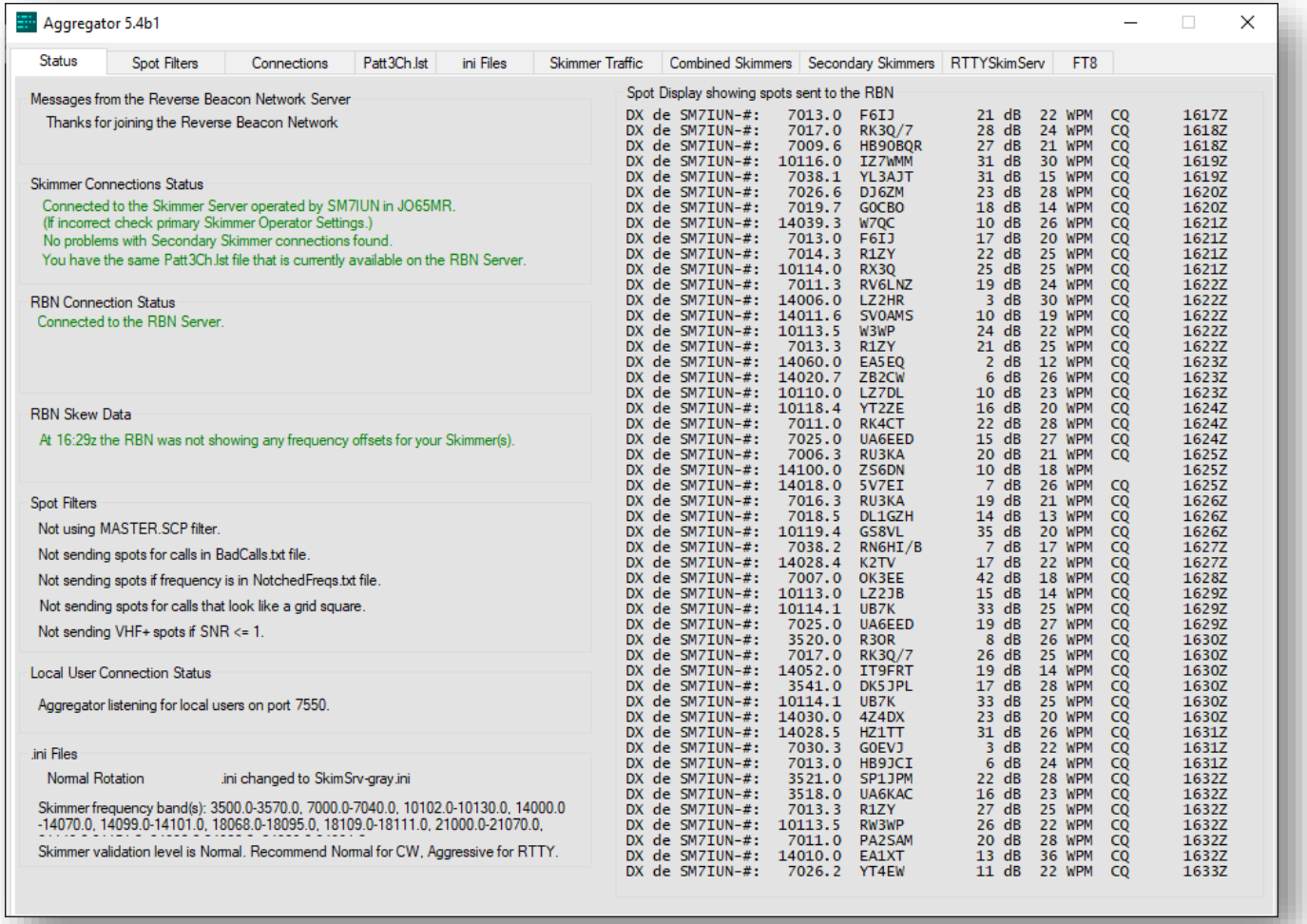
- Gratis

https://github.com/alexranaldi/CWSL_DIGI

# RBN Aggregator

- **Kurerar och aggregerar** spottar från skimmermottagaren innan den rapporterar dem till RBN
- Försumbar CPU-last
- Ansluter till CW Skimmer Server och RTTY Skimmer Server via Telnet
- Ansluter till WSJT-X, MSHV och CWSL_DIGI via UDP

