EPN Regional Broadcasters for Real-Time GNSS Data Dissemination

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- **e-GEOS ASI/CGS Centro di Geodesia Spaziale "G. Colombo", Matera, Italy**
- **Royal Observatory of Belgium, Brussels, Belgium**

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Federal Agency for Cartography and Geodesy

agenzia spaziale italiana

e-geos UNA SOCIETÀ ASI/TELESPAZIO

EPN Broadcasting Elements

EPN network components („Guidelines for EPN Stations & Operational Centres“, see http://www.epncb.oma.be/_organisation/guidelines):

- Local Broadcaster (LB): It receives the real-time data streams from the stations in a local network and disseminates them, without changing them, on request to clients. Clients may be users, monitoring tools, Regional Broadcasters, Data Centres, or Analysis Centres.
- Regional Broadcaster (RB): It receives all the EPN real-time data streams and disseminates them, without changing them, on request to clients. Clients may be users, monitoring tools, other broadcasters, Data Centres, or Analysis Centres.

Regional Broadcaster: ROB

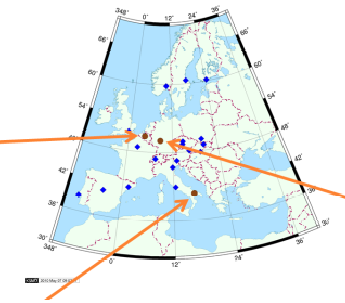
Link: http://www.euref-ip.be
Located: Royal Observatory of Belgium
Number of EPN stations: 115
Number of mountpoints at all: 149
(some stations relayed from multiple casters)

Registration Link:
http://www.gnss.be/data.php#NTRIPaccess

Regional Broadcaster: ASI

Link: http://192.106.234.7:2101/
Located: ASI/CGS Centro di Geodesia Spaziale
Number of EPN stations: 113
Number of mountpoints at all: 114
(some stations relayed from multiple casters)

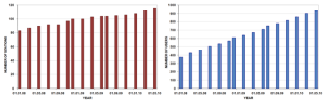
Registration mail: geodaf@hp835.mt.asi.it



Blue diamonds: Local, national or other (e.g.„IGS) Ntrip Broadcaster supporting EUREF activities
Red dots: EPN Regional Broadcaster (see http://www.epncb.oma.be/_dataproducts/data_access/real_time/broadcasters.php for a complete list of Ntrip Broadcasters)

Regional Broadcaster: BKG

Link: http://www.euref-ip.net
Located: external provider
Number of EPN stations: 115
Number of mountpoints at all: 141

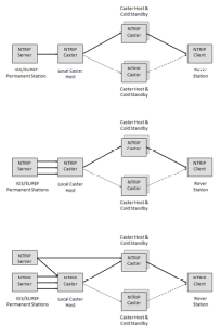


Evolution of number of EPN stations (top left) and number of registered users at regional broadcaster www.euref-ip.net within the last four years.

Registration link:
http://igs.bkg.bund.de/ntrip/registration

Broadcast Dissemination Concept

Early stage (still valid): each station streams its data to the euref-ip caster (left)
Alternatively, data are streamed to a local Ntrip Broadcaster where it is pulled from by the euref-ip caster (right)



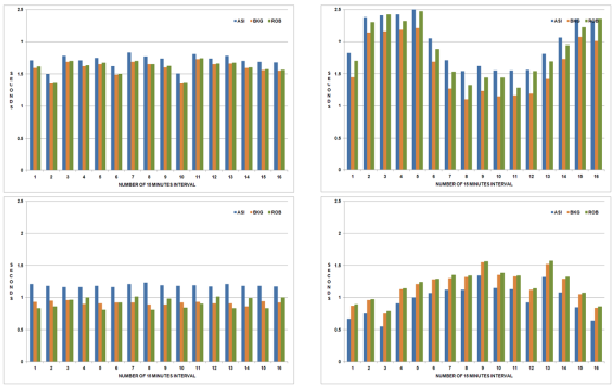
Current stage: streams from Local Casters are pulled from the individual Regional Broadcasters

Next level: more institutions and station providers to be motivated to install a local Ntrip Caster to allow dissemination to the EPN Regional Broadcasters

Future: RT streams from station to more than one caster in parallel

Performance Test of EPN Regional Broadcasters

On May, 12, 10 – 14 UTC, real-time data of several EPN stations were streamed from the three Regional Broadcasters using the BKG Ntrip Client (BNC). The latency was logged over 15 minutes intervals. The test was performed at BKG premises in Frankfurt.



