

Real-time IGS

Infrastructure, Data & Formats

Georg Weber, BKG

IGS Workshop 2010
Newcastle University, United Kingdom

Outline

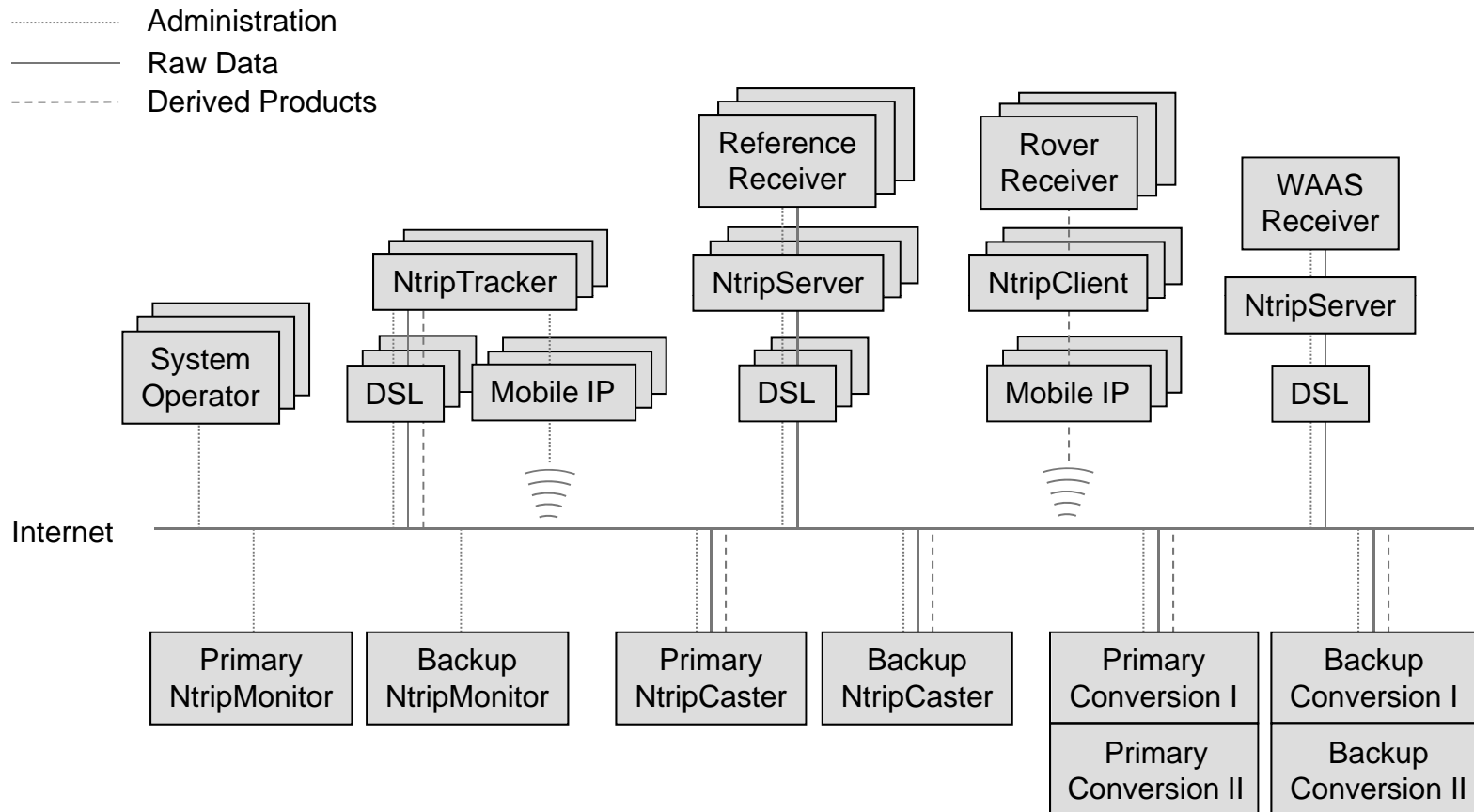
1. Stream Broadcast Infrastructure & Contributors

2. Software & Standards

3. Application Areas, BNC

- **Feeding Engines**
- **Static PPP**
- **RINEX**
- **Kinematic PPP**

Real-time IGS Service Provision

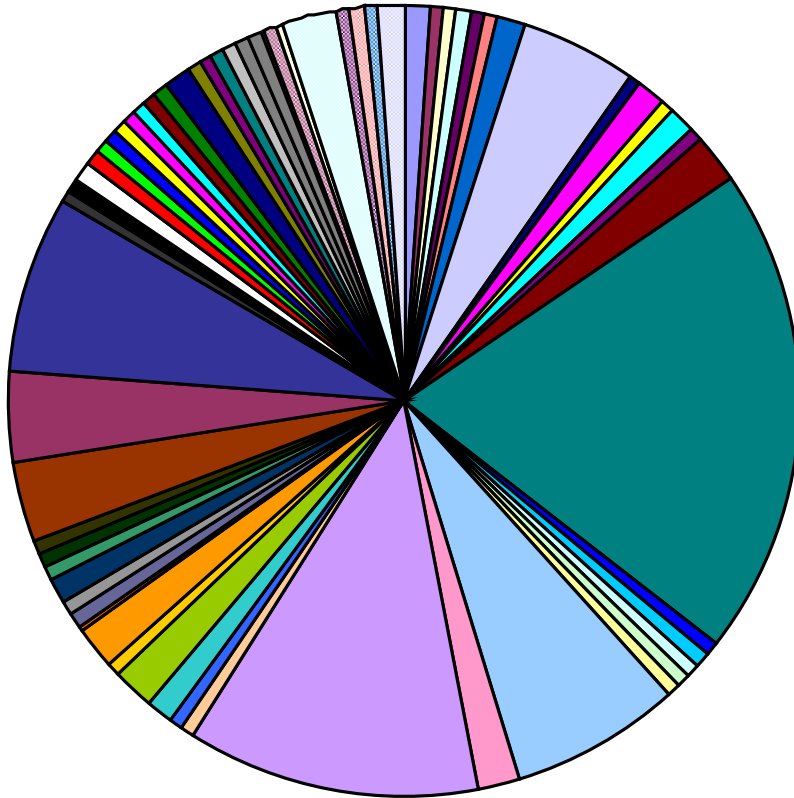


Real-time IGS Streams

