

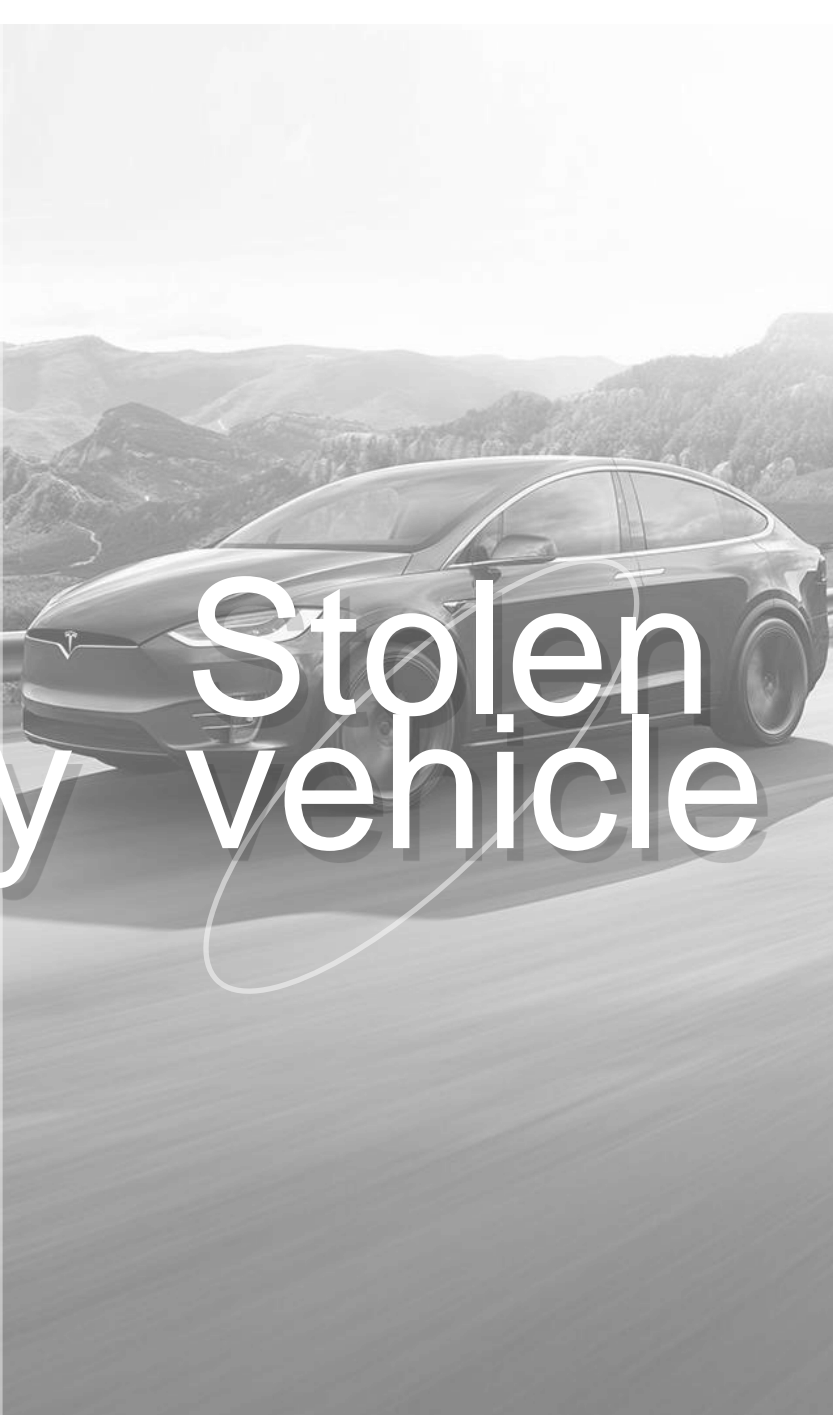
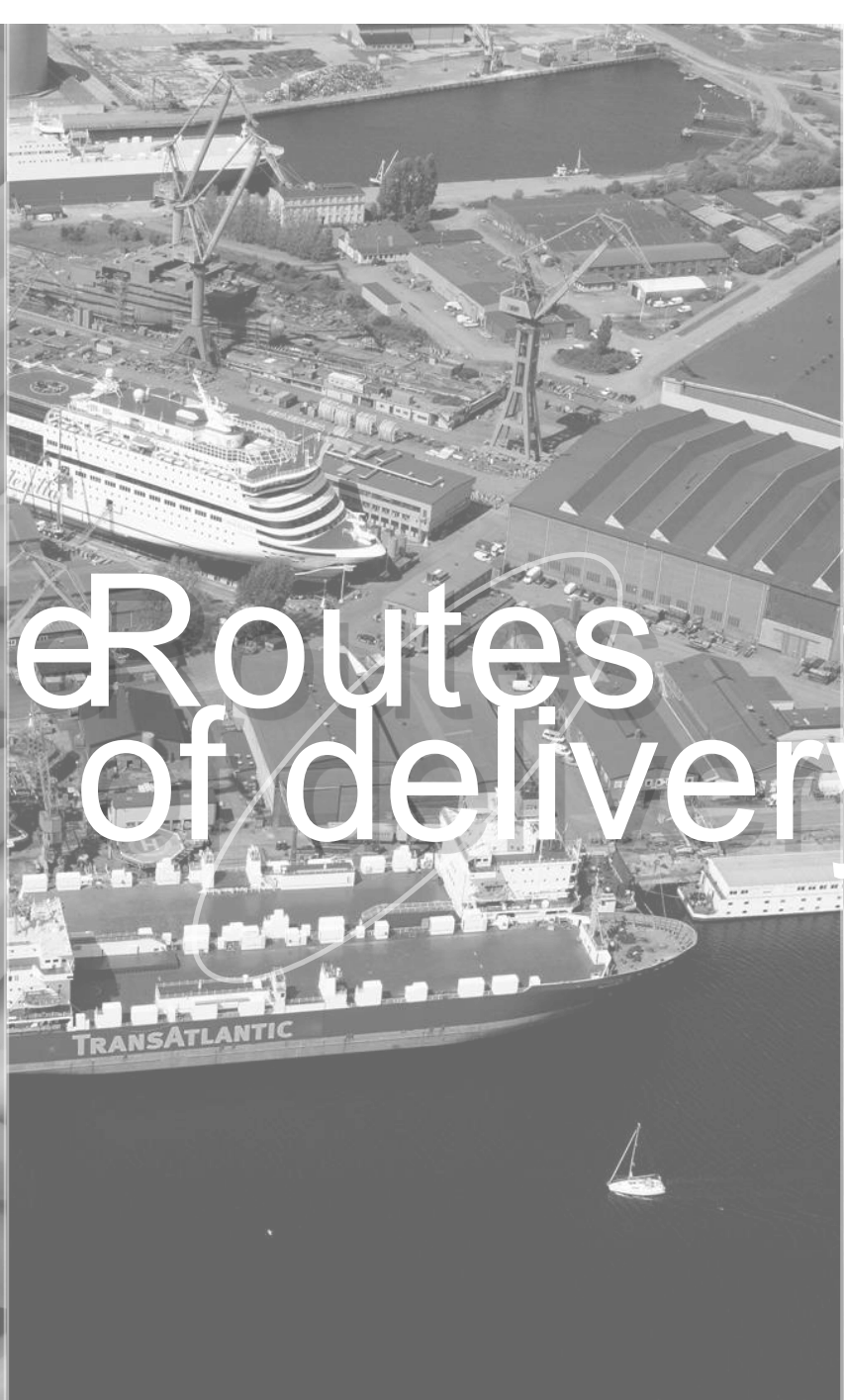
**SIGFOX**  
**and Internet of Things :**  
**We are making things**  
**alive**