BORR (top left) is streamed from the Spanish national caster and shows typical latency for the 22 Spanish stations.
BRUS (top right) is one of few EPN stations coming with RTIGS instead of RTCM format. It is pulled by ASI and ROB from BKG resulting in an additional latency of approx. 0.2 seconds.
GOPE (mid left) is streamed from the caster at Pecny. It has a low latency at all regional casters.
USAL (mid right) is pulled by BKG and ROB from ASI caster. Therefore, the latency is lowest for the ASI caster itself.
WARN (bottom right) is pulled by ASI and ROB from BKG caster resulting in an additional latency of approx. 0.2 seconds.
In general, the latency at ASI broadcaster is approx. 0.2-0.3 seconds higher as seen from BKG in Germany. This may come from internal issues, e.g. a firewall, or depend from the distance between the caster and the user.

Conclusions

Currently, 44 of 115 EPN real-time stations are streaming data to the EPN Regional Broadcasters in parallel.
With regard to latency, performance differences between the EPN Regional Broadcasters are small. Pulling from another Regional Broadcaster results in an additional delay of approx. 0.2-0.3 seconds only.
More station manager are encouraged to install a Local / National Broadcaster for supporting EPN's Dissemination Concept.

Acknowledgement: e-geos activities are carried out under ASI contract I-001-07-0.