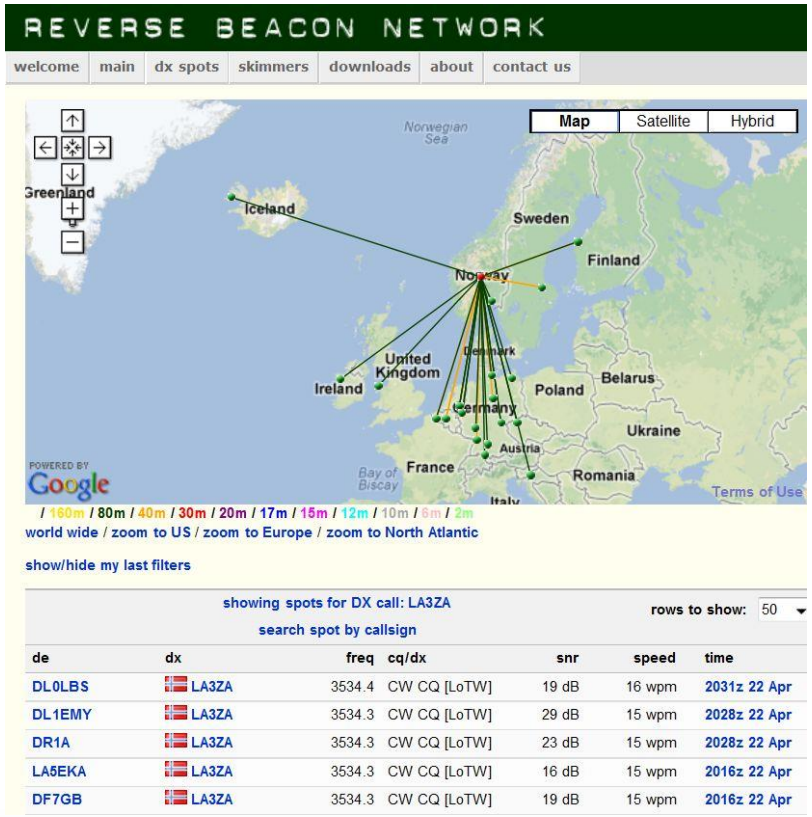


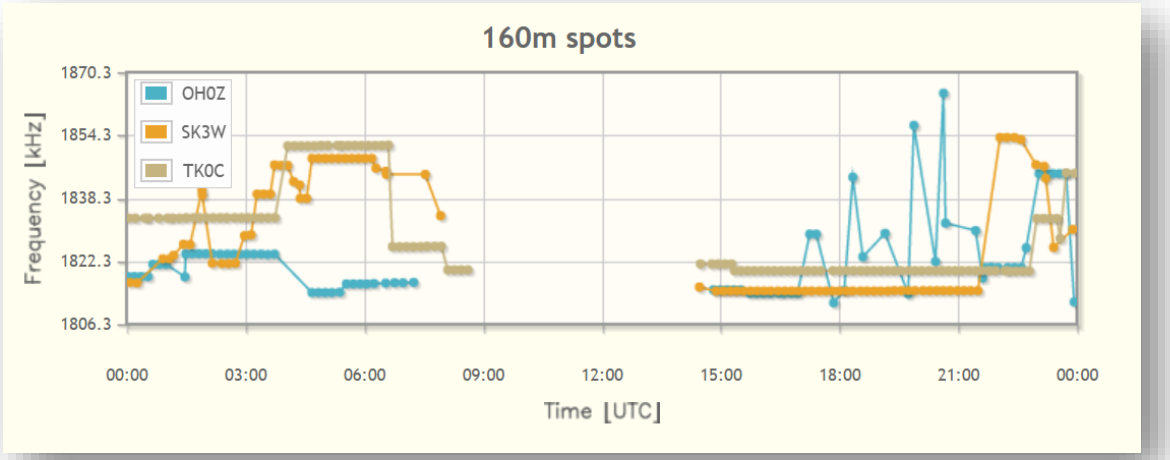


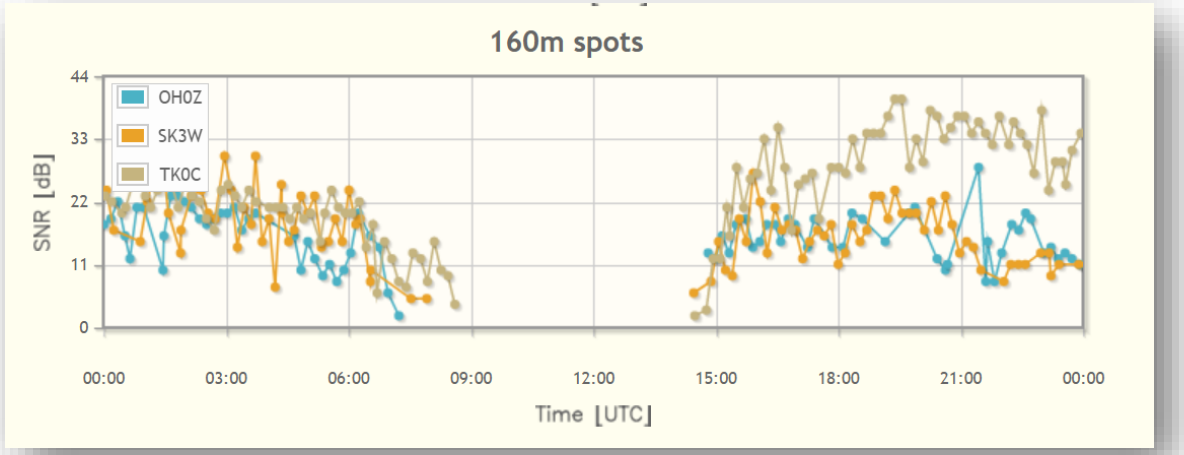

http://www.reversebeacon.net/pages/Aggregator+34

# The Reverse Beacon network

