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The new Euref-IP NtripCaster at IGNE

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The public released NtripCaster software, available since February 2004 for disseminating real-time GNSS data via Internet, has made it possible to install a Broadcaster in Madrid. In order to ensure the reliability of the system, a dedicated Linux server with leased corporative independent Internet access has been set up. Within the framework of EUREF, this server is broadcasting today four GNSS data streams belonging to the Spanish ERGPS network, one of them RTK, and 15 virtual EGNOS DGPS streams in RTCM format covering the Iberian Peninsular. The concept of distributing a number of Broadcasters over the European continent leads to reduced latencies at the user end and enables sharing the workload of providers. A cross monitoring between all installations ensures control over the continuity of EUREF's services. Field tests using GPRS and other Internet connections show an excellent and unique opportunity to disseminate real-time GNSS data via Internet for the purpose of accurate positioning and navigation.

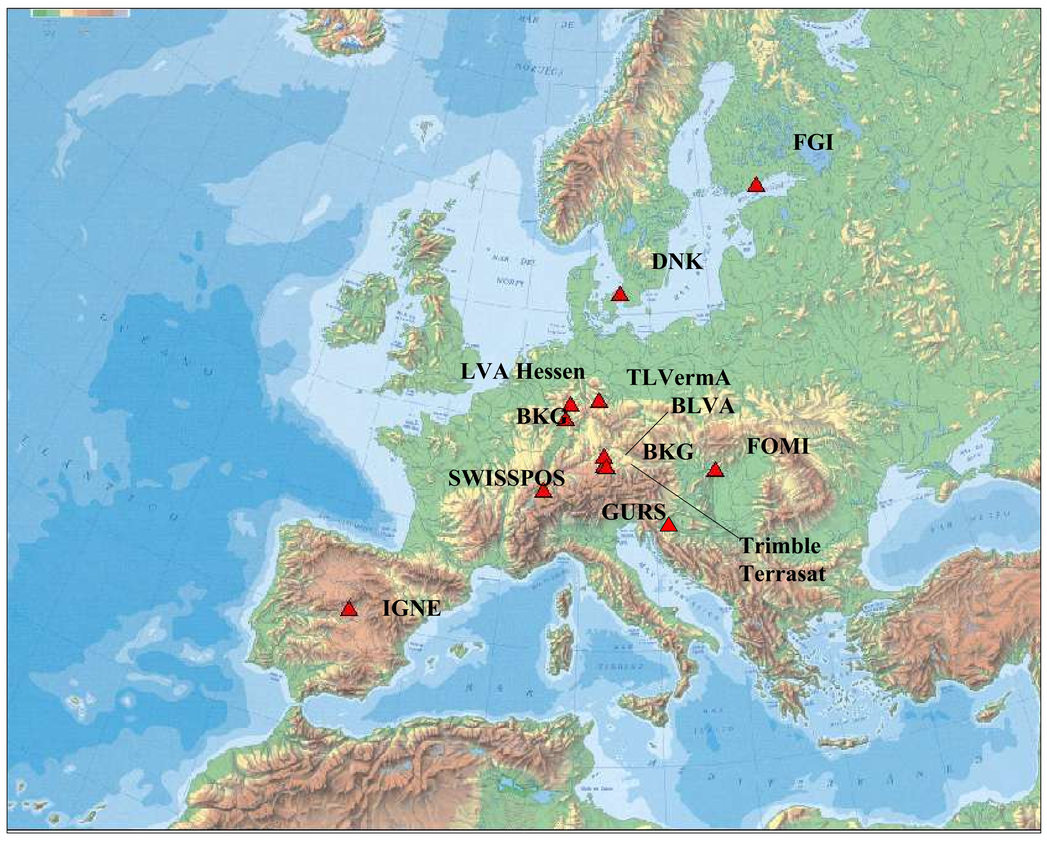


Figure 1. NTRIP Casters available in Europe

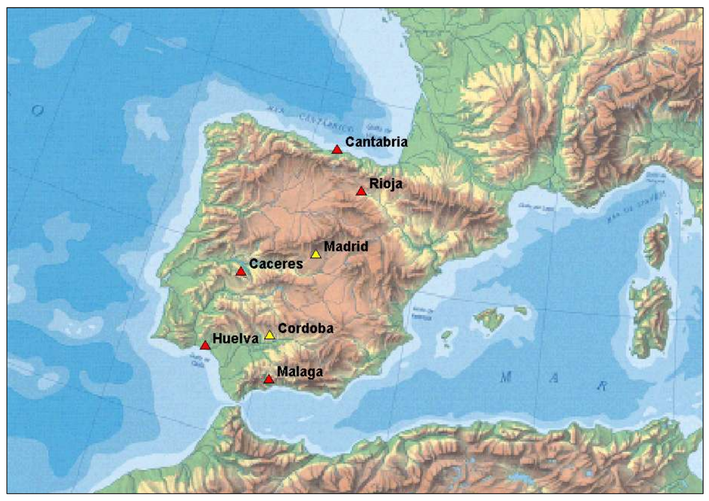


Figure 2. ERGPS Stations

NTRIP CASTERS

•There are different servers working today in Europe creating the biggest real time GNSS network in the world. (Source BKG website also available in the sourcetable of each Caster)

•Within the EUREF framework

- •80.38.104.84:80 operated by IGNE, Spain. Software: NtripCaster, Info: http://www.ign.es
- •193.224.183.67:2101 operated by SGO/FOMI, Hungary. Software: NtripCaster, Info: http://www.gpsnet.hu
- •caster.fgi.fi:80 operated by FGI, Finland. Software: NtripCaster, Info: http://www.fgi.fi/osastot/navi/index_eng.html
- •193.2.110.249:8080 operated by Geodetska Uprava, Slovenia. Software: Trimble-iGate, Info: http://www.gu-signal.si
- •www3.swisstopo.ch:8080 operated by Swisstopo, Switzerland. Software: Trimble-iGate, Info: http://www.swisstopo.ch/de/geo/swipos.htm
- •141.74.33.11:80 operated by BKG, Germany. Software: NtripCaster, Info: http://igs.ifag.de/index_ntrip_cast.htm
- •129.217.182.51:80 operated by ICD, Germany. Software: NtripCaster, Info: http://www.icd.de

