Networked Transport of RTCM via Internet Protocol
Networked Transport of RTCM via Internet Protocol

Bundesamt für Kartographie und Geodäsie
Motivation:
- Use Internet to transport GNSS corrections

Communication satellite

Radio link: AM, FM, VHF

Mobile phone: GSM

Internet + Mobile Internet: GPRS

NTRIP

Reference

Rover
Motivation:

- Mass usage

Server → Splitter Caster → Client

100+ x 10 kbit/s

1000+ x 10 kbit/s
Motivation:

• Make GNSS corrections accessible to a wider user range
  ➔ GSM, GPRS, EDGE, UMTS, ...

• RTCM - Standard
  ➔ any NTRIP - capable hardware - and software can be used
Motivation:
- Metadata

[Stream Details window]

- Broadcaster Details
  - Broadcaster: EUREF-IP

- Stream Details
  - Stream: Frankfurt, Stream No: 68 of 75
  - Mountpoint: FFMJ1
  - Authentication: None
  - Format: RTCM 2.3
  - Format Details: 3(13),16(59),18(1),19(1),22(13),23(11),24(11)
  - Carrier: L1 and L2
  - Client must send NMEA-GGA: No
  - System: GPS+GL0
  - Country: DEU
  - Latitude: 50.09 deg North
  - Longitude: 8.66 deg East
  - Generator: GPSNet
  - Solution: Single Base
  - Compression: none
  - Bitrate: 2800 bits per sec
  - Charges: No
  - Miscellaneous: Demo

- Network Details
  - Network: Test
  - Operator: BKG
  - Details: [Link]
  - Registration: Closed

[bkg logo]
History – Scientific Community:

IGS-IP (Start: May 2006)
- BKG operates www.igs-ip.net (ports 80, 2101)
- cooperate with RTIGS Working Group
- offer world-wide data streams via NTRIP
- following Open Data Policy
- support RTCM 2.x, RTCM 3 and RTIGS data formats
- Strategic Planning Meeting 8-9 Dec 2006
NEWS from the Radio Technical Commission for Maritime Services (RTCM)
November 29, 2004


Summary: RTCM Special Committee 104 has completed a new standard which defines a protocol for streaming differential correction data or other kinds of Global Navigation Satellite System (GNSS) data to stationary or mobile users over the Internet. Titled “Networked Transport of RTCM via Internet Protocol (Ntrip)” the standard is named for the widely used RTCM data format, but it can also be used for other data formats. Designated as Version 1.0, (Paper 200-2004/SC104-STD), the standard is available from RTCM at its secure online publication store. Visit www.rtcm.org and click on “Publications.”
Radio Technical Commission for Maritime Services:

• Non-profit organisation
• ~ 100 members
• Develops industry standards for marine and land-based applications
• SC-104: Differential GNSS data formats → RTCM 2.x and RTCM 3.0 data formats
History – Scientific Community:

• **EUREF Symposium 2002**
  - set up and maintain a differential GNSS infrastructure based on selected EPN stations through the Internet
  - upgrade respective EPN stations
  - enable real-time data stream dissemination
  - Broadcaster: www.euref-ip.net (ports 80, 2101)

• **EUREF Symposium 2005**
  - Stream also carrier phase data
History – Scientific Community:

**EUREF – IP**  
(Start: 2002)

- Real-time access to reference frame
- Disseminate real-time data from EPN stations
- Develop NTRIP software tools (GPL)
- Run network of NTRIP casters
- Promote NTRIP technology
- Enable generation of EUREF real-time products
- Support scientific community in generating real-time products:
  - Orbits & clocks
  - Atmospheric parameters, disaster monitoring, ...
NTRIP Streams
Europe:
June 2003
NTRIP Streams
Europe:
October 2006
World-wide NTRIP Streams: December 2003
## Formats