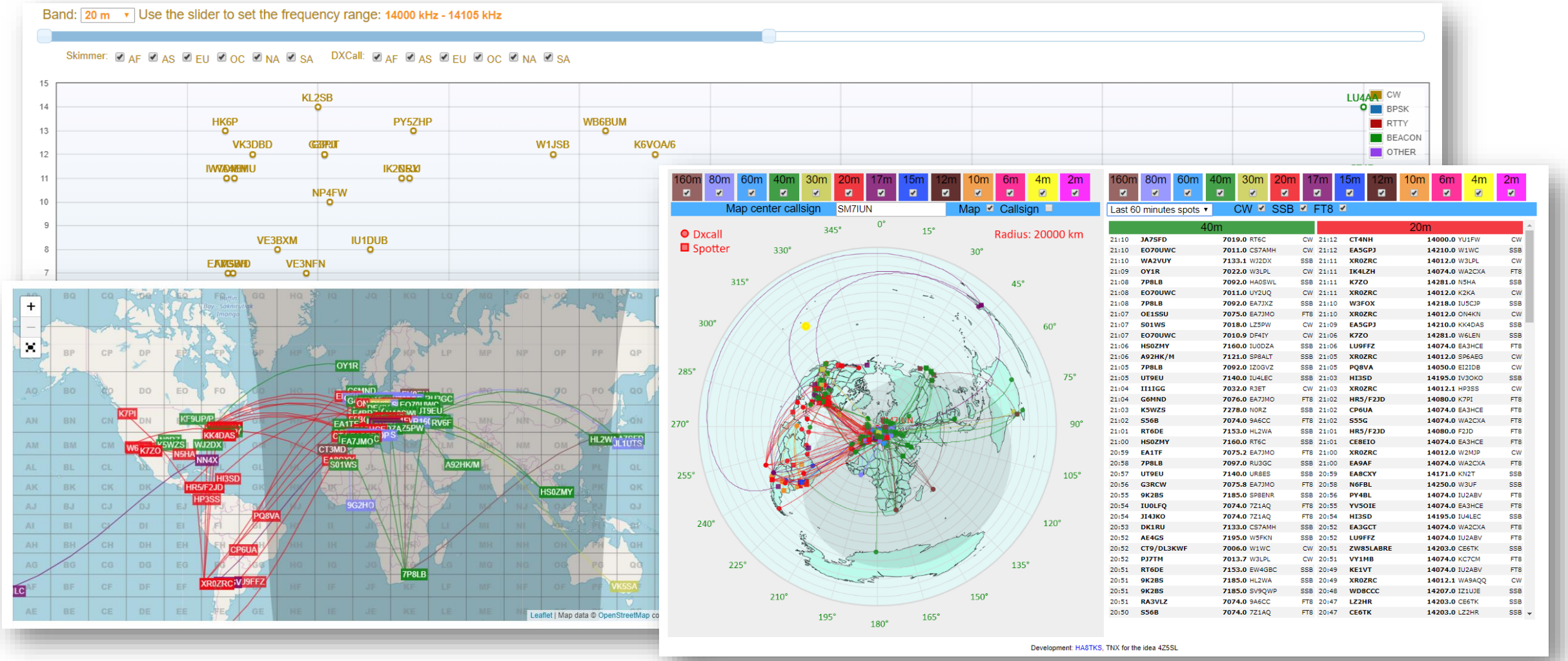
- En webtjänst
- En kortvågens ”data lake” med all data tillgängligt för nedladdning (CW & RTTY)
- 300,000,000+ datapunkter sen 2009
- En rik uppsättning analysverktyg