•Apart from EUREF

- •195.145.245.203:8040 operated by Landesvermessung Thueringen, Germany. Software: Trimble-iGate, Info: http://sapos.thueringen.de
- •141.90.2.81:8080 operated by Landesvermessung Hessen, Germany. Software: Trimble-iGate, Info: http://www.hkvv.hessen.de
- •62.134.61.201:8080 operated by Landesvermessung Bayern, Germany. Software: Trimble-iGate, Info: http://sapos.bayern.de
- •62.154.166.171:8080 operated by Trimble Terrasat, Germany. Software: Trimble-iGate, Info: http://www.virtualrtk.com
- •Makalu.GPSnet.dk:9000 operated by Trimble Center Denmark. Software: Trimble-iGate, Info: http://Everest.GPSnet.dk

CASTER DESIGN

•The server is designed to allow the Continuity and Availability of the service. The main features are:

- •Two Pentium processors (just one is installed now)
- •4 RJ45 network connections
- •1 RJ45 Gigabit network connection
- •2.8 GHz Pentium Processor
- •1Gb RAM
- •RAID 5
- •Suse Linux Operating System
- •VNC server sharing desktop for administration purposes
- •NtripCaster 1.0.2 software listening on ports 80 and 2101

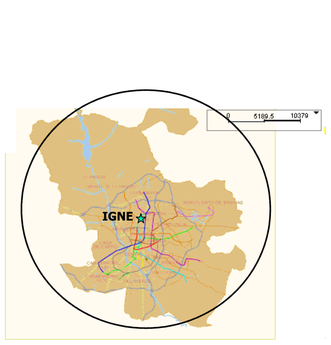
•A secondary server has been installed in order to ensure the continuity of the service with:

- •Pentium III 500 Mhz
- •256 Mb RAM
- •Suse Linux Operating System
- •VNC server sharing desktop for administration purposes
- •NtripCaster 1.0.2 software listening on ports 80 and 2101

The internet access for this first stage is a 256/128 Kb/s (down/up) dedicated connection independent from the corporative access

MOBILE ACCESS

Some test has been made to check the latency and results of the obtained position. GPRS internet access has demostrated a powerful tool for surveying, mapping, fleet management… with no big increase of latencies (between 2 and 4 seconds) and an cm accuracy with RTK transmission inside 20Km radius of the reference stations. Obviously the system can be increased including virtual stations to avoid the 20km base-rover limit but the results using OTF receivers shown that it is enough 15-20 seconds to obtain a fixed position with excellent results. For most cities in Spain (probably the cm mass market) 20 km is enough to give a free based RTK service, the table below shows the these results using GPRS with an average cost of 0.42 Euros/point.



