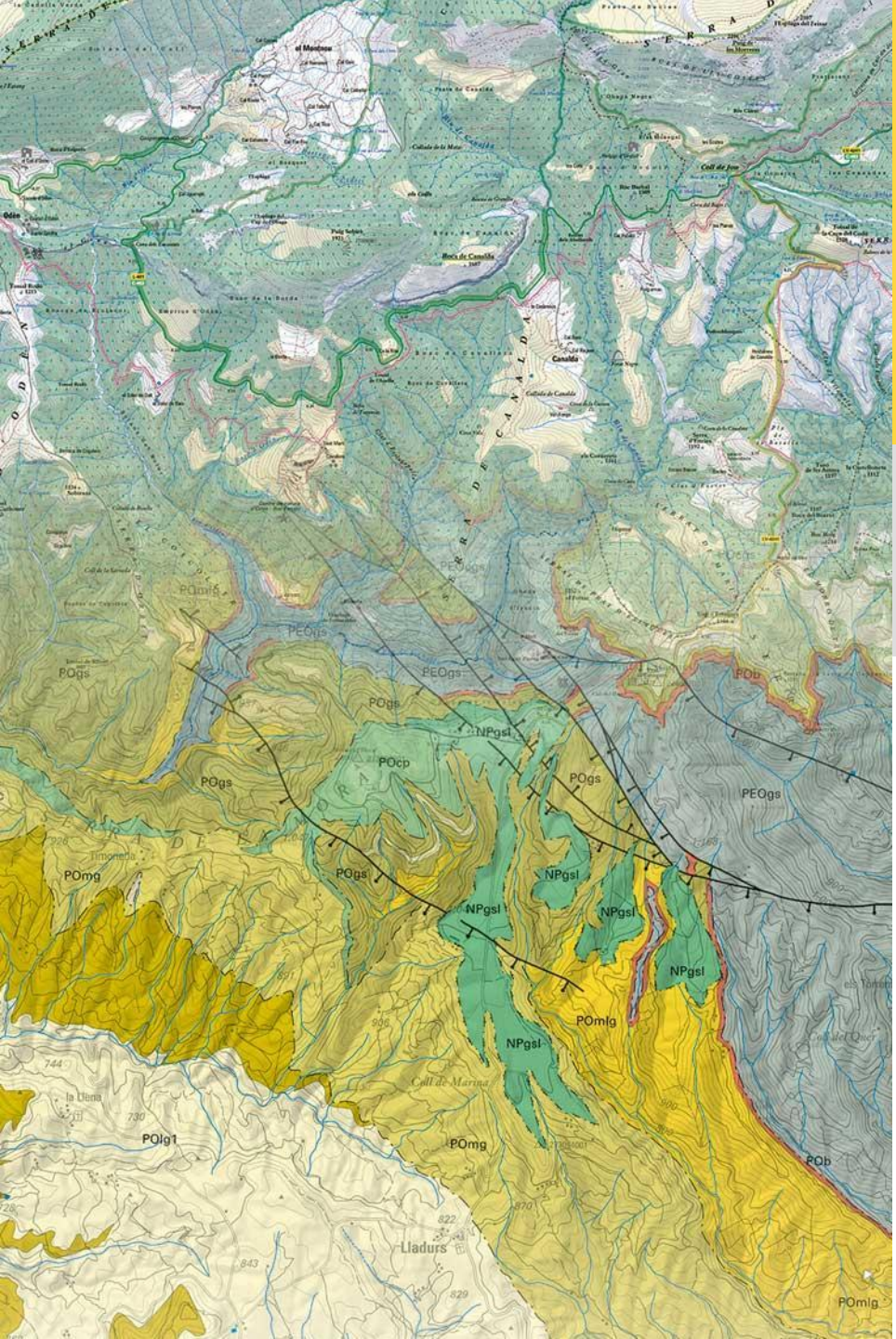

Current status of the real time services at ICGC and scalability for the future

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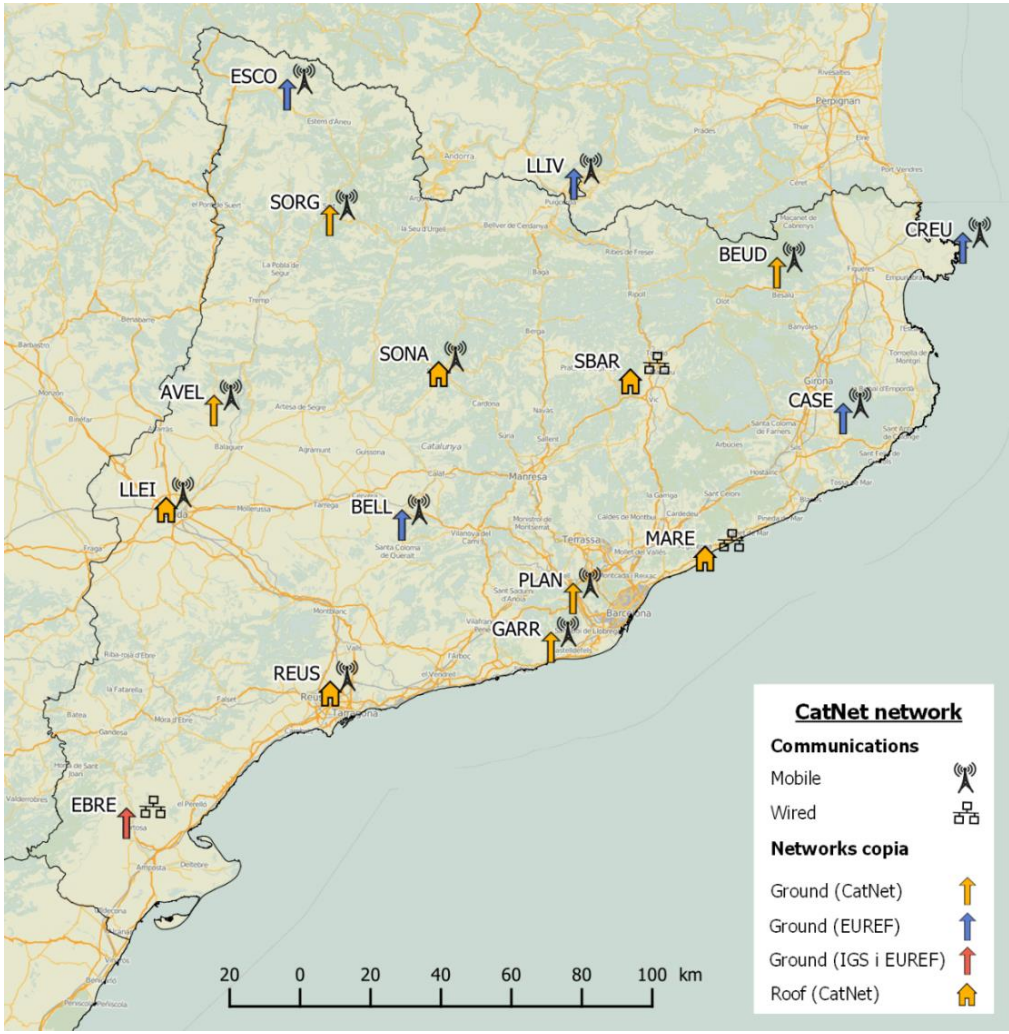
CORS networks

- Amongst most used when the highest accuracy is needed
- Nowadays, far exceeded the computation/maintenance for RFs
- Are based on 3 main pillars:
  - GNSS reference stations
  - Network control centre
  - Service positioning platforms
- Corrections can be provided mainly in 2 different representations:
  - OSR (RTK or NRTK), where corrections are sent to the users
  - SSR (PPP), where errors in clocks/orbits/atmosphere are sent to the users
- RTK or NTRK are transmitted on 2 different systems
  - VRS, user approximate position → VRS (computation!) → corrections to users
  - FKP and MAC, data from stations is unidirectionally sent to users (computation!)