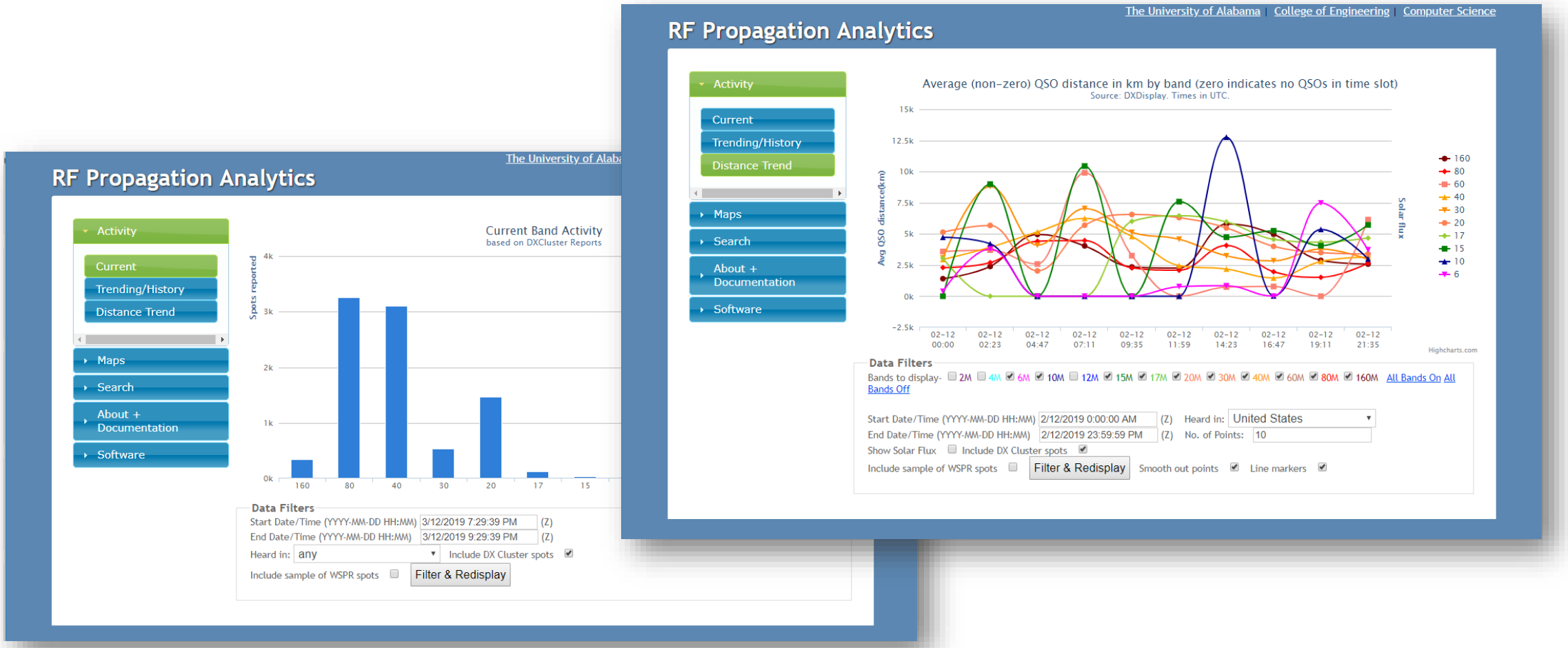



# Cloud-to-cloud: HA8TKS



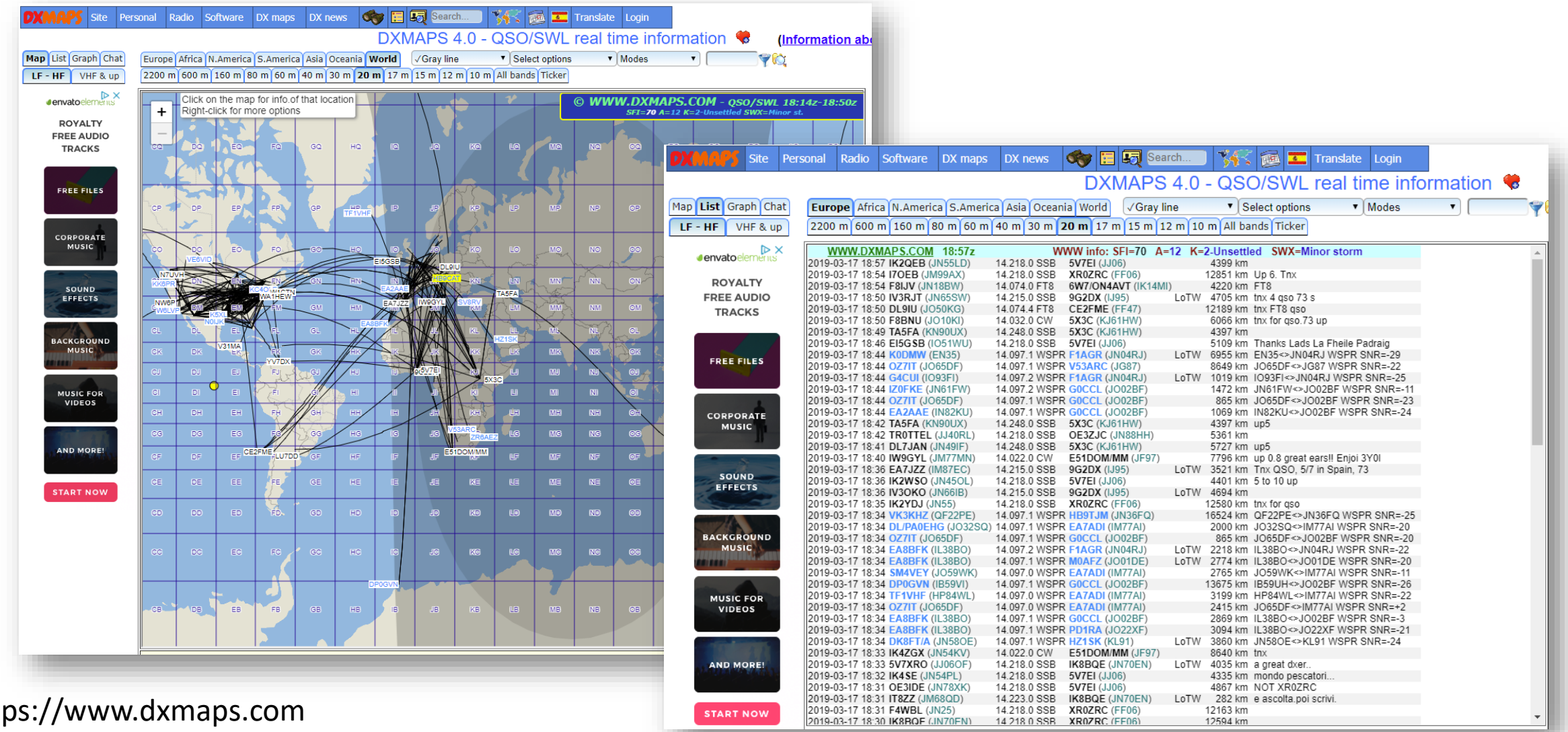

https://dxcluster.ha8tks.hu

# Cloud-to-cloud: University of Alabama



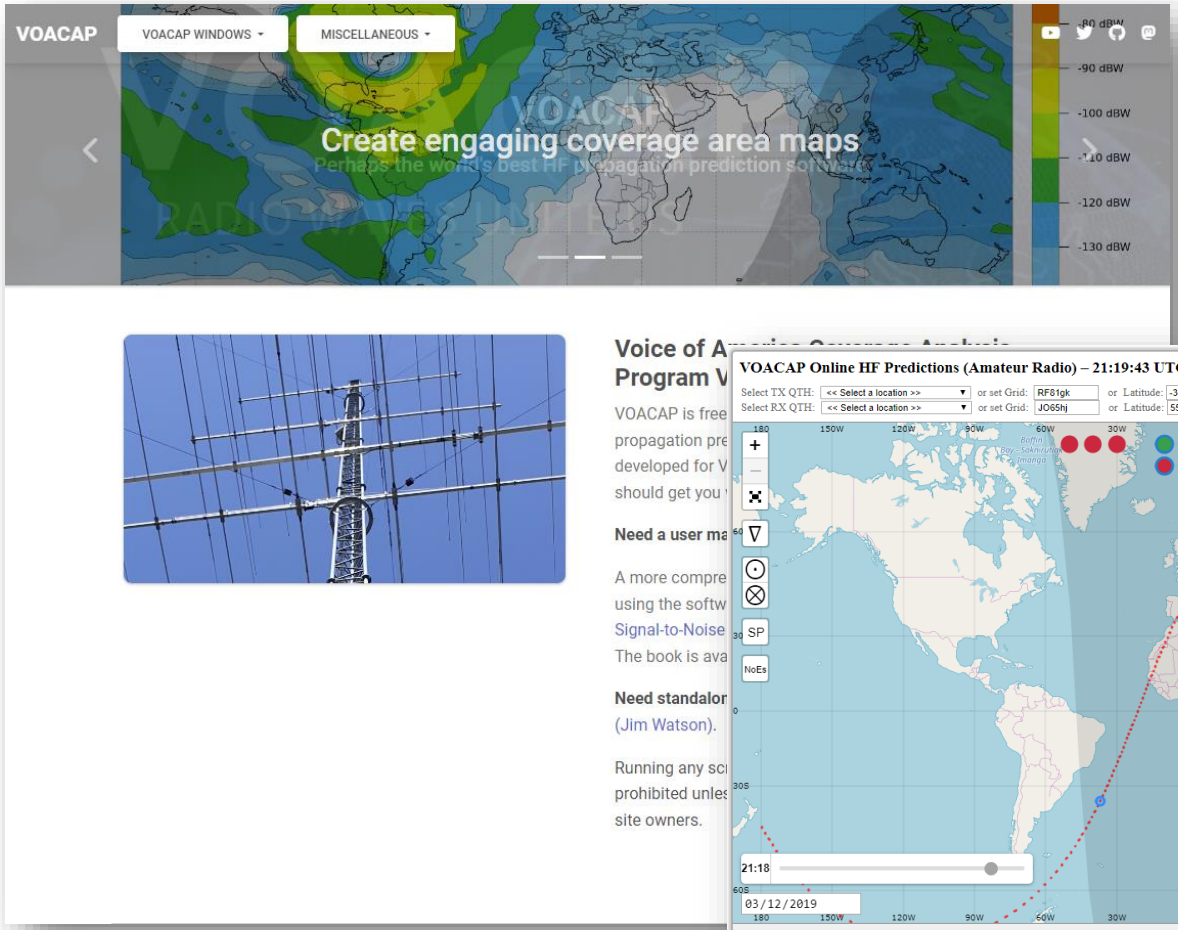