November 14, 2017









Perishable  
goods

Routes  
of delivery

Stolen  
vehicle



**simple. reliable. global.**

# Paradoxe and rationals behind Massive IoT

# The paradoxe and rationals behind MTC and IoT

- You want large cells to minimize Capex/Opex
- Use Tiny free spectrums
- Minimize protocol and ideally go for totally random access leading to device simplicity and fully predictable lifespan
- But you also want massive capacities per KM<sup>2</sup>
- And low power / ultra low cost “non perfect” devices
- Thus you will have to deal with unpredictable spectrum
- But you definitely want high reliability
- Hopefully you will focus on tiny piece of information



**A totally new approach is needed – Choosing the right waveforms, massively using modern computer techniques for network cognition capability, advanced signal processing, massive MiMo, and extensive real-time data processing in general**



**The right waveforms**

# SIGFOX is like the rain...

```
top - 14:40:56 up 1 day, 5:20, 2 users, load average: 2.18, 2.07, 1.99
Tasks: 93 total, 1 running, 92 sleeping, 0 stopped, 0 zombie
Cpu(s): 59.3%us, 2.5%sy, 0.0%ni, 38.2%id, 0.0%wa, 0.0%hi, 0.0%si, 0.0%st
Mem: 1960004k total, 745648k used, 1214356k free, 4084k buffers
Swap: 0k total, 0k used, 0k free, 221004k cached
```