Dist.To Ref.	E Dif	N Dif	H Dif	# SV	Time span (sec)	Point
5015	-0.008	0.006	0.028	10	429	BM5
10403	0.003	0.008	0.046	6	105	BM10
10403	0.014	0.023	0.022	8	357	BM10
14649	-0.014	0.055	0.008	5	460	BM15
14649	-0.041	0.034	0.010	9	374	BM15
20493	0.010	-0.008	0.020	7	362	VILLE
20640	0.007	0.021	0.021	9	134	VILLT
27568	No fix					Lomo

ERGPS STATIONS

The ERGPS (GPS Permanent Stations) from the IGNE (Figure 2) are being updated to transmit RTCM/RTK corrections through internet. The stations are located in public buildings like Universities or geophysical observatories belonging to the IGNE to allow a internet connection. Transmitting real time data is not a time processor consuming task and the bandwidth is quite small for today's DSL/network connections. In some cases has been demonstrated that the client software (NtripClient) keeps the router alive and prevents the typical inactivity hanging.

EGNOS VIRTUAL STATIONS

In order to ensure the best possible coverage the BKG has provided 15 EGNOS virtual stations data streams obtained converting the RTCA received from the Inmarsat IOR (PRN 131) to RTCM. The results obtained applying these stations can be found in Figure 5 showing a great alternative when it is not possible to install a "real" station or the coverage is deficient.

	Mean Offset [m]	Std. Dev. of Offset [m]	Minimum [m]	Maximum [m]
	Last Minute			
N	-0.154	0.016	-0.030	-0.341
E	-0.263	0.016	-0.072	-0.511
H	-0.375	0.016	-0.057	-0.649
	Last Hour			
N	0.041	0.031	0.001	0.772
E	0.061	0.031	0.000	0.845
H	0.032	0.031	-0.001	-2.203

Figure 3. Position quality obtained using Madrid Station & Caster with 50m baseline. Code only.

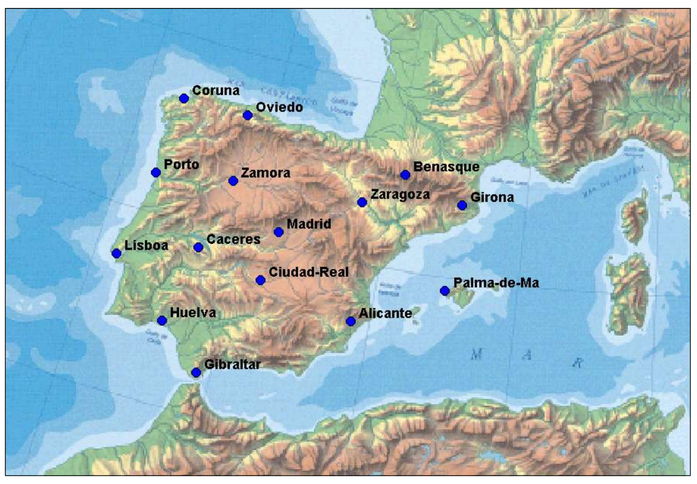


Figure 4. EGNOS virtual reference stations provided by BKG

	Mean Offset [m]	Std. Dev. of Offset [m]	Minimum [m]	Maximum [m]
	Last Minute			
N	1.327	0.047	-0.113	1.897
E	0.381	0.047	-0.016	0.672
H	1.442	0.047	-0.134	2.311
	Last Hour			
N	-0.081	0.040	0.003	-2.494
E	0.578	0.040	0.008	1.587
H	1.674	0.040	-0.009	5.035

Figure 5. Position quality obtained using Madrid EGNOS virtual Station & Caster with 50m baseline. Code only.

CONCLUSIONS

NTRIP technology shows an excellent way to transmit any kind of GNSS data, if we think of the traditional ways of sending DGPS/RTK corrections ie. RASANT, DAB, MSK … this method avoid a huge number of limitations. The full possibilities are still to come, with a TDC (Transparent Data Channel) like this is possible to interchange an even compute real time aspects of GNSS as monitoring, orbits… but not only GNSS data, the channel is as flexible as can send even seismic, GIS or any raw data.

ACKNOWLEDGEMENT

All the people involved in ERGPS in IGNE wish to thank Georg Weber and Denise Dettmering from BKG all the help, support and advices to make this project not only a promising future technology but a present one. Without them it will not be possible even to dream with a simple, fast and reliable way of transmitting GNSS real time data.