<table>
<thead>
<tr>
<th>RTCM-SC104</th>
<th>Raw</th>
</tr>
</thead>
<tbody>
<tr>
<td>Versions – 2.0, 2.1, 2.2, 3.0</td>
<td>Topcon/Javad Compact (1)</td>
</tr>
<tr>
<td>Type 1 Fixed GPS corrections (1 sec)</td>
<td>Ashtech MBEN (5) / PBEN (5)</td>
</tr>
<tr>
<td>Type 3 GPS reference station parameters (10)</td>
<td>/ SNAV</td>
</tr>
<tr>
<td>Type 16 GPS special message (30,60)</td>
<td>Thales ASCII</td>
</tr>
<tr>
<td>Type 18 RTK uncorrected carrier phases (1)</td>
<td>SP3 ASCII</td>
</tr>
<tr>
<td>Type 19 RTK uncorrected pseudoranges (1)</td>
<td>Trimble RT17, concise</td>
</tr>
<tr>
<td>Type 22 Extended station parameters (15)</td>
<td>Leica LB2</td>
</tr>
<tr>
<td>Type 59 Proprietary messages (1)</td>
<td>RINEX</td>
</tr>
<tr>
<td></td>
<td>BINEX</td>
</tr>
</tbody>
</table>
NTRIP Background – History, Development & BKG

Diagram:
- NtripClient 1 to NtripClient N
- HTTP Streams
- NtripCaster
- Administration
- HTTP/Telnet
- NtripServer 1 to NtripServer N
- NtripSource 1 to NtripSource N
NTRIP Background – History, Development & BKG

INTERNET

Central Processing Center

NTRIP Caster Port 80 or 8080
NTRIP – network Transportation of RTCM via Internet Protocol

Server – what sends data to a caster (CORS or RTN Software)

Caster – the ‘exchange’ for incoming and outgoing data

Client – application(s) used to get user data from the caster

Download a free client for testing, training (and correction relaying) from:

http://igs.bkg.bund.de/ntrip/ntrip_down.htm
NtripCasters in Europe

EUREF-IP
www.euref-ip.net

- 17 networks
- 180 data streams
- 27 EPN stations
- 488 registered users

(14/Jan/2006)
Stream Sharing – Beyond RTN

- Tectonic Plate Studies
- Geodetic Monitoring Agencies / Services / Programs
- National CORS Program
- National / World Iono & Tropo Modeling
- National / World Timing Modeling / Studies
- National Positioning Initiatives (e.g. NDGPS, HaNDGPS)
- International Positioning Initiatives (IGS – PPP)
- Augmentation Systems (WAAS, AGPS)
# BKG NTRIP Client Downloads

## GNSS Internet Radio

![Image of GNSS Internet Radio](image)

## Downloads Table

<table>
<thead>
<tr>
<th>Ntrip Client</th>
<th>Software</th>
<th>KB</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Windows Client</strong></td>
<td>GNSS Internet Radio, Vers. 1.4.10</td>
<td>EXE</td>
</tr>
<tr>
<td></td>
<td>Plain Example NtripClient Program, Vers. 1.14</td>
<td>~680</td>
</tr>
<tr>
<td></td>
<td>GNU General Public License</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Provided by Dirk Stoecker, Euronik</td>
<td></td>
</tr>
<tr>
<td><strong>Linux Client</strong></td>
<td>Plain Example NtripClient Program, Vers. 0.6</td>
<td>ZIP</td>
</tr>
<tr>
<td></td>
<td>GNU General Public License</td>
<td>~7</td>
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<tr>
<td><strong>Linux Perl Client</strong></td>
<td>Perl NtripClient Program for Linux, Vers. 0.6</td>
<td>ZIP</td>
</tr>
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<td></td>
<td>Provided by Dirk Stoecker, Euronik</td>
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<tr>
<td><strong>Windows CE Client</strong></td>
<td>GNSS Internet Radio, Vers. 1.0.0</td>
<td>EXE</td>
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<tr>
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<td>WinCE, PocketPC 2002/3, Intel PXA Processor</td>
<td>~700</td>
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<tr>
<td><strong>Windows CE Client</strong></td>
<td>GNSS Internet Radio, Vers. 1.0.0</td>
<td>CAB</td>
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<td>WinCE, PocketPC 2002/3, Intel PXA Processor</td>
<td>~70</td>
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<tr>
<td><strong>Palm OS Client</strong></td>
<td>Demo NtripClient Program, Vers. 1.2.1</td>
<td>ZIP</td>
</tr>
<tr>
<td></td>
<td>Provided by Guenther Thalmann</td>
<td>~50</td>
</tr>
</tbody>
</table>
BKG NTRIP Server Downloads