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
1476	root	20	0	83368	78m	296	S	50	4.1	628:21.48	sdr-5
1477	root	20	0	83368	78m	296	S	48	4.1	605:48.41	sdr-5
1473	root	20	0	4228	2228	1616	S	16	0.1	278:20.32	sdr-5
1330	root	20	0	46492	12m	6324	S	3	0.7	64:43.97	python3
1303	root	20	0	242m	71m	4840	S	2	3.7	0:32.80	bcommd
1460	root	20	0	61212	26m	3544	S	2	1.4	7:33.13	transceiverd
1230	root	20	0	7468	3340	2180	S	2	0.2	0:19.53	syslog-ng

```
sigfox@sigfox-arch-team-lab: ~
FDATA_V1 1 27 0 400067F40000F4786279A36DE190B6C8FB37F0A9 1427812856 -29962 25.12 -98.41
FDATA_V1 1 27 0 800021F40000AE2714C151F892B24F18CE2318E9 1427812856 -68338 21.81 -107.26
FDATA 0 04 f478 c235b8492565 1 1427812855 6619 29.15 -99.30
FDATA_V1 1 19 0 800071F400007A3762AF75D3 1427812855 52214 26.05 -93.72
FDATA 0 05 f361 87d33806f615b230 1 1427812855 -73560 -0.50 -95.63
FDATA_V1 1 16 0 000026F40000E3058C 1427812855 6259 33.22 -91.62
FDATA 0 05 f3d2 f82c0ea6180682eb 1 1427812855 35311 8.43 -96.21
FDATA 0 03 f38c ed4d1fc9 1 1427812855 29059 33.54 -93.66
FDATA 0 00 f460 - 1 1427812855 -64879 29.77 -94.05
FDATA 0 01 f436 d8 1 1427812856 -74402 36.03 -88.82
FDATA_V1 1 19 0 00008EF300009ECF2B51EEED 1427812855 46332 31.02 -96.75
FDATA_V1 1 27 0 C0005BF300000453310A2A7A2C476D92B1946255 1427812856 -40557 32.64 -95.23
FDATA 0 06 f452 399e62ccb80f67cc7c8f 1 1427812855 591 20.01 -98.94
FDATA 0 05 f3ee 8e30094d4a66e863 1 1427812855 77935 35.22 -91.61
FDATA_V1 1 19 0 400055F300002CDD07CD9751 1427812855 -20357 29.28 -91.73
FDATA_V1 1 16 0 0000A4F300000863207 1427812855 -52550 34.29 -85.69
FDATA 0 05 f362 62d504ee866a59c8 1 1427812855 10122 28.11 -94.24
FDATA 0 07 f462 50da4e9fd5c70b050b0bdea2 1 1427812856 -46109 28.04 -101.18
FDATA_V1 1 23 0 C00024F400002DC5DE9DB2F569E6DFFC 1427812855 -32895 32.01 -94.50
FDATA_V1 1 27 0 00003AF4000093BE25D2B12077DC46D0CC6C6EFA 1427812855 58930 12.34 -95.32
FDATA 0 01 f427 64 1 1427812855 75124 -nan -98.75
FDATA 0 00 f370 - 1 1427812855 -72485 23.79 -105.35
FDATA_V1 1 16 0 00005BF30000A2E049 1427812855 9030 1.69 -90.21
FDATA 0 05 f415 c2b848ca8c600a1e 1 1427812855 50561 36.16 -88.56
FDATA_V1 1 19 0 800058F30000088A1159EBD42 1427812855 -58796 33.81 -92.00
FDATA_V1 1 23 0 000065F40000BB3A808F375435DF6599 1427812855 48055 32.53 -95.04
FDATA 0 04 f3f1 82e9f0d459e4 1 1427812855 77343 10.95 -95.56
FDATA_V1 1 27 0 800094F3000071C69265F5AA0221123F6631F15D 1427812855 7504 9.89 -96.46
FDATA 0 00 f36f - 1 1427812855 -75043 32.09 -94.61
FDATA_V1 1 27 0 C00045F40000EC9A6A0E9CE03522C18BEF032D68 1427812855 30480 14.14 -96.07
FDATA_V1 1 19 0 000073F40000F958A30080A2 1427812855 -1493 27.52 -98.21
FDATA_V1 1 16 0 000091F30000746414 1427812855 47710 10.47 -93.86
FDATA_V1 1 27 0 0000D8F3000072449CF49AD6CBAC4BAED068010D 1427812855 -10022 16.55 -83.15
FDATA_V1 1 23 0 400065F30000A1623697CBB16EFA50A 1427812855 39710 33.87 -92.95
FDATA_V1 1 19 0 800054F300000859D87684644 1427812856 -41164 26.19 -102.51
FDATA_V1 1 27 0 4000E0F30000EB928D24BD6D690B25E1908A8C78 1427812855 63090 32.46 -95.66
FDATA_V1 1 19 0 8000E4F300004850CE66A301 1427812855 -22078 23.59 -105.04
FDATA 0 07 f386 acd24b6173bd3faa41bfd631 1 1427812855 75832 28.04 -100.15
FDATA_V1 1 23 0 8000A9F30000E50CA17D4A2485E0D541 1427812855 44052 25.30 -99.98
FDATA 0 04 f390 e9091c213900 1 1427812855 -24131 35.76 -89.04
FDATA_V1 1 23 0 0000C6F300007EE1817C431DACA971B3 1427812855 -55687 27.52 -96.21
```

