Real-Time Tools Provided by BKG: Professional Ntrip Caster and BKG Ntrip Client (BNC)

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Outline

- Introduction/Motivation
- Ntrip
- Professional Ntrip Caster
- BKG Ntrip Client
- Summary
GNSS Real-Time Processing at BKG

- Reference Stations
- Broadcast Corrections

Ntrip Caster

Observations and Broadcast Ephemeris

BNC Decoder

Synchronized Observations

BNC Encoder

Broadcast Ephemeris

Real-time software

RINEX Nav. Ephemeris

Clocks & Orbits SP3

IGS Ultra Rapid Orbit & Clock files

Server, listening on port

Client, talking to server's host and port

RINEX Clock files

SP3 Orbit files
Ntrip concept

- HTTP application layer on top of TCP/IP
- Data streaming begins with selective HTTP request
- Communication between Server, Caster and Client handled through HTTP port
- Major software components developed under “GNU General Public License”
- Open documentation

*RTCM: Radio Technical Commission for Maritime Services (founded 1947)
Ntrip characteristics

- Streaming protocol: distribution of any kind of GNSS data
- HTTP: easy to implement, usually not blocked by firewalls
- Security: stream providers and users are not in contact
- Mass usage: Disseminating hundreds of streams simultaneously for a few thousand users when applying modified Internet Radio broadcasting software
Ntrip characteristics

~5 kbit/s per GNSS Stream max.
Ntrip

history

- Developed by BKG and Informatikzentrum Dortmund
- Industry standard since 2004
- Standardized as Version 1 in RTCM Special Committee 104 “DGNSS”
- Version 2 completed 2009
  - Problems and bugs of version 1 fixed (improved HTTP compatibility)
  - Chunked transfer encoding added
  - Header records improved
  - Sourcetable filtering provided
  - Streaming protocol RTSP/RTP for UDP communication added
  - SSL/TLS included
  - Downward compatible to Ntrip version 1
Ntrip

server-caster communication

NTRIP-SOURCE /Mountpoint HTTP/1.1
User-Agent: NTRIP ServerCMD/1.5
Authorization: Basic aHVnb2JlbjpodWdvYmVuMTIz
NTRIP-STR: <STR-String><CR><LF> (optional)
Upgrade: Ntrip/1.1
Connection: Upgrade <CR><LF>
<CR><LF>

HTTP/1.1 101 Switching Protocols
Upgrade: Ntrip/2.0, HTTP/1.1
Connection: Upgrade
HTTP/1.1 200 OK
<CR><LF>

GNSS Data
Ntrip

client-caster communication

CLIENT
GET /Mountpoint HTTP/1.1\r\nUser-Agent: NTRIP GNSSInternetRadio/2.0.10\r\nAccept: */*\r\nUpgrade: Ntrip/2.0\r\nConnection: Upgrade\r\n\r\nCASTER
HTTP/1.1 101 Switching Protocols\r\nUpgrade: Ntrip/2.0, HTTP/1.1\r\nConnection: Upgrade\r\nHTTP/1.1 200 OK\r\nServer: NTRIP Caster 2.0.1\r\nContent-Type: gnss/data\r\nDate: 25/Jan/2005:17:41:48 UTC\r\n\r\nCLIENT
GNSS Data
Ntrip caster

Installation

- Copy it somewhere into an empty directory
- run `bunzip2 ntripcaster-version.tar.bz2`
- run `tar xfv ntripcaster-version.tar` for un-compression
- Run `.configure`
  - if you do not want the server to be installed in "/usr/local/ntripcaster"
    specify the desired path with `.configure --prefix=<path>`
- Run `make`
- Run `make install`
- After that, the server files will be installed
  - binaries in `/usr/sbin` and `/usr/bin`
  - configuration files in `/etc/ntripcaster`
  - logs in `/var/log/ntripcaster`
  - html templates in `/usr/local/ntripcaster/templates`
Ntrip caster

Installation

- **Configuration files** within the sub-directory `/conf`
  - for general administration
    - `ntripcaster.conf`
  - for Ntrip server and client authorization
    - `clientmounts.aut`
    - `sourcemounts.aut`
    - `groups.aut`
    - `users.aut`
  - to save meta-data
    - `sourcetable.dat`
Ntrip caster configuration
Ntrip caster

configuration

- **Home page**
  - [http://NTRIP_CasterIP:port/home](http://NTRIP_CasterIP:port/home)