**Ntrip Server 1.3.0**

- Settings:
  - COM Port
  - NtripCaster
  - Reconnection

**Ntrip Server**

<table>
<thead>
<tr>
<th>Ntrip Server</th>
<th>Software</th>
<th>KB</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Windows Server</strong></td>
<td>Windows NtripServer Reading from Serial Port, Vers. 1.3.0</td>
<td>EXE</td>
</tr>
<tr>
<td><strong>Windows Server</strong></td>
<td>Command Line Version of Windows NtripServer Reading from TCP/IP Port, Vers. 1.6</td>
<td>ZIP</td>
</tr>
<tr>
<td><strong>Linux Server</strong></td>
<td>Linux C-Version of NtripServer Reading from SISNet server or TCP/UDP Port or Serial Port or NtripCaster, Vers. 0.17 GNU General Public License Provided by Dirk Stoecker, Euronik</td>
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</tr>
<tr>
<td><strong>Linux Server</strong></td>
<td>Linux Perl-Version of NtripServer Reading from Standard Input, Vers. 0.2 GNU General Public License</td>
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### BKG Misc. Downloads

<table>
<thead>
<tr>
<th>Software</th>
<th>File Format</th>
<th>Size</th>
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<tbody>
<tr>
<td>GnssSurfer, Vers. 1.06 Combined Function</td>
<td>ZIP</td>
<td>~2000 KB</td>
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<tr>
<td>RTCM 2.x DGPS/RTK Decoder Reading from TCP/IP Port, Vers. 2.1</td>
<td>ZIP</td>
<td>~240 KB</td>
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<tr>
<td>RTCM 2.x DGPS/RTK Decoder Reading from Standard Input, Vers. 1.1 GNU General Public License Provided by Carsten Becker, DLR, Neustrelitz</td>
<td>ZIP</td>
<td>~25 KB</td>
</tr>
<tr>
<td>Multi-Stream Client, translates RTCM 2.x RTK to RINEX, Vers. 1.21 GNU General Public License Provided by Carsten Becker, DLR, Neustrelitz</td>
<td>ZIP</td>
<td>~120 KB</td>
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<tr>
<td>Single-Stream Client, translates RTCM 3 RTK to RINEX, Vers. 1.4 GNU General Public License Provided by Dirk Stoecker, Euronav</td>
<td>ZIP</td>
<td>~15 KB</td>
</tr>
<tr>
<td>UNAVCO's Teqc, translates Raw GNSS receiver data to RINEX</td>
<td>pdf</td>
<td>~40 KB</td>
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<tr>
<td>UNAVCO's Teqc, translates Raw GNSS receiver data to RINEX</td>
<td>zip</td>
<td>~340 KB</td>
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<tr>
<td>Standard NtripCaster, Vers. 0.1.5 GNU General Public License</td>
<td>tgz</td>
<td>~265 KB</td>
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</table>

[Image of software interface]
### NTRIP Caster

#### Users

<table>
<thead>
<tr>
<th>Mountpoint</th>
<th>Connection Type</th>
<th>Connections</th>
<th>Connected to Source</th>
<th>Source Host</th>
<th>Source Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNI_RAW</td>
<td>Broadcast</td>
<td>0</td>
<td>Yes</td>
<td>10.2.159.231</td>
<td>1053</td>
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<td>AUG_RAW</td>
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<td>moha</td>
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<tr>
<td>MuonRTK-1</td>
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<td>10.2.159.231</td>
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<td>MUE_RAW</td>
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<td>10.2.159.231</td>
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<tr>
<td>HoehRTK</td>
<td>Broadcast</td>
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<td>Yes</td>
<td>10.2.159.231</td>
<td>1071</td>
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<tr>
<td>UniBVRRTK-1</td>
<td>Broadcast</td>
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<td>Yes</td>
<td>10.2.156.38</td>
<td>3856</td>
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<tr>
<td>UniBVRRTK-2</td>
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<tr>
<td>RTCM3Net</td>
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<tr>
<td>HoehDGPS</td>
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<td>NAL_RAW</td>
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<td>RTCM3NetIn</td>
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<tr>
<td>HOE_RAW</td>
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<td>10.2.159.231</td>
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<tr>
<td>N51</td>
<td>NtripServer</td>
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<td>No</td>
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</tr>
</tbody>
</table>

- **Active connections:** 0
- **Inbound data rate:** 0 Bytes/sec
- **Total connections:** 81,256
- **Outbound data rate:** 0 Bytes/sec
- **Caster uptime:** 3d 00:55:43
- **Ports:** TCP 6422 (10.2.159.231) - TCP 8080 (10.2.159.231)
NTRIP – Tools and Solutions

Onboard Client and Server Applications