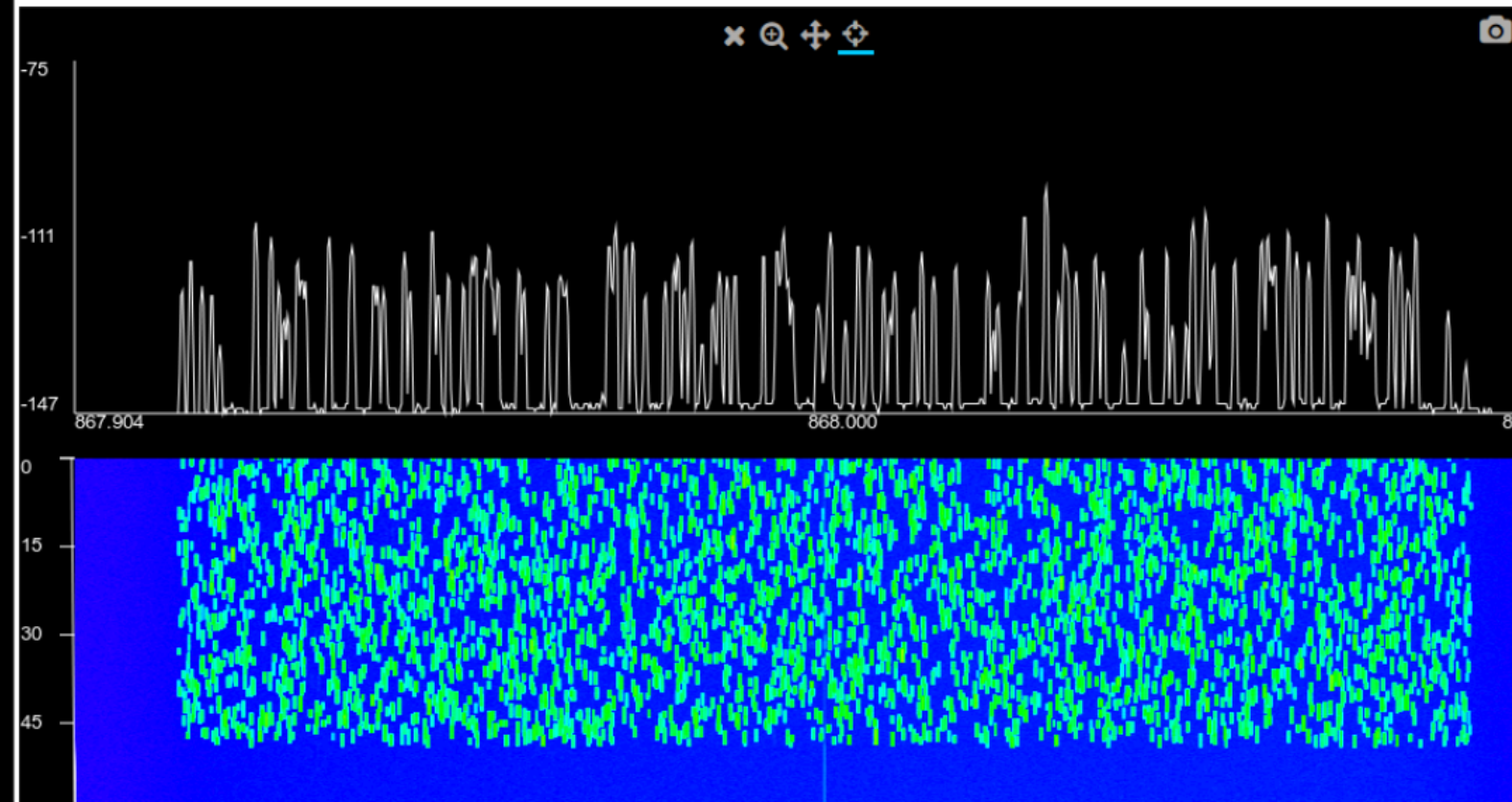
SITE	BASE STATION	DEVICE	DEVICE TYPE	USER	GROUP	SIMULATION	BILLING
------	--------------	--------	-------------	------	-------	------------	---------

## Tap 05AF - Spectrum

Units

Spectrum: ↑ Signal (dBm), ↔ Frequency (MHz)

Waterfall: ↑ Seconds (s), ↔ Frequency (MHz)