https://dxdisplay.caps.ua.edu

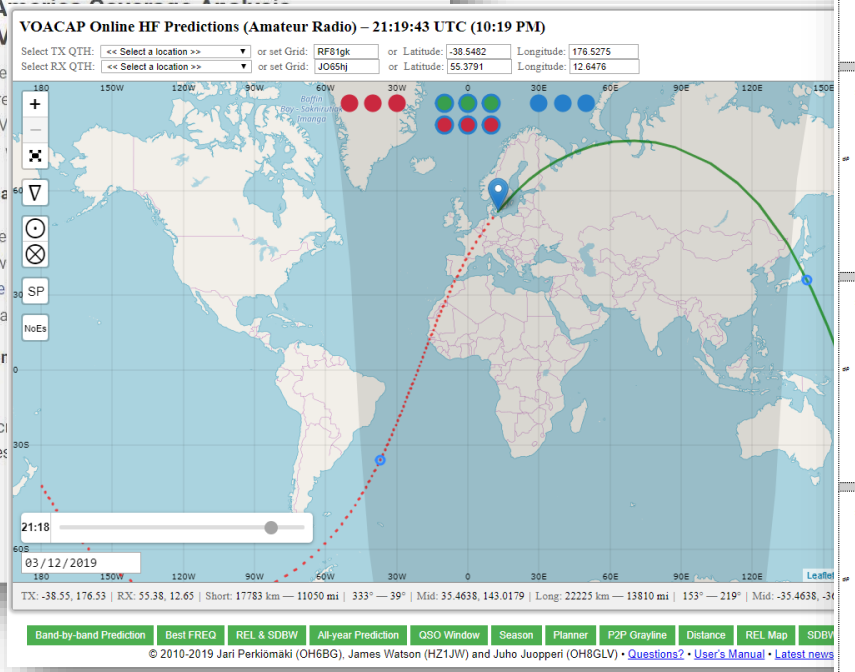
# Cloud-to-cloud: DX maps

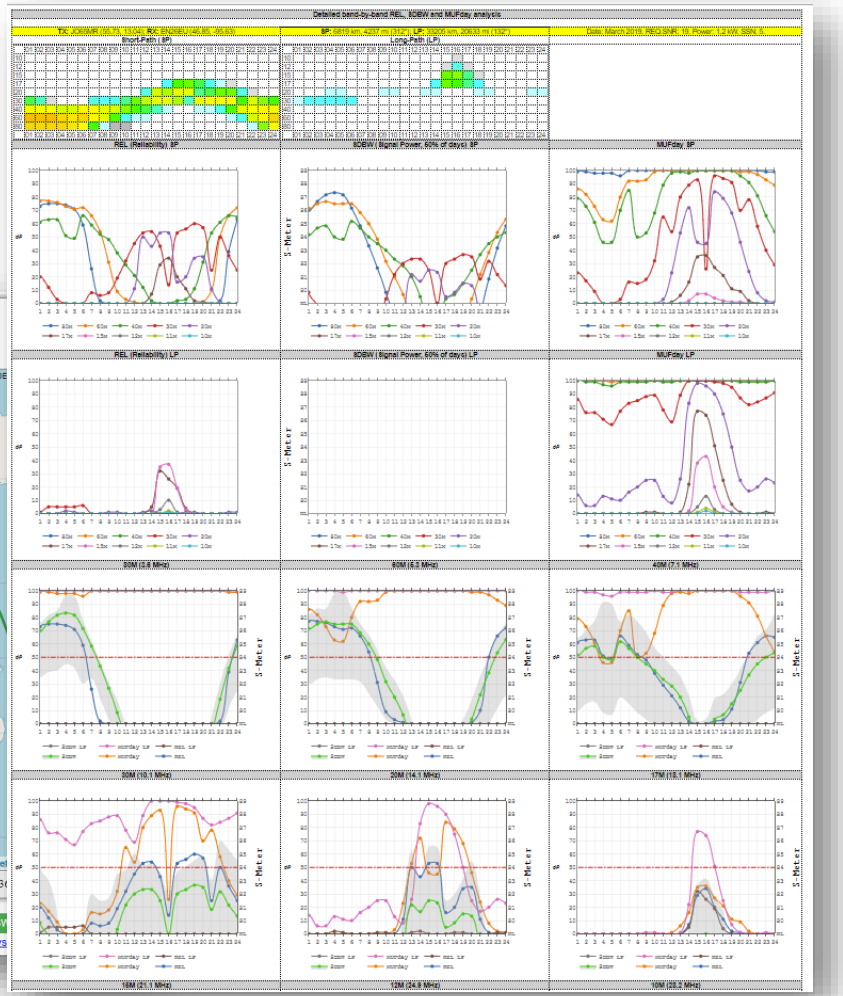



https://www.dxmaps.com

# Cloud-to-cloud: VOACAP



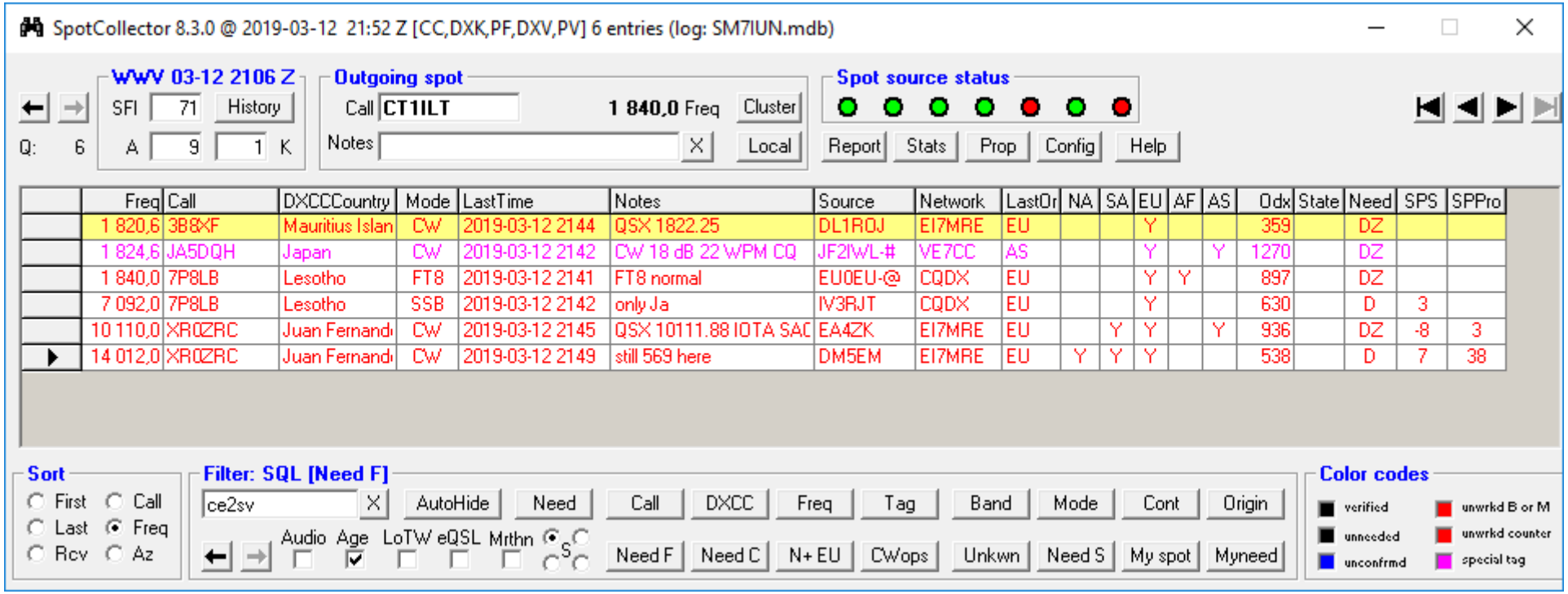



http://www.voacap.com

# Klientprogram: DXLab SpotCollector

Del av den betydligt större DXLab-sviten för komplett hantering av en amatörradiostation.
Integrerad med utbredningsförutsägelser, loggbok, diplomhantering, etc.