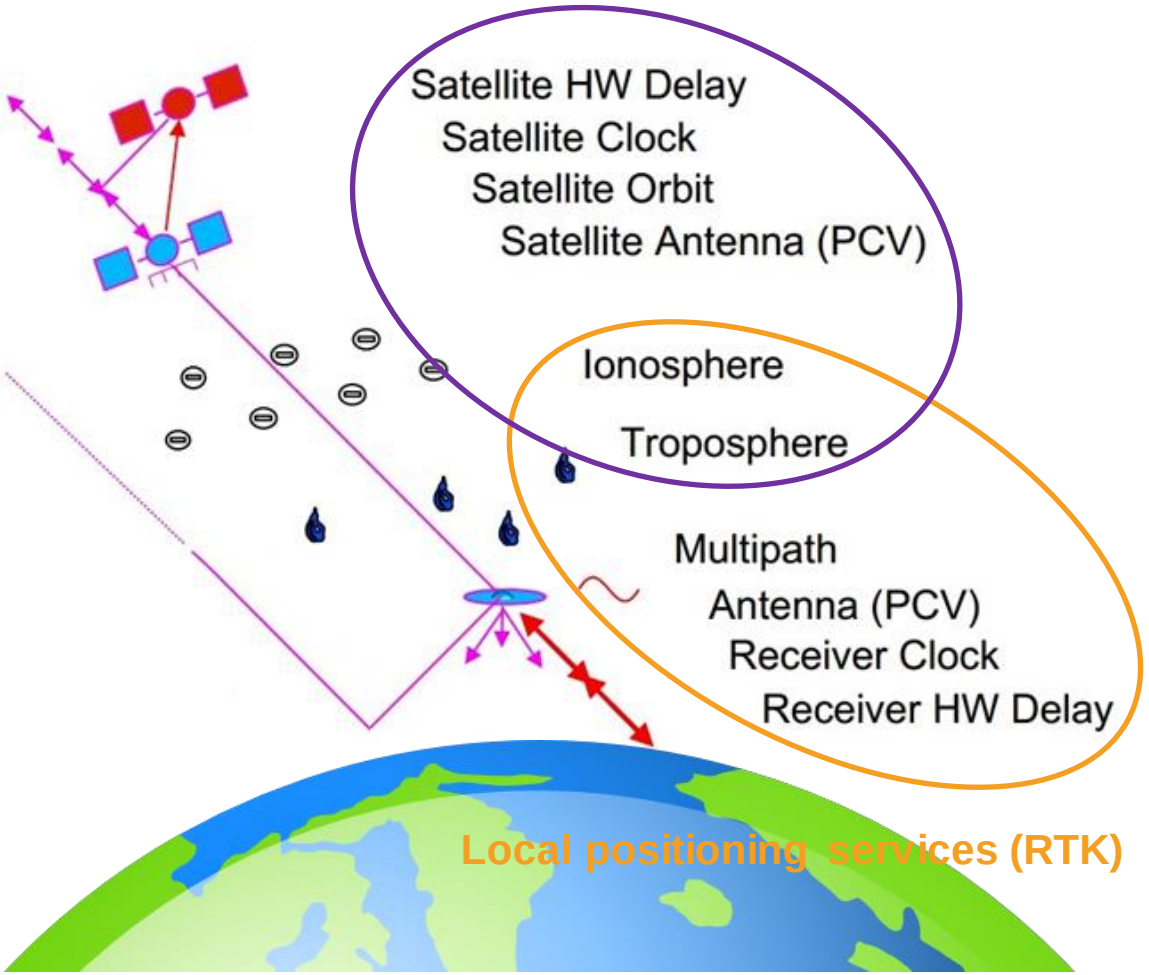
CatNet network current status

- GPS, GLO, GAL & BDS receivers
- Geodetic and individually calibrated antennas
- 4G and LAN connectivity
- Services
  - NTRIP
  - GeoFons
  - RINEX shop



Why do we need positioning services?

Error sources	Absolut GNSS
Spatial segment	
System errors	
Ephemeris	0,4 – 0,5 m
Clocks	1 – 1,2 m
Atmospheric errors	
Ionosphere	0,5 – 5 m
Troposphere	0,2 – 0,7 m
User segment	
Receiver	0,1 – 3 m
Multipath	0 – 10 m