- **Administrator web interface**
  - [http://NTRIP_CasterIP:port/admin](http://NTRIP_CasterIP:port/admin)
  - password protected

- Sub-directory `/templates` contains templates for both
Professional NtripCaster

global distribution
Ntrip caster

**source-table**

- Ntrip caster source-table for meta-data handling

**Records**

- **CAS** record: caster entry
- **NET** record: network entry
- **STR** record: source entry
Ntrip caster source-table

- Ntrip caster source-table for meta-data handling
- Records
  - **CAS** record

- caster host; port
- caster name; operator; NMEA support; 3 char country ID
- latitude; longitude of caster location
- Backup caster IP and host
Ntrip caster 

source-table

- Ntrip caster source-table for meta-data handling
- Records
  - NET record

- network identifier
- network operator; authentication (None, Basic, Digest); fee (Yes, No)
- Web pages (network, streams, registration, etc.)
- miscellaneous information
Ntrip caster source-table

- Ntrip caster source-table for meta-data handling
- Records
  - STR record

- “Mountpoint”; Identifier (Name of the city next to source location)
- Format; Format details
- Carrier; GNSS; network; 3 char country ID; Latitude; longitude; NMEA support solution (0 = reference station, 1 = network)
- Generator (hardware, software, receiver)
- miscellaneous information
Sourcetable Validation Service

This service checks a Ntrip sourcetable referring to the format described at http://software.rtcn-trip.org/

Enter address here

Security question: 4 less than ninethnine is:
Ntrip caster example: EUREF

Regional Broadcaster: ROB
Link: [http://www.euref-ip.be](http://www.euref-ip.be)
Located: Royal Observatory of Belgium

Regional Broadcaster: BKG
Link: [http://www.euref-ip.net](http://www.euref-ip.net)
Located: external provider

Regional Broadcaster: ASI
Link: [http://192.106.234.7:2101/](http://192.106.234.7:2101/)
Located: ASI/CGS Centro di Geodesia Spaziale

**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/_networkdata/data_access/real_time/broadcasters.php](http://www.epncb.oma.be/_networkdata/data_access/real_time/broadcasters.php) for a complete list of Ntrip Broadcasters)

Guidelines

- “EPN Stations and Operational Centres” ([http://www.epncb.oma.be/_documentation/guidelines/guidelines_station_operationalcentre.pdf](http://www.epncb.oma.be/_documentation/guidelines/guidelines_station_operationalcentre.pdf))
### Ntrip caster example: EUREF

**EUREF PERMANENT NETWORK**

**REAL-TIME PRODUCTS**

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<td>RTCM 3.0 - EUREF filter combination</td>
<td>RTCM 3.0 - EUREF filter combination</td>
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**REAL-TIME DATA STREAMS**

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</table>
Welcome to the EUREF-IP Ntrip Broadcaster

Protocol: NTRIP 2.0
This server is www.euref-ip.net, running on Port 80 and 2101 (http) and on Port 443 (https), operated by BKG in support of the EUREF-IP Project.

Details about GNSS data streams on the EUREF-IP Ntrip Broadcaster are available as:

- Distribution Map
- Stream Table
- Notice Advisories to Broadcaster Users NABU
- List of Contributors and Applications

An overview on EUREF-IP data is available from the EPN CB server.

To receive GNSS streams via NTRIP in real-time you will need an NTRIP Client program. This can be used on a PC/Laptop, PDA or mobile phone. NTRIP Clients send HTTP stream requests and transfer GNSS data to serial or IP port to your application. NTRIP Clients can also be part of your GNSS receiver firmware.

All streams on this server are protected. Authorization is provided through an online user Registration.

For more information visit:

- EUREF-IP for the EUREF-IP Project
- RTIGS for the Real-time IGS Pilot Project, or www.igs-ip.net for Real-time IGS observations, or products.igs-ip.net for Real-time IGS products
- NTRIP for the real-time GNSS stream dissemination technique
- Other Ntrip Broadcaster implementations

or contact euref-ip@bkg.bund.de.

The BKG is responsible today for operating this Real-time GNSS streaming server. It disclaims any liability, or responsibility to any person or entity with respect to any loss or damage, or alleged to be caused, direct or indirectly by the use and application of its GNSS Ntrip service.