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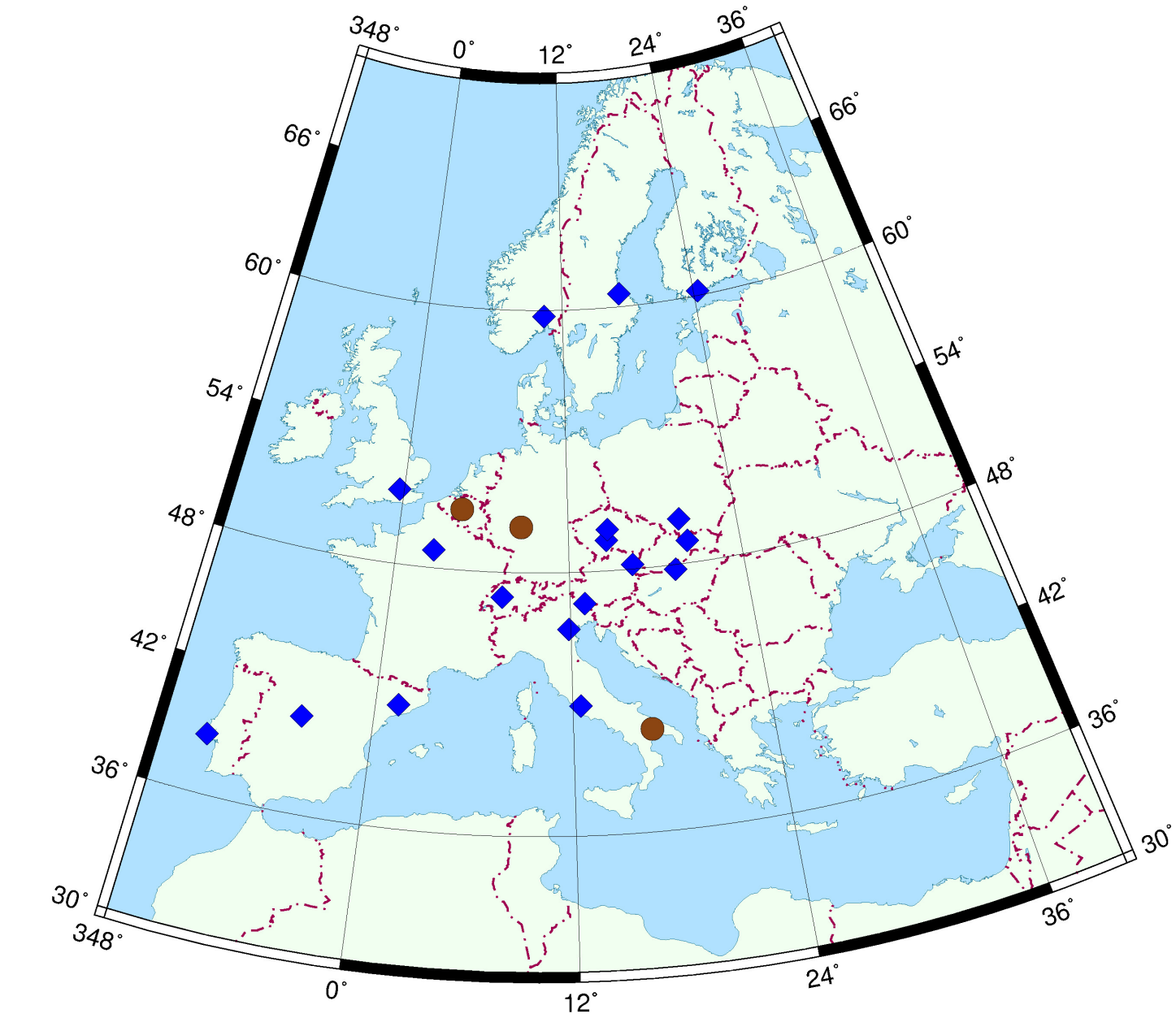
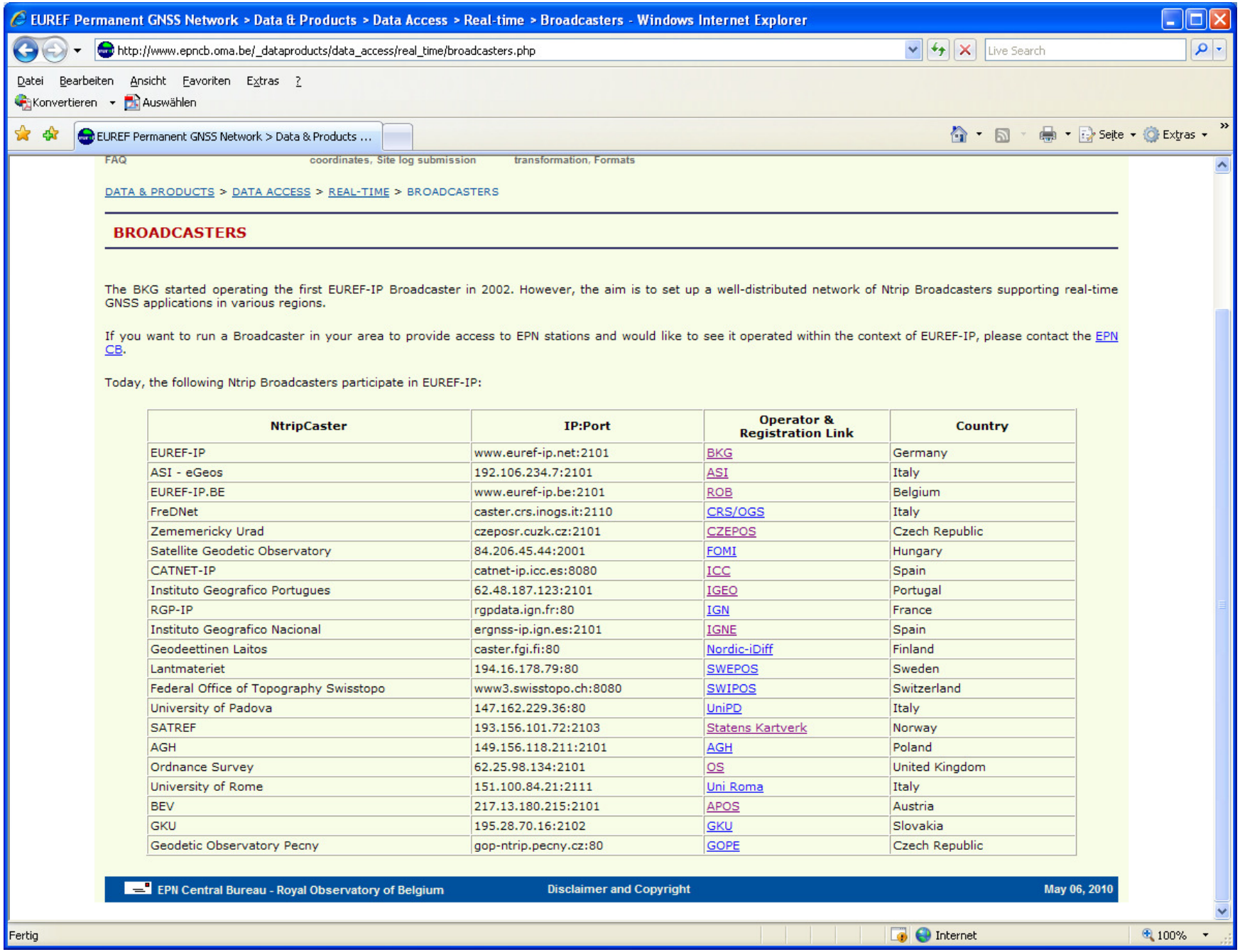