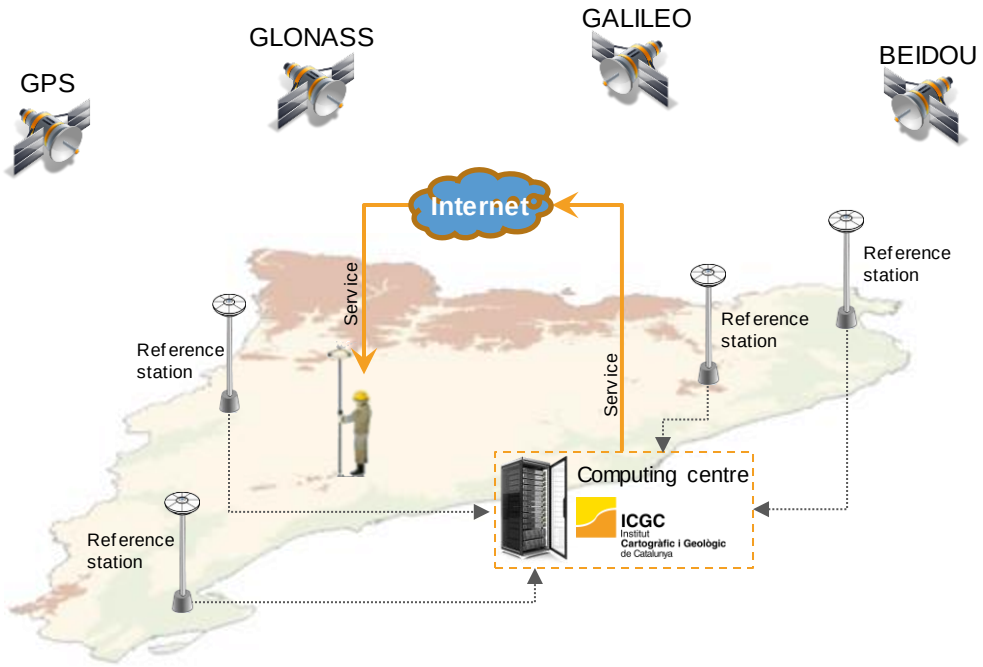
Current NTRIP services at ICGC

- Decimetric accuracy

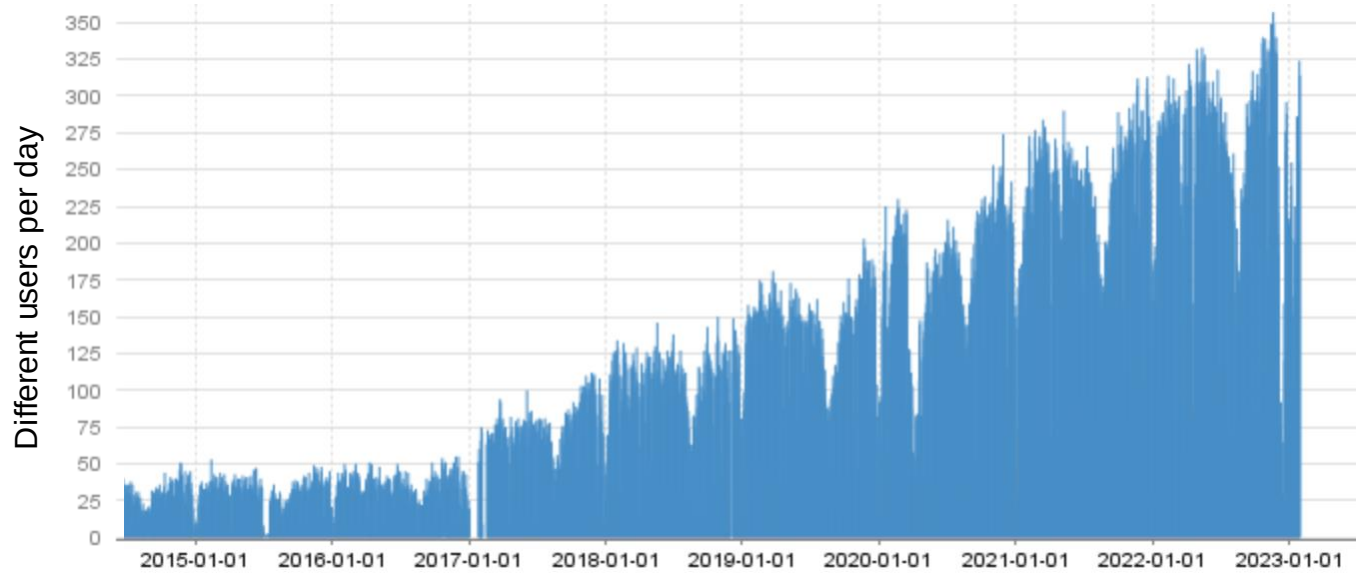
Service	Constellations	Format
VRS2_DGNSS	GPS + GLO	RTCM 2.3
XXXX2_DGNSS	GPS + GLO	RTCM 2.3

- Centimetric accuracy

Service	Constellations	Format
VRS3M	GPS + GLO + GAL + BDS	RTCM 3.2 MSM5
VRS3	GPS + GLO	RTCM 3.1
VRS2	GPS + GLO	RTCM 2.3
VRS+	GPS + GLO	CMR+