NO javascript
Sourcetable

- Ntrip caster configuration example: BKG

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### Listing sources

<table>
<thead>
<tr>
<th>Mountpoint</th>
<th>Id</th>
<th>Host</th>
<th>Source Agent</th>
<th>Time of connect</th>
<th>IP</th>
<th>Clients</th>
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<th>KBytes written</th>
<th>Client connections</th>
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### Connected Listeners

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- **[Host: 141.74.33.13]** [IP: 141.74.33.13] [User: bkpg] [Mountpoint /ONSA0] [Id: 139] [Connected for: 5 days, 22 hours, 46 minutes and 8 seconds] [Bytes written: 185695652] [Errors: 0] [User agent: NTRIP BNC/2.12.3 (LINUX)] [Type: http client]
- **[Host: 212.18.21.156]** [IP: 212.18.21.156] [User: tvn-de-1] [Mountpoint /GRAZ23] [Id: 290] [Connected for: 5 days, 22 hours, 46 minutes and 8 seconds] [Bytes written: 183818636] [Errors: 0] [User agent: NTRIP Trimble NtripClient] [Type: http client]
- **[Host: 212.18.21.156]** [IP: 212.18.21.156] [User: tvn-de-1] [Mountpoint /BUTE0] [Id: 294] [Connected for: 5 days, 22 hours, 46 minutes and 8 seconds] [Bytes written: 183358183] [Errors: 0] [User agent: NTRIP Trimble NtripClient] [Type: http client]
- **[Host: 212.18.21.156]** [IP: 212.18.21.156] [User: tvn-de-1] [Mountpoint /MAR60] [Id: 295] [Connected for: 5 days, 22 hours, 46 minutes and 8 seconds] [Bytes written: 169281746] [Errors: 0] [User agent: NTRIP Trimble NtripClient] [Type: http client]
- **[Host: 212.18.21.156]** [IP: 212.18.21.156] [User: tvn-de-1] [Mountpoint /PENO] [Id: 297] [Connected for: 5 days, 22 hours, 46 minutes and 8 seconds] [Bytes written: 151762371] [Errors: 0] [User agent: NTRIP Trimble NtripClient] [Type: http client]
- **[Host: 212.18.21.156]** [IP: 212.18.21.156] [User: tvn-de-1] [Mountpoint /ONSA0] [Id: 358] [Connected for: 5 days, 22 hours, 46 minutes and 8 seconds] [Bytes written: 185695352] [Errors: 0] [User agent: NTRIP Trimble NtripClient] [Type: http client]
- **[Host: 94.198.134.87]** [IP: 94.198.134.87] [User: ded9090] [Mountpoint /MEL10] [Id: 438] [Connected for: 5 days, 22 hours, 46 minutes and 8 seconds] [Bytes written: 169976658] [Errors: 0] [User agent: NTRIP SPP] [Type: http client]
- **[Host: 94.198.134.87]** [IP: 94.198.134.87] [User: alex591] [Mountpoint /ONSA0] [Id: 443] [Connected for: 5 days, 22 hours, 46 minutes and 8 seconds] [Bytes written: 185695352] [Errors: 0] [User agent: NTRIP SPP] [Type: http client]
- **[Host: 147.175.19.177]** [IP: 147.175.19.177] [User: kgza] [Mountpoint /PENO] [Id: 455] [Connected for: 5 days, 22 hours, 46 minutes and 7 seconds] [Bytes written: 151762371] [Errors: 0] [User agent: NTRIP Trimble NtripClient] [Type: http client]
- **[Host: 194.199.172.227]** [IP: 194.199.172.227] [User: regina2] [Mountpoint /BRUX0] [Id: 460] [Connected for: 5 days, 22 hours, 46 minutes and 7 seconds] [Bytes written: 187986271] [Errors: 0] [User agent: NTRIP Caster/2.0.15] [Type: puller]
- **[Host: 194.199.172.227]** [IP: 194.199.172.227] [User: regina2] [Mountpoint /NYA20] [Id: 465] [Connected for: 5 days, 22 hours, 46 minutes and 7 seconds] [Bytes written: 601405555] [Errors: 0] [User agent: NTRIP Caster/2.0.15] [Type: puller]
- **[Host: 194.199.172.227]** [IP: 194.199.172.227] [User: regina2] [Mountpoint /MATE0] [Id: 466] [Connected for: 5 days, 22 hours, 46 minutes and 7 seconds] [Bytes written: 148015026] [Errors: 0] [User agent: NTRIP Caster/2.0.15] [Type: puller]
- **[Host: 147.175.19.177]** [IP: 147.175.19.177] [User: kgza] [Mountpoint /TUW10] [Id: 504] [Connected for: 5 days, 22 hours, 46 minutes and 7 seconds] [Bytes written: 164502373] [Errors: 0] [User agent: NTRIP Trimble NtripClient] [Type: http client]
- **[Host: 94.198.134.87]** [IP: 94.198.134.87] [User: spp] [Mountpoint /MATE0] [Id: 509] [Connected for: 5 days, 22 hours, 46 minutes and 7 seconds] [Bytes written: 148015026] [Errors: 0] [User agent: NTRIP SPP] [Type: http client]
- **[Host: 139.17.3.112]** [IP: 139.17.3.112] [User: Gseis] [Mountpoint /YEBE0] [Id: 555] [Connected for: 5 days, 22 hours, 46 minutes and 5 seconds] [Bytes written: 288257927] [Errors: 0] [User agent: NTRIP ntrips/2.0.22672] [Type: http client]
- **[Host: 139.17.3.112]** [IP: 139.17.3.112] [User: Gseis] [Mountpoint /WRO0] [Id: 557] [Connected for: 5 days, 22 hours, 46 minutes and 5 seconds] [Bytes written: 187241837] [Errors: 0] [User agent: NTRIP ntrips/2.0.22672] [Type: http client]
- **[Host: 139.17.3.112]** [IP: 139.17.3.112] [User: Gseis] [Mountpoint /ONSA0] [Id: 571] [Connected for: 5 days, 22 hours, 46 minutes and 5 seconds] [Bytes written: 185694752] [Errors: 0] [User agent: NTRIP ntrips/2.0.22672] [Type: http client]
- **[Host: 139.17.3.112]** [IP: 139.17.3.112] [User: Gseis] [Mountpoint /MATE0] [Id: 573] [Connected for: 5 days, 22 hours, 46 minutes and 5 seconds] [Bytes written: 148014626] [Errors: 0] [User agent: NTRIP ntrips/2.0.22672] [Type: http client]
- **[Host: 139.17.3.112]** [IP: 139.17.3.112] [User: Gseis] [Mountpoint /MAR60] [Id: 575] [Connected for: 5 days, 22 hours, 46 minutes and 5 seconds] [Bytes written: 169280720] [Errors: 0] [User agent: NTRIP
Statistics