**Cognitive network :  
Distribute intelligence  
everywhere in the  
network**



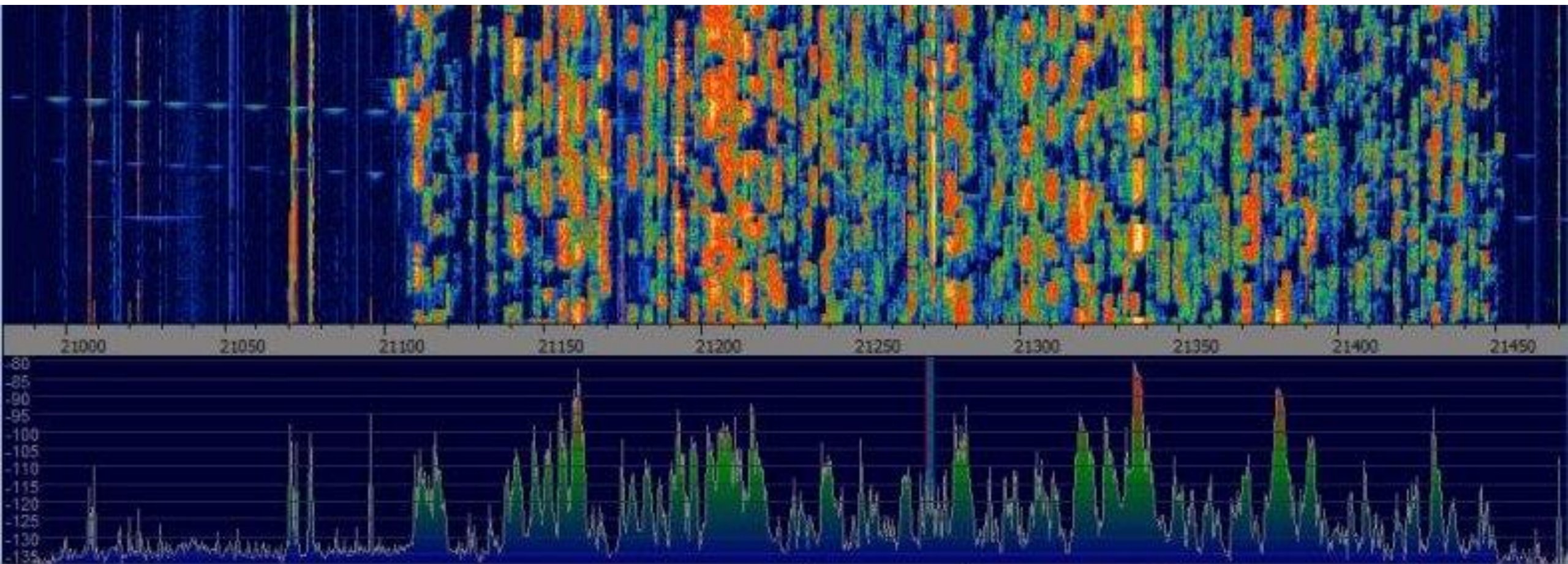
# Back in the early days of radio ...

How could this kind of simplistic transmitter allow to establish reliable long distance communication...



# Back in the early days of radio ...

...Within that kind of tiny, crowded, chunk of decametric spectrum ?





## Back in the early days of radio ...

Because of such organization  
taking advantage of  
**cognitive** human abilities !



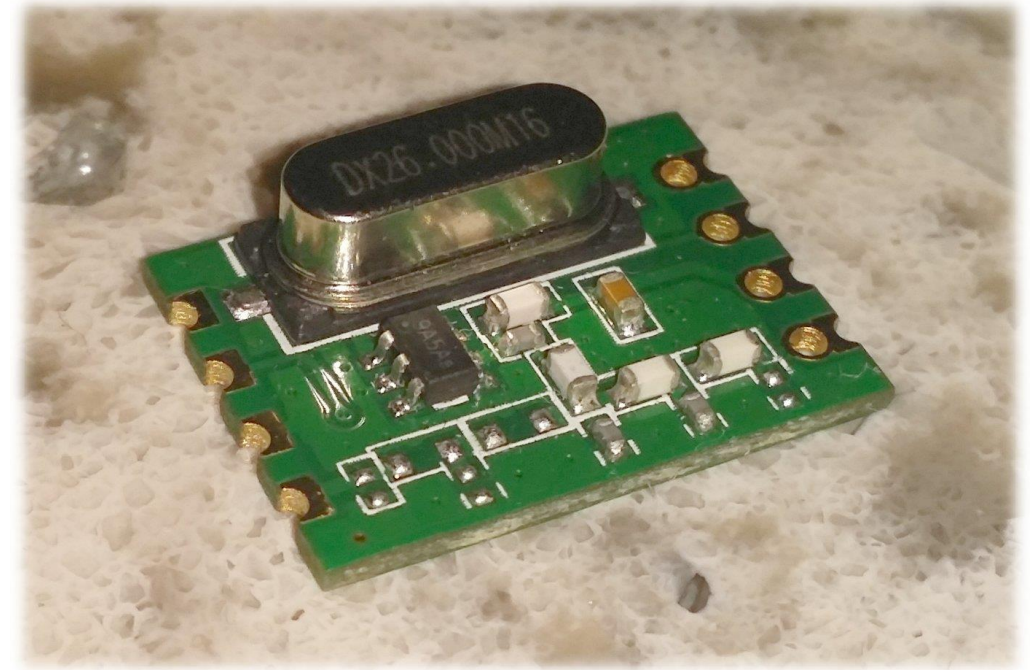


Back in our days ...

How to collect information from **billions** of those ultra simple “**half dollar**” devices ?