CatNet NTRIP services usage growth



From 50 (2017) to more than 350

↓

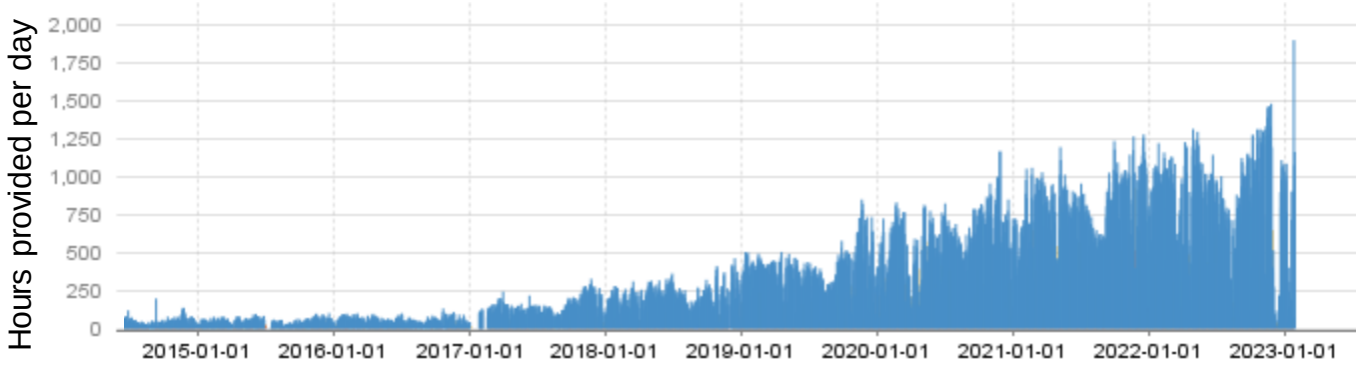
39% average per year

↓

What in 2033? (in ten years)

↓

Nearly 10.000 user per day?
27 times the users of 2023?



From 100 (2017) to more than 1850

↓

63% average per year

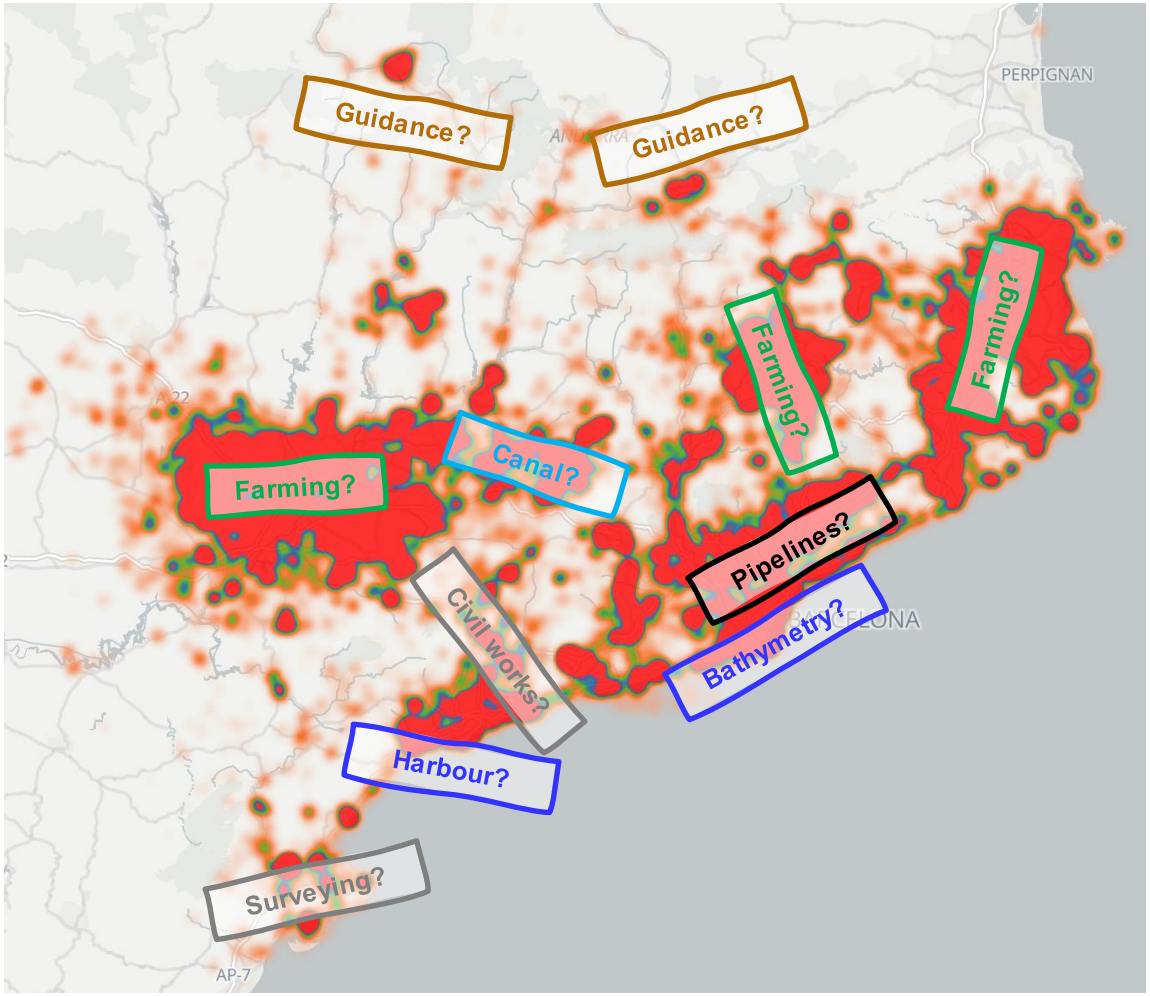
↓

What in 2033? (in ten years)