Following info is server total:
NtripCaster 2.0.27 server running on www.euref-ip.net default port 80, uptime: 5 days, 22 hours, 46 minutes and 57 seconds
Admins (0):
Sources (159):
Listeners (1228):
Displaying server statistics since last resync at: 05/May/2017:13:32:45
Total KBytes read: 28423086
Total KBytes written: 240525708
Number of source connects: 4376
Number of client connects: 110917
Average listener time: 1 hours, 33 minutes
Average listener transfer: 2168 KBytes
Average source connect time: 4 hours, 34 minutes
Average source transfer: 6495 KBytes
End of statistics
GNSS Real-Time Processing
at BKG

Reference Stations

Broadcast Corrections

Observations and Broadcast Ephemeris

Broadcast Ephemeris

Synchronized Observations

BNC Decoder

BNC Encoder

Real-time software

Ntrip Caster

Broadcast Corrections

RINEX Nav. Ephemeris

Clocks & Orbits SP3

IGS Ultra Rapid Orbit & Clock files

RINEX Clock files

SP3 Orbit files

(!) Server, listening on port

(,) Client, talking to server's host and port
BKG Ntrip Client

motivation

- Provide Open Source tool for real-time GNSS
- Push development and usage of RTCM standards
  - Ntrip
  - RTCM v2/v3
  - State Space Representation (SSR) messages
  - Multiple Signal Messages (MSM)
- Provide tool which allows others to concentrate on development of real-time GNSS engines
  - Decoding, synchronization before engine
  - Encoding, conversion after engine
BKG Ntrip Client

technical stuff

- BNC source consists of more than 50,000 lines of code
- Approximately 90% is C++, 10% standard C
- BNC uses a few third-party pieces of software
- RTCM decoders/encoders and a matrix algebra library
- Qt library is used for
  - GUI
  - networking
  - threads
  - containers, streams, etc.
- BNC intended to be useable on different platforms
- Can be used
  - in graphics (interactive) mode
  - in ‘no window’ mode
  - with command line configuration
BKG Ntrip Client

history

- BNC 1.0 (12/2005)
  - Decoding, synchronization before real-time GNSS processing engine
  - Encoding, conversion after real-time GNSS processing engine