348°
0°
12°
24°
36°
66°
60°
54°
48°
42°
36°
30°
GMT 2010 May 07 09:07:47


EUREF Permanent GNSS Network > Data & Products > Data Access > Real-time > Broadcasters - Windows Internet Explorer
http://www.epncb.oma.be/_dataproducts/data_access/real_time/broadcasters.php
Live Search
Datei Bearbeiten Ansicht Favoriten Extras ?
Konvertieren Auswählen
EUREF Permanent GNSS Network > Data & Products ...
Seite Extras
FAQ coordinates, Site log submission transformation, Formats
DATA & PRODUCTS > DATA ACCESS > REAL-TIME > BROADCASTERS
BROADCASTERS
The BKG started operating the first EUREF-IP Broadcaster in 2002. However, the aim is to set up a well-distributed network of Ntrip Broadcasters supporting real-time GNSS applications in various regions.
If you want to run a Broadcaster in your area to provide access to EPN stations and would like to see it operated within the context of EUREF-IP, please contact the EPN CB.
Today, the following Ntrip Broadcasters participate in EUREF-IP:
NtripCaster | IP:Port | Operator & Registration Link | Country
EUREF-IP | www.euref-ip.net:2101 | BKG | Germany
ASI - eGeos | 192.106.234.7:2101 | ASI | Italy
EUREF-IP.BE | www.euref-ip.be:2101 | ROB | Belgium
FreDNet | caster.crs.inogs.it:2110 | CRS/OGS | Italy
Zememericky Urad | czeposr.cuzk.cz:2101 | CZEPOS | Czech Republic
Satellite Geodetic Observatory | 84.206.45.44:2001 | FOMI | Hungary
CATNET-IP | catnet-ip.icc.es:8080 | ICC | Spain
Instituto Geografico Portugues | 62.48.187.123:2101 | IGEO | Portugal
RGP-IP | rgpdata.ign.fr:80 | IGN | France
Instituto Geografico Nacional | ergnss-ip.ign.es:2101 | IGNE | Spain
Geodeettinen Laitos | caster.fgi.fi:80 | Nordic-iDiff | Finland
Lantmateriet | 194.16.178.79:80 | SWEPOS | Sweden
Federal Office of Topography Swisstopo | www3.swisstopo.ch:8080 | SWIPOS | Switzerland
University of Padova | 147.162.229.36:80 | UniPD | Italy
SATREF | 193.156.101.72:2103 | Statens Kartverk | Norway
AGH | 149.156.118.211:2101 | AGH | Poland
Ordnance Survey | 62.25.98.134:2101 | OS | United Kingdom
University of Rome | 151.100.84.21:2111 | Uni Roma | Italy
BEV | 217.13.180.215:2101 | APOS | Austria
GKU | 195.28.70.16:2102 | GKU | Slovakia
Geodetic Observatory Pecny | gop-ntrip.pecny.cz:80 | GOPE | Czech Republic
EPN Central Bureau - Royal Observatory of Belgium Disclaimer and Copyright May 06, 2010
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Internet
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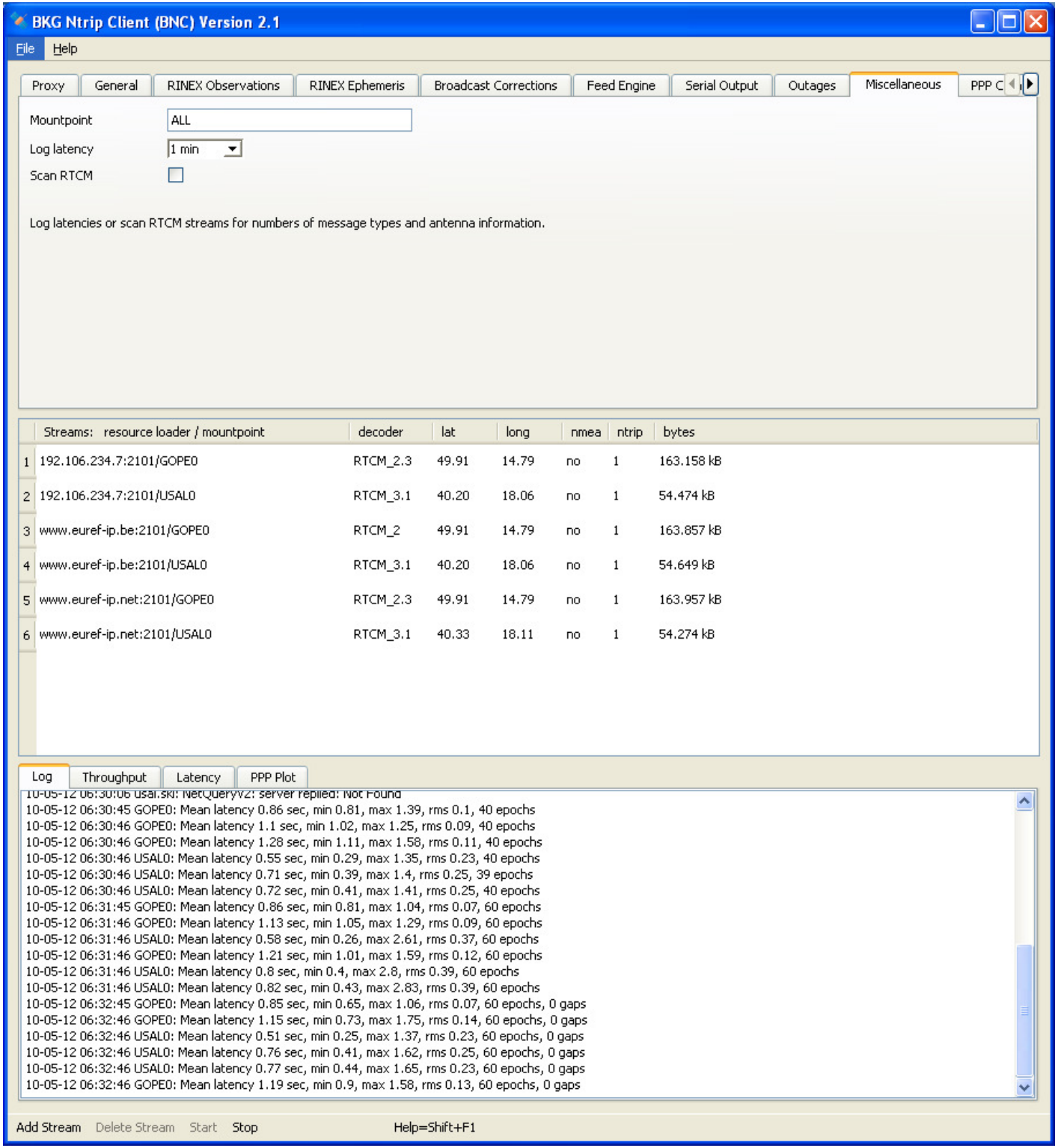
BKG Ntrip Client (BNC) Version 2.1
File
Help
Proxy
General
RINEX Observations
RINEX Ephemeris
Broadcast Corrections