http://www.dxlabsuite.com

# Vad kan RBN göra för dig?

## Test

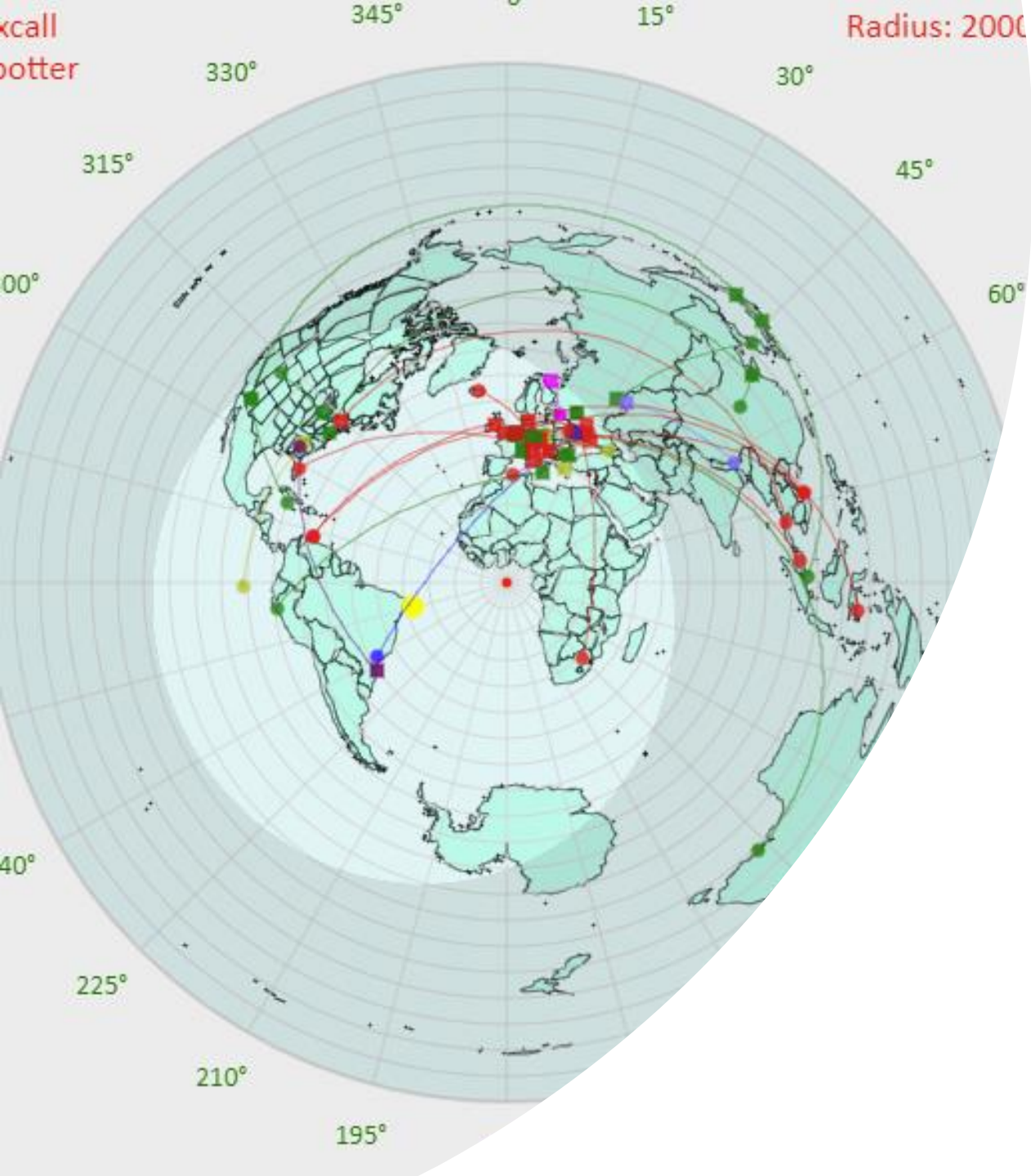
- Bandöppningar
- Fyller bandkartan
- Spottar dig
- Visar lediga frekvenser
- Jämförelser med konkurrenter