- BNC 1.3 (5/2007)
  - Source code published

- BNC 1.4 (7/2007)
  - RINEXv3 output

- BNC 1.6 (12/2008)
  - Offline mode
  - Re-configuration on-the-fly
  - Support of Ntrip v2
BKG Ntrip Client

*history*

- **BNC 2.0 (2/2010)**
  - Real-time PPP option

- **BNC 2.4 (12/2010)**
  - Drafted RTCMv3 Multiple Signal Messages
  - Drafted Galileo ephemeris messages

- **BNC 2.5 (2/2011)**
  - Include Galileo in SPP
  - SP3 and Clock RINEX output
  - PPP in post-processing mode
  - Combination of orbit & clock correction streams
  - Corrections for antenna eccentricities
BKG Ntrip Client

*history*

- **BNC 2.6 (5/2012)**
  - RINEX editing, concatenation and quality check
- **BNC 2.9 (7/2013)**
  - QC multipath and SNR plots for GLONASS and Galileo
- **BNC 2.10 (12/2013)**
  - Transformation of corrections from global to regional datums
- **BNC 2.11 (9/2014)**
  - ‘Append files’ option for RINEX observation files
BKG Ntrip Client

key features

- BNC 2.12 (2014 - now)
  - Modification of PPP module necessary with respect to additional constellations and new signals on different frequencies
  - Multiple PPP solutions with one BNC command, individual configuration for each mount-point
  - Rx2 <-> Rx3 conversion
  - SINEX TRO output
  - Quality control checking feature for Rx3
    - Observation statistics
    - Multipath analysis sky plots
    - Signal-to-noise ration sky plots
    - PDOP plots
    - Satellite availability and elevation plots
    - Man/machine readable ASCII output format
## Latency and Redundancy Aspects

**BKG Ntrip Client (BNC) Version 2.12.3**

**Precise Point Positioning - Plots.**

- **PPP Plot:** FFMJ1
- **Mountpoint:**
- **Audio response:**

**Track map:** Open Map

**Dot properties:**
- **Size:** red
- **Color:**

**Post-processing speed:**

### Streams: resource loader / mountpoint

<table>
<thead>
<tr>
<th>Stream</th>
<th>decoder</th>
<th>lat (m)</th>
<th>long (m)</th>
<th>nmea</th>
<th>ntrip</th>
<th>bytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. products.igs-ip.net2101/CLK11</td>
<td>RTCM_3.0</td>
<td>50.08967</td>
<td>8.66458</td>
<td>no</td>
<td>2</td>
<td>11.079 kB</td>
</tr>
<tr>
<td>2. products.igs-ip.net2101/RTCM3EPH</td>
<td>RTCM_3.2</td>
<td>50.08967</td>
<td>8.66458</td>
<td>no</td>
<td>2</td>
<td>108.12 kB</td>
</tr>
<tr>
<td>3. <a href="http://www.igs-ip.net2101/FFMJ1">www.igs-ip.net2101/FFMJ1</a></td>
<td>RTCM_3.1</td>
<td>50.09</td>
<td>8.66</td>
<td>no</td>
<td>2</td>
<td>37.48 kB</td>
</tr>
</tbody>
</table>

**Log**

**Throughput**

**Latency**

**PPP Plot**

Start 06:20:16

**Add Stream**  **Delete Stream**  **Map**  **Start**  **Stop**  **Help?=Shift+f1**
### Precise Point Positioning - Processed Stations

<table>
<thead>
<tr>
<th>Station</th>
<th>Sigma N</th>
<th>Sigma E</th>
<th>Sigma H</th>
<th>Noise N</th>
<th>Noise E</th>
<th>Noise H</th>
<th>Tropo Sigma</th>
<th>Tropo Noise</th>
<th>NMEA Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>FFMJ1</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>0.1</td>
<td>3e-6</td>
<td>0</td>
<td></td>
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</tbody>
</table>