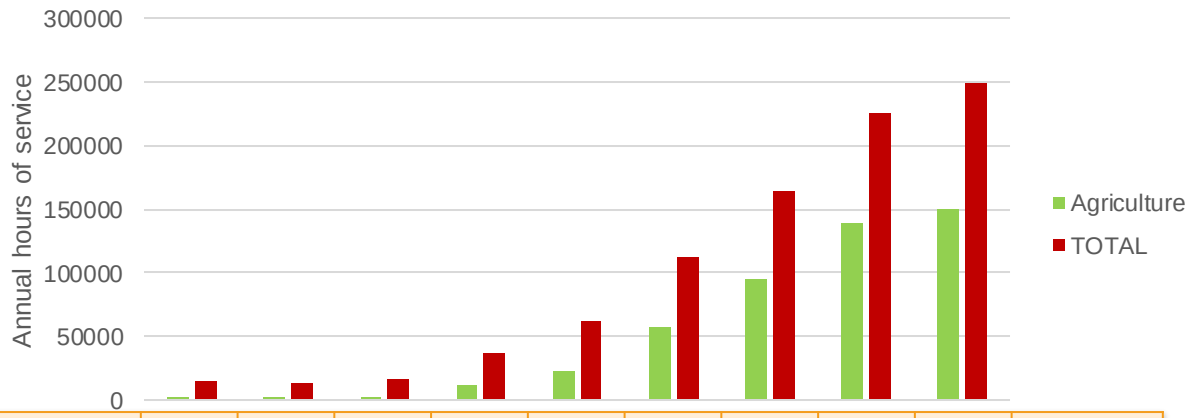
↓

Nearly 250.000 hours per day?
130 times the hours of 2023?

CatNet NTRIP services usage distribution



CatNet NTRIP usage growth in precision farming



	2014	2015	2016	2017	2018	2019	2020	2021	2022	**2018-2022**
Agriculture	1539	1460	1905	12271	22725	56920	94601	139348	150007	
% increse	-	-5%	30%	544%	85%	150%	66%	47%	8%	**71%**
% w rt TOTAL	11%	12%	12%	33%	37%	51%	58%	62%	60%	**53%**

- 20% (average) increment for the annual NTRIP users connected
  - 4.000 different users per year in the next 10 upcoming years?
- 71% (average) increment for the annual hours of service provided
  - 10.000.000 hours per year in the next 10 upcoming years?

Precise farming is nowadays a fact

- Fertilizer distribution
- Application of herbicides
- Phytosanitary treatments
- Sowing and harvesting

Usage growth summary and considerations

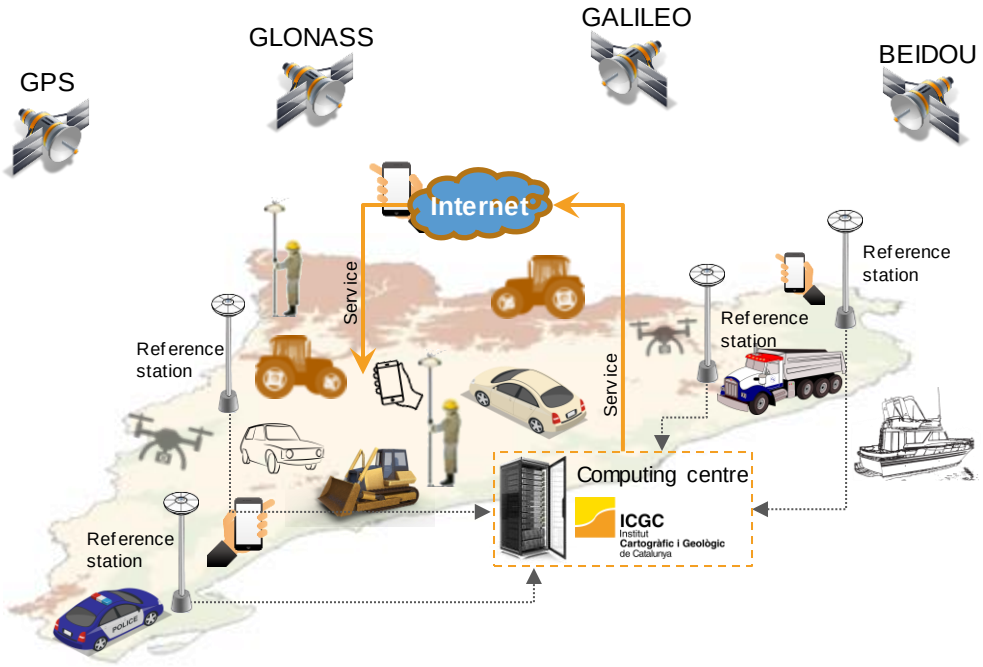
- NTRIP services in general
  - 39% (in average) of users connected increase per year
  - 63% (in average) of hours provided increase per year
- Precision farming in particular
  - 20% (in average) of users connected increase per year
  - 71% (in average) of hours provided increase per year
- What if we are at the beginning of growth (2017) for…
  - Automotive?
  - LBS sectors?
  - …