## DX

- Varseblivning
- Bandöppningar
- Utbredningsanalys
- Varningar

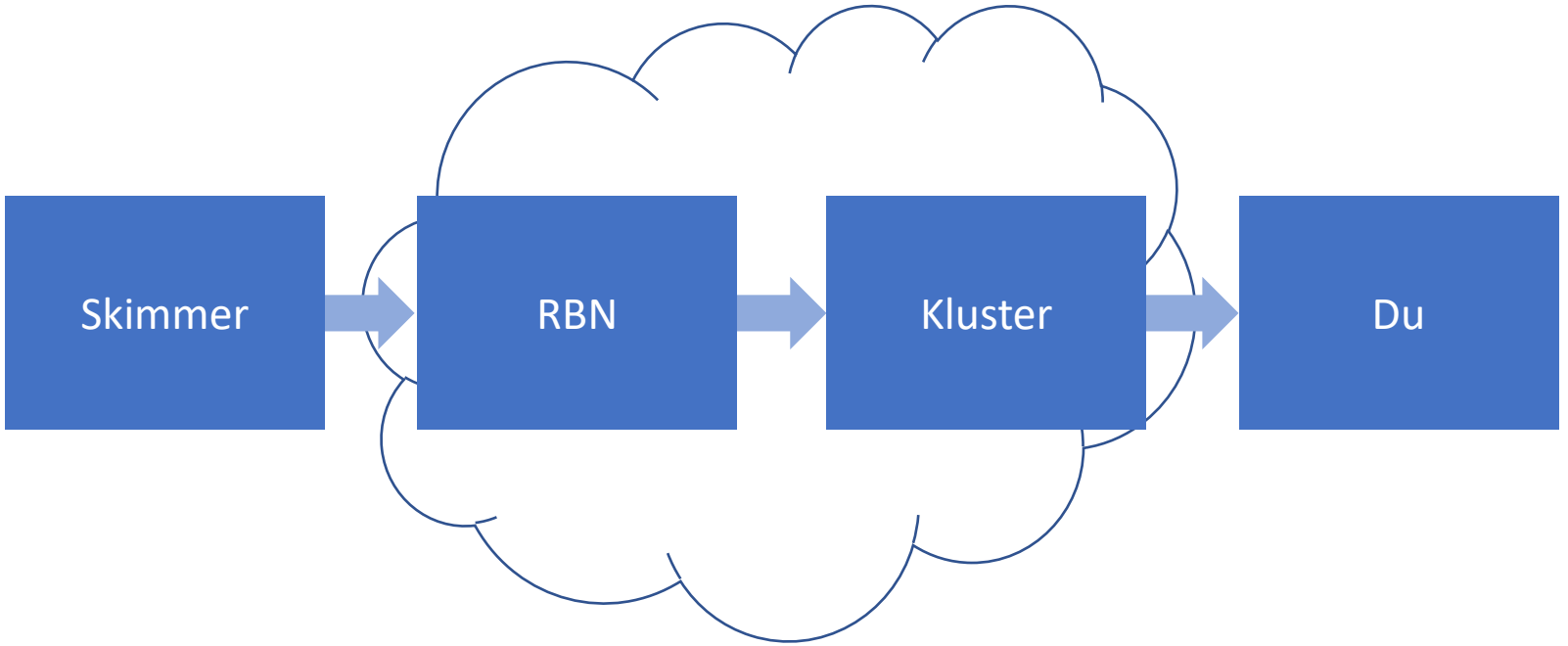
## Antenn-experiment

- Antennprestanda
- Riktverkan och utbredningsvinkel
- A-B tester

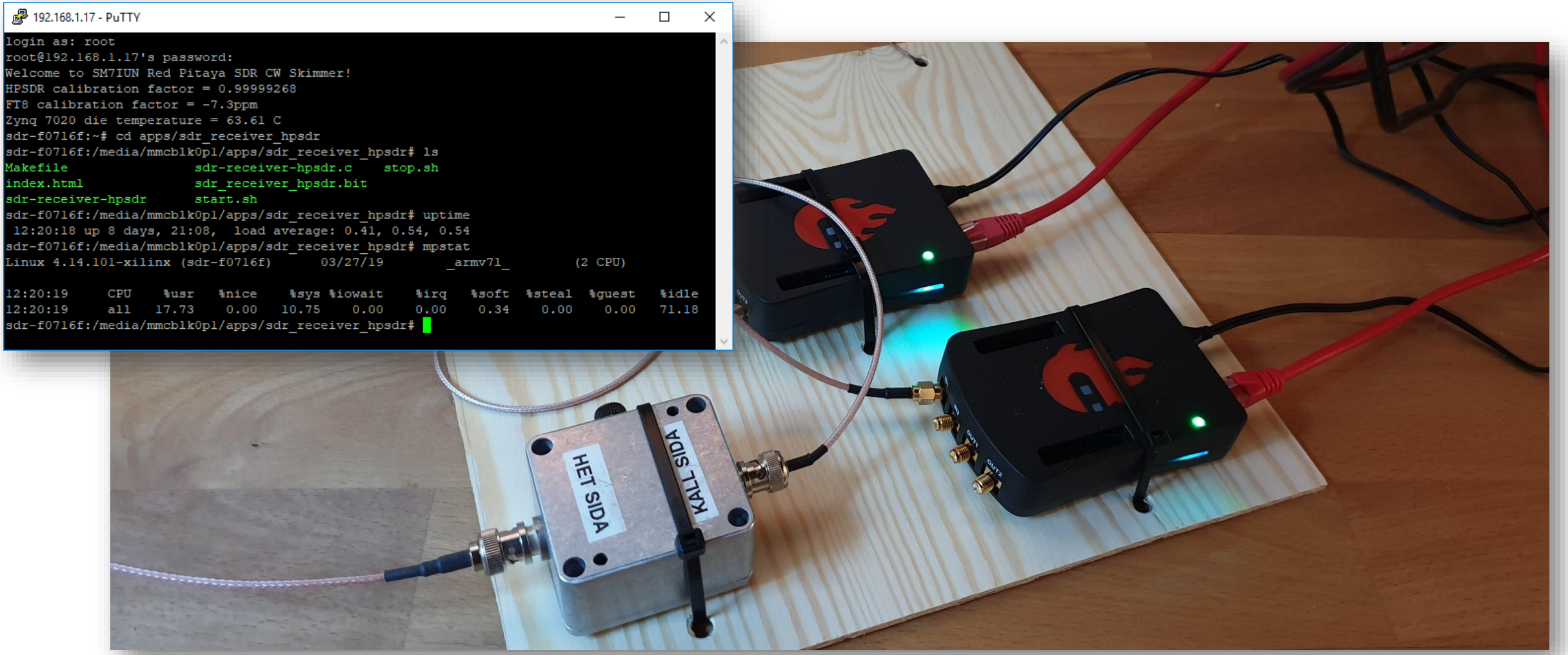

xcall
botter
Radius: 2000
345°
15°
330°
30°
315°
45°
00°
60°
40°
225°
210°
195°

# Tack

# Hela kedjan



# SM7IUN-#


192.168.1.17 - PuTTY
login as: root
root@192.168.1.17's password:
Welcome to SM7IUN Red Pitaya SDR CW Skimmer!
HPSDR calibration factor = 0.99999268
FT8 calibration factor = -7.3ppm
Zynq 7020 die temperature = 63.61 C
sdr-f0716f:~# cd apps/sdr_receiver_hpsdr
sdr-f0716f:/media/mmcblk0p1/apps/sdr_receiver_hpsdr# ls
Makefile sdr-receiver-hpsdr.c stop.sh
index.html sdr_receiver_hpsdr.bit
sdr-receiver-hpsdr start.sh
sdr-f0716f:/media/mmcblk0p1/apps/sdr_receiver_hpsdr# uptime
12:20:18 up 8 days, 21:08, load average: 0.41, 0.54, 0.54
sdr-f0716f:/media/mmcblk0p1/apps/sdr_receiver_hpsdr# mpstat
Linux 4.14.101-xilinx (sdr-f0716f) 03/27/19 _armv7l_ (2 CPU)
12:20:19 CPU %usr %nice %sys %iowait %irq %soft %steal %guest %idle
12:20:19 all 17.73 0.00 10.75 0.00 0.00 0.34 0.00 0.00 71.18
sdr-f0716f:/media/mmcblk0p1/apps/sdr_receiver_hpsdr#
HET SIDA
KALL SIDA

# #3 Värddator och mjukvara

- **“CW Skimmer Server” och/eller “RTTY Skimmer Server”**
  - Avkodar telegrafi inom den anslutna radions passband
  - CW tar ca 10-20% av en 2GHz Core i5 medan RTTY tar **mycket** mer
- **”CWSL_DIGI”**
  - Kör ett godtyckligt antal kopior av WSJT-X utan GUI
- **“RBN Aggregator”**
  - Konsoliderar och kurerar strömmen av avkodade anropssignaler från flera skimrar och publicerar på RBN
  - Kan styra bandcykling