### Streams: resource loader / mountpoint

<table>
<thead>
<tr>
<th>Stream</th>
<th>decoder</th>
<th>lat</th>
<th>long</th>
<th>nmea</th>
<th>ntrip</th>
<th>bytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>products.igs-ip.net2101/CLK11</td>
<td>RTCM_3.0</td>
<td>50.08967</td>
<td>8.56458</td>
<td>no</td>
<td>2</td>
<td>20.96</td>
</tr>
<tr>
<td>products.igs-ip.net2101/RTCM3EPH</td>
<td>RTCM_3.2</td>
<td>50.08967</td>
<td>8.56458</td>
<td>no</td>
<td>2</td>
<td>183.83</td>
</tr>
<tr>
<td><a href="http://www.igs-ip.net2101/FFMJ1">www.igs-ip.net2101/FFMJ1</a></td>
<td>RTCM_3.1</td>
<td>50.09</td>
<td>8.66</td>
<td>no</td>
<td>2</td>
<td>66.199</td>
</tr>
</tbody>
</table>

### Log Throughput Latency PPP Plot

![Graph showing latencies and data throughput over time]
BKG Ntrip Client

examples
BKG Ntrip Client examples

![Ntrip Client Interface](image-url)
W. Söhne

Latency and Redundancy Aspects

25.05.2016

Seite

BKG Ntrip Client (BNO) Version 2.12.3

RINEX file editing, concatenation and quality check.

- **Action**: Edit/Concatenate Analyze
- **Input files (full path)**
- **Output file (full path)**
- **Logfile**
- **Plots for signals**
- **Directory for plots**

---

**Streams: resource loader / mountpoint**

<table>
<thead>
<tr>
<th>Resource Loader</th>
<th>Decoder</th>
<th>Lat</th>
<th>Long</th>
<th>NMEA</th>
<th>Ntrip</th>
<th>Bytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>products.igs-ip.net:2101/CLK11</td>
<td>RTCM_3.0</td>
<td>50.08967</td>
<td>8.66458</td>
<td>no</td>
<td>2</td>
<td>48.603 kB</td>
</tr>
<tr>
<td>products.igs-ip.net:2101/RTCM3EPH</td>
<td>RTCM_3.2</td>
<td>50.08967</td>
<td>8.66458</td>
<td>no</td>
<td>2</td>
<td>438.13 kB</td>
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<tr>
<td><a href="http://www.igs-ip.net:2101/BO6D">www.igs-ip.net:2101/BO6D</a></td>
<td>RTCM_3.0</td>
<td>52.48</td>
<td>21.04</td>
<td>no</td>
<td>2</td>
<td>0 byte(s)</td>
</tr>
<tr>
<td><a href="http://www.igs-ip.net:2101/FFM1">www.igs-ip.net:2101/FFM1</a></td>
<td>RTCM_3.1</td>
<td>50.09</td>
<td>8.56</td>
<td>no</td>
<td>2</td>
<td>153.51 kB</td>
</tr>
</tbody>
</table>

---

**Log**

- Start: 06:20:16

Graph showing data points from June 22 to June 25.
### BKG Ntrip Client (8NC) Version 2.12.3

#### Combine Broadcast Correction streams.

<table>
<thead>
<tr>
<th>Mountpoint</th>
<th>AC Name</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLK11</td>
<td>BKG</td>
<td>1.0</td>
</tr>
<tr>
<td>CLK91</td>
<td>CNES</td>
<td>1.0</td>
</tr>
</tbody>
</table>