RF oscillator

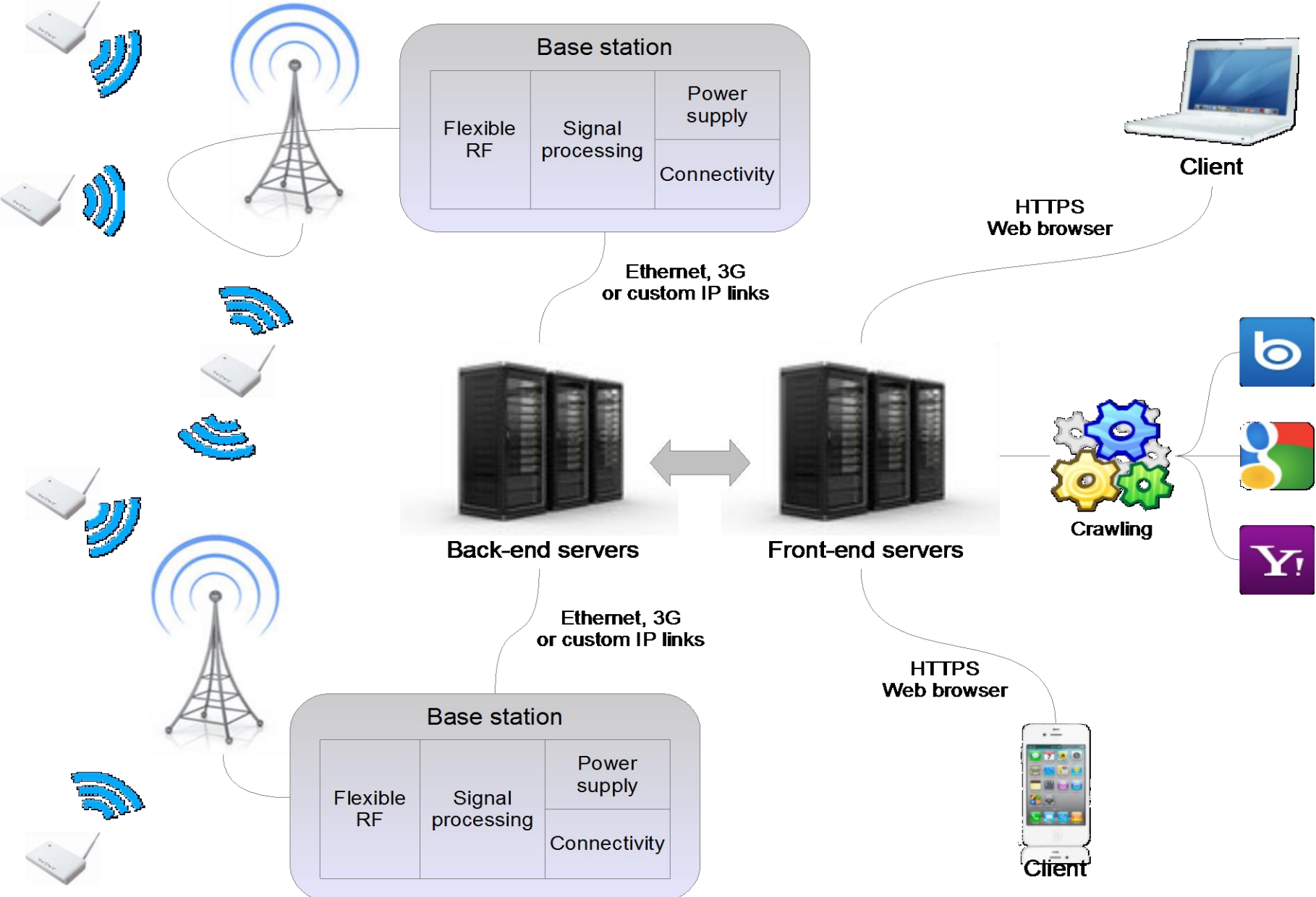
8bit  $\mu$ C



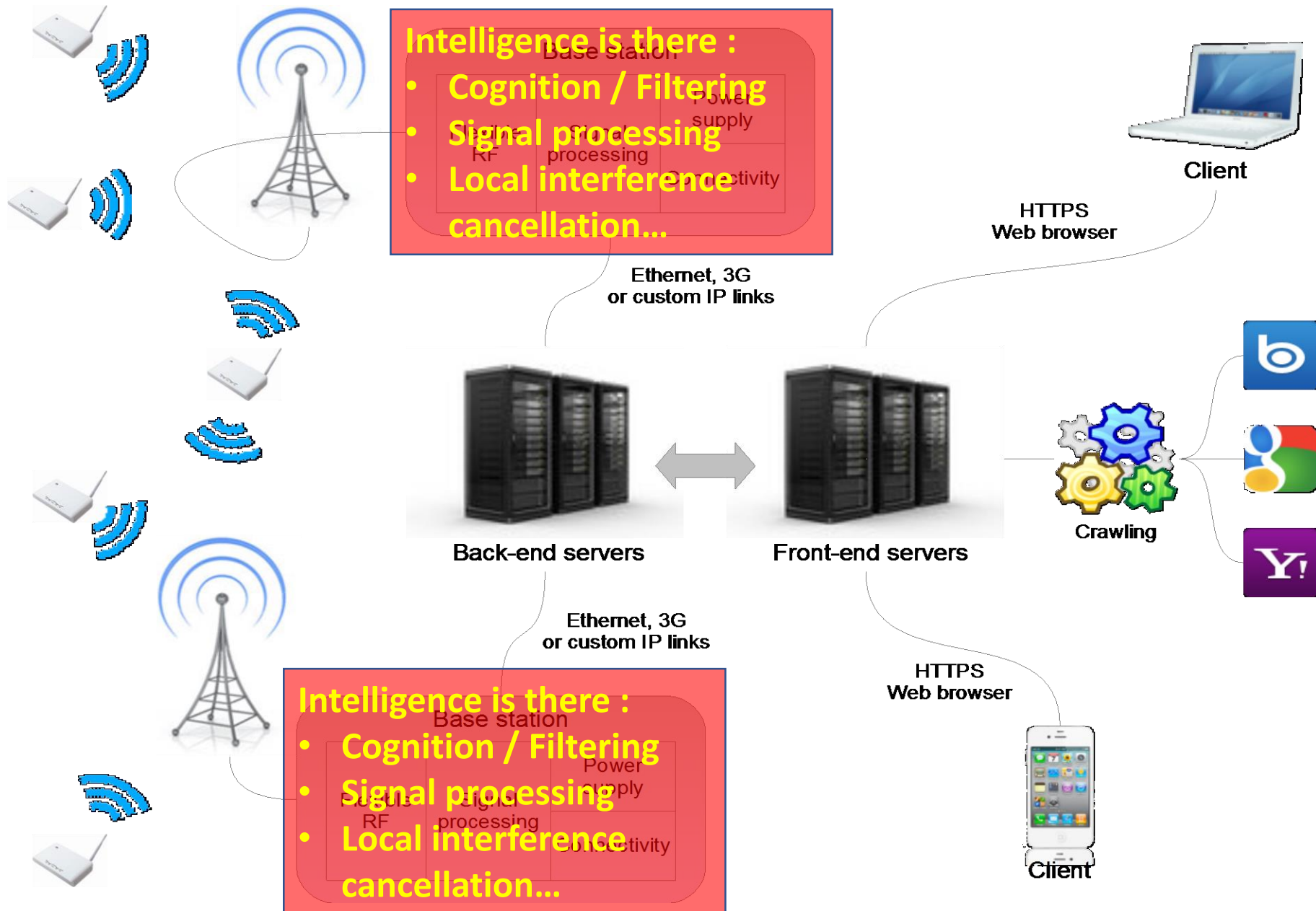
8bit  $\mu$ C + FM modulated RF oscillator

Replacing human abilities by A.I.  
Through massive usage of modern computer science