Feed Engine
Serial Output
Outages
Miscellaneous
PPP C
Mountpoint
ALL
Log latency
1 min
Scan RTCM
Log latencies or scan RTCM streams for numbers of message types and antenna information.
Streams: resource loader / mountpoint
decoder
lat
long
nmea
ntrip
bytes
1 192.106.234.7:2101/GOPE0 RTCM_2.3 49.91 14.79 no 1 163.158 kB
2 192.106.234.7:2101/USAL0 RTCM_3.1 40.20 18.06 no 1 54.474 kB
3 www.euref-ip.be:2101/GOPE0 RTCM_2 49.91 14.79 no 1 163.857 kB
4 www.euref-ip.be:2101/USAL0 RTCM_3.1 40.20 18.06 no 1 54.649 kB
5 www.euref-ip.net:2101/GOPE0 RTCM_2.3 49.91 14.79 no 1 163.957 kB
6 www.euref-ip.net:2101/USAL0 RTCM_3.1 40.33 18.11 no 1 54.274 kB
Log
Throughput
Latency
PPP Plot
10-05-12 06:30:45 GOPE0: Mean latency 0.86 sec, min 0.81, max 1.39, rms 0.1, 40 epochs
10-05-12 06:30:46 GOPE0: Mean latency 1.1 sec, min 1.02, max 1.25, rms 0.09, 40 epochs
10-05-12 06:30:46 GOPE0: Mean latency 1.28 sec, min 1.11, max 1.58, rms 0.11, 40 epochs
10-05-12 06:30:46 USAL0: Mean latency 0.55 sec, min 0.29, max 1.35, rms 0.23, 40 epochs
10-05-12 06:30:46 USAL0: Mean latency 0.71 sec, min 0.39, max 1.4, rms 0.25, 39 epochs
10-05-12 06:30:46 USAL0: Mean latency 0.72 sec, min 0.41, max 1.41, rms 0.25, 40 epochs
10-05-12 06:31:45 GOPE0: Mean latency 0.86 sec, min 0.81, max 1.04, rms 0.07, 60 epochs
10-05-12 06:31:46 GOPE0: Mean latency 1.13 sec, min 1.05, max 1.29, rms 0.09, 60 epochs
10-05-12 06:31:46 USAL0: Mean latency 0.58 sec, min 0.26, max 2.61, rms 0.37, 60 epochs
10-05-12 06:31:46 GOPE0: Mean latency 1.21 sec, min 1.01, max 1.59, rms 0.12, 60 epochs
10-05-12 06:31:46 USAL0: Mean latency 0.8 sec, min 0.4, max 2.8, rms 0.39, 60 epochs
10-05-12 06:31:46 USAL0: Mean latency 0.82 sec, min 0.43, max 2.83, rms 0.39, 60 epochs
10-05-12 06:32:45 GOPE0: Mean latency 0.85 sec, min 0.65, max 1.06, rms 0.07, 60 epochs, 0 gaps
10-05-12 06:32:46 GOPE0: Mean latency 1.15 sec, min 0.73, max 1.75, rms 0.14, 60 epochs, 0 gaps
10-05-12 06:32:46 USAL0: Mean latency 0.51 sec, min 0.25, max 1.37, rms 0.23, 60 epochs, 0 gaps
10-05-12 06:32:46 USAL0: Mean latency 0.76 sec, min 0.41, max 1.62, rms 0.25, 60 epochs, 0 gaps
10-05-12 06:32:46 USAL0: Mean latency 0.77 sec, min 0.44, max 1.65, rms 0.23, 60 epochs, 0 gaps
10-05-12 06:32:46 GOPE0: Mean latency 1.19 sec, min 0.9, max 1.58, rms 0.13, 60 epochs, 0 gaps
Add Stream
Delete Stream
Start
Stop
Help=Shift+F1

Example SASS1

RT data streamed directly (via NtripServer) to BKG caster → lowest latency

Data stream pulled (via relay function) by ASI and ROB → additional delay of ~0.25 s

More investigations needed concerning, e.g., trace checks etc.