Are new uses coming soon?

- Machine guidance
- Precision farming

- Autonomous driving
- Smartphone positioning

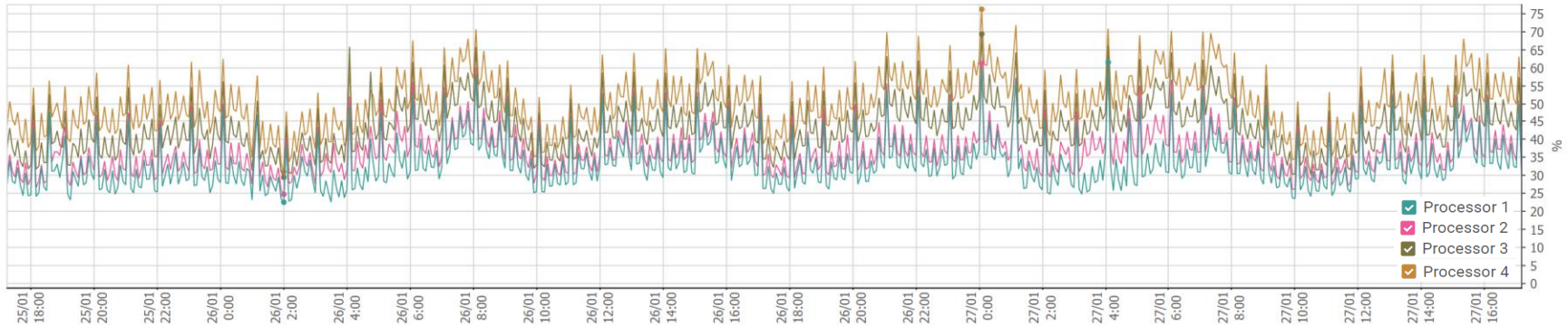
- Drone navigation
- Sports monitoring
- Emergency serving
- Fleet management
- …



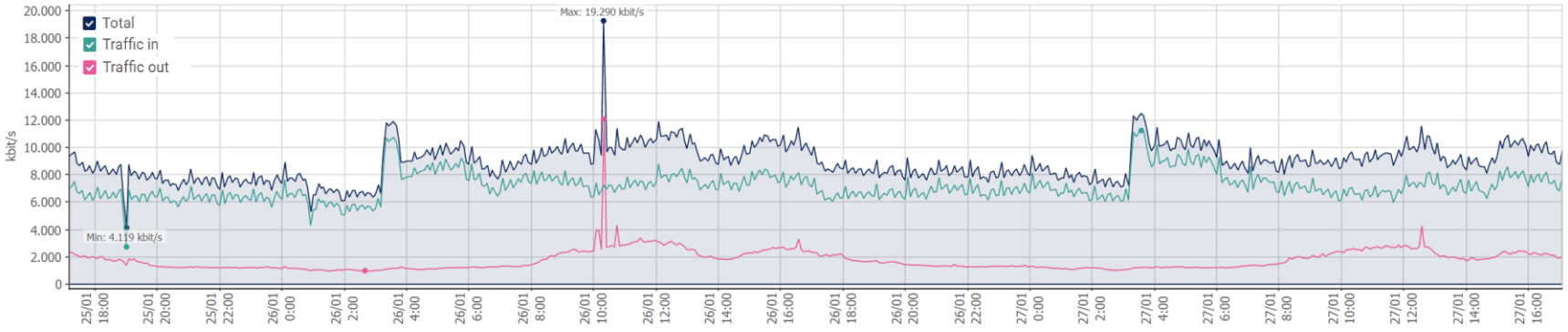
MASS - MARKET

Which resources are needed in the future?