# An IoT network...

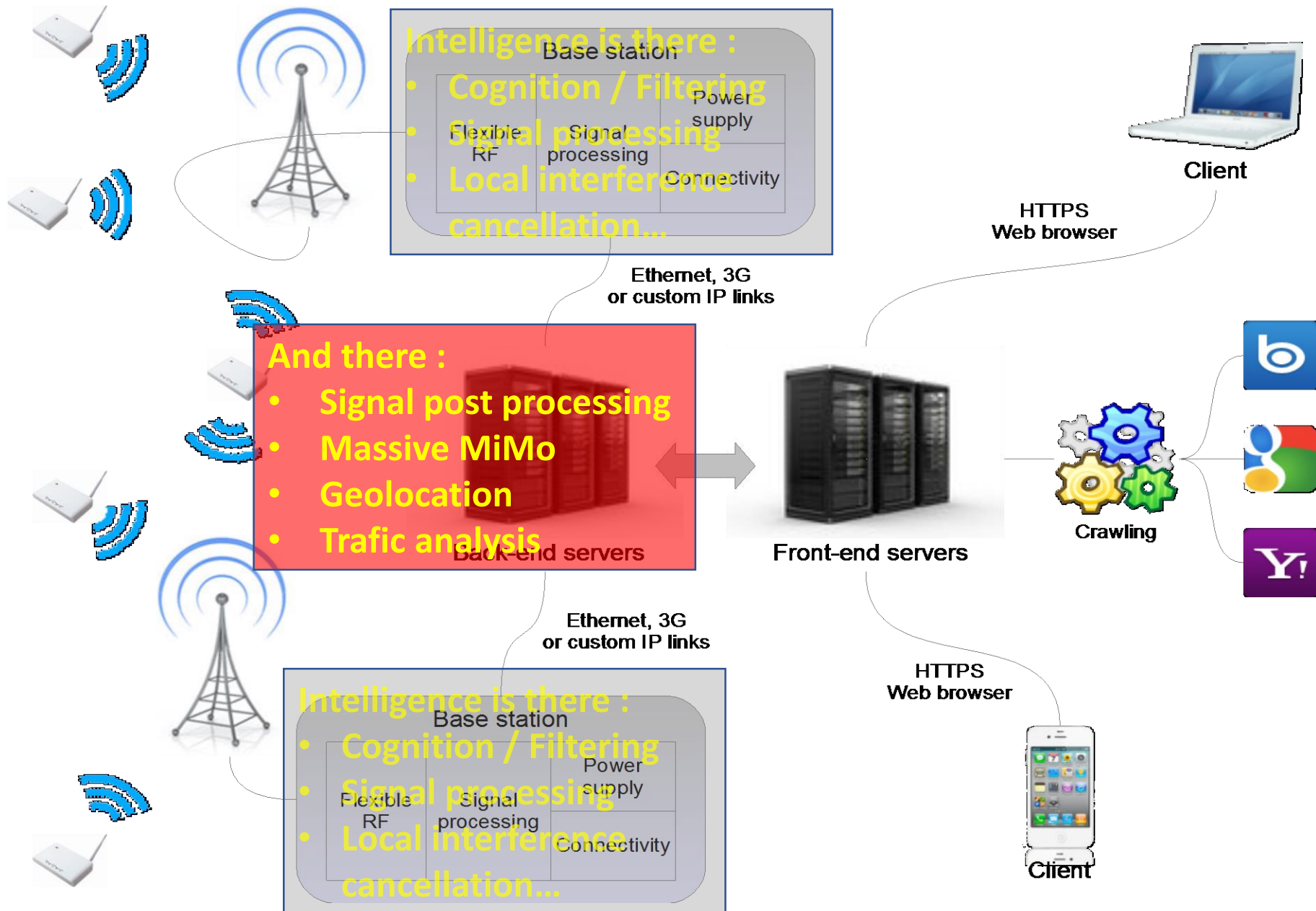


# ...With intelligence everywhere...Radio...



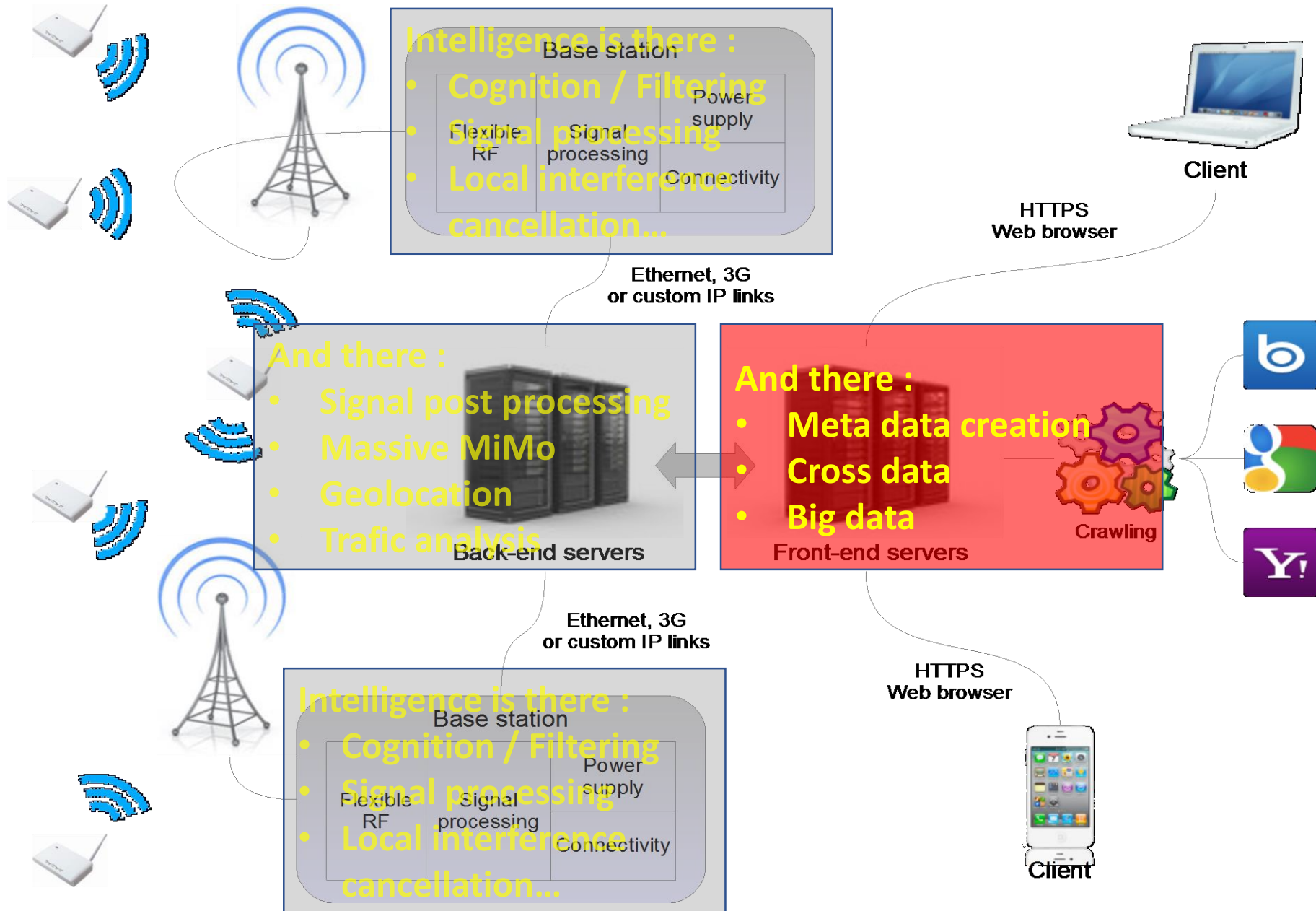


# ...With intelligence everywhere...Telecom cloud...





# ...With intelligence everywhere...Data processing...



**Network**

as a

**service**

# Network

At your

# service



# SIGFOX in Slovakia ... It is NOW with SimpleCell