**Method**
- Filter

**Maximal residual**
- Single Epoch

**Sampling**
- 10 sec

**Use GLONASS**
- [ ]

### Streams: resource loader / mountpoint

<table>
<thead>
<tr>
<th>Stream</th>
<th>decoder</th>
<th>lat</th>
<th>long</th>
<th>nmea</th>
<th>ntrip</th>
<th>bytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>products.igs-ip.net:2101/CLK11</td>
<td>RTCM_3.0</td>
<td>50.08967</td>
<td>8.66458</td>
<td>no</td>
<td>2</td>
<td>65.929 kB</td>
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<tr>
<td>products.igs-ip.net:2101/RTCM3EPH</td>
<td>RTCM_3.2</td>
<td>50.08967</td>
<td>8.66458</td>
<td>no</td>
<td>2</td>
<td>584.255 kB</td>
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<tr>
<td><a href="http://www.igs-ip.net:2101/BO610">www.igs-ip.net:2101/BO610</a></td>
<td>RTCM_3.0</td>
<td>52.48</td>
<td>21.04</td>
<td>no</td>
<td>2</td>
<td>0 bytes(s)</td>
</tr>
<tr>
<td><a href="http://www.igs-ip.net:2101/FFM1">www.igs-ip.net:2101/FFM1</a></td>
<td>RTCM_3.1</td>
<td>50.05</td>
<td>8.56</td>
<td>no</td>
<td>2</td>
<td>221.023 kB</td>
</tr>
</tbody>
</table>

#### Log

**Throughput**

**Latency**

**PPP Plot**

Start: 06:20:16
Summary Ntrip

▪ Ntrip is a worldwide accepted and used standard for real-time GNSS data and products

▪ Current professional Ntrip caster version 2.0.26
  ▪ Resolving firewall issues for relay caster

▪ To Do: Increasing the rate to > 1 Hz

▪ References
  ▪ http://igs.bkg.bund.de/ntrip
Summary BNC

- To Do: introduce new clock combination taking phase biases into account
- To Do: Update all transformation parameters to ITRF2014 etc.
- Download
  - BNC executables from BKG web page [http://igs.bkg.bund.de/ntrip/download](http://igs.bkg.bund.de/ntrip/download)
  - svn co [http://software.rtcn-ntrip.org/svn/trunk/BNC](http://software.rtcn-ntrip.org/svn/trunk/BNC)
- References
  - Online BNC Help function
**Downloads**

Open Source Ntrip software provided here is also available from the Subversion server software rtm-ntrip.org. This includes POSIX ntripclient/server programs, multi-stream BKG Ntrip Client/Server programs, an RTCMv3 encoder/decoder for observations and proposed RTCM State Space Representation messages, and an RTCMv3 to RINEX converter. The included bug tracker system allows you to inform authors about software problems that you may detect when using these resources.

The two following tools are provided by BKG and are under active development:

- **BKG Professional NtripCaster**
  - *Linux, v2.0.26*
- **BKG Ntrip Client (BNC)**
  - *v2.12*

### Other Ntrip Tools

<table>
<thead>
<tr>
<th>Name, Description</th>
<th>Operating System</th>
<th>Code Executable</th>
<th>Provider</th>
<th>Vers.</th>
<th>Type Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>NtripClient, NtripServer, and NtripCaster Repositories, search for 'ntrip'</td>
<td>Unix/Linux, Distributions SUSE, Fedora, Mandriva</td>
<td>RPMs or Search SUSE</td>
<td>Dirk Stoecker</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>RTKLIB, Open Source Program Package for RTK-GPS</td>
<td>Windows NT/2000/XP</td>
<td>RTKLIB</td>
<td>Tomoji Takasu, Japan</td>
<td>2.4</td>
<td>ZIP ~30 MB</td>
</tr>
<tr>
<td>GmssSurfer, Ntrip-Client and Server, RTCM 2.x and 3.x Encoder &amp; Decoder, Topcon/Javard Raw Decoder, RINEX Generator, Web-Monitoring, Backup-System</td>
<td>Windows (x64)</td>
<td>Executable Light Version</td>
<td>Juergen Siebert, SAPOS</td>
<td>1.10, 1.08</td>
<td>ZIP ~9 MB</td>
</tr>
<tr>
<td>Ntrip Version 2.0 Command Line Server, reading from SISNet Server, TCP/UDP IP Port, Serial port, or NtripCaster to support an Ntrip Version 1.0 or 2.0 Caster</td>
<td>Posix Windows</td>
<td>GPL Executable</td>
<td>Andrea Stuerze, BKG, Dirk Stoecker, Alberding GmbH</td>
<td>1.5.1</td>
<td>ZIP 17 K</td>
</tr>
</tbody>
</table>
Thank you for your attention!

Contact:
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Referat G2
Richard-Strauss-Allee 11
60598 Frankfurt

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