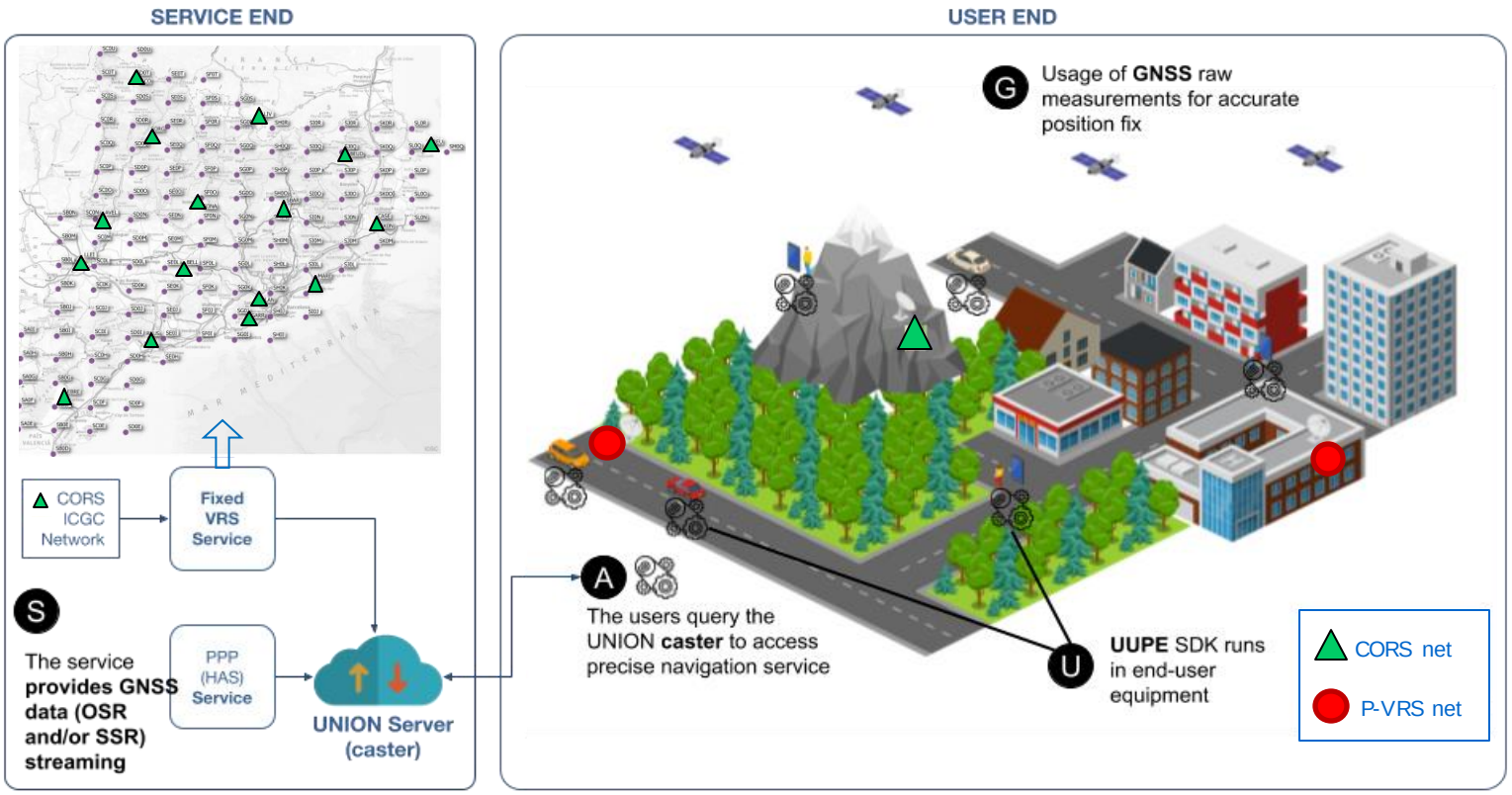
- Communications with real stations shouldn't be a big deal
- Processing facilities may be overflowed? What about CPUs?



- What about the bandwidth required to communicate with users?



Here is where UNION is meant to be



Conclusions

- We don’t know where the future on positioning will bring us
  - We know that usage is growing and technology is evolving
- We don’t know if UNION will be the technology to be adopted
  - We know that new technologies will come and we’ll need to be up to date
- UNION is a new technology:
  - Based on already in use technologies (RTK, PPP, HAS…)
  - Also implementing a new concept as the P-VRS
  - Combining everything in a new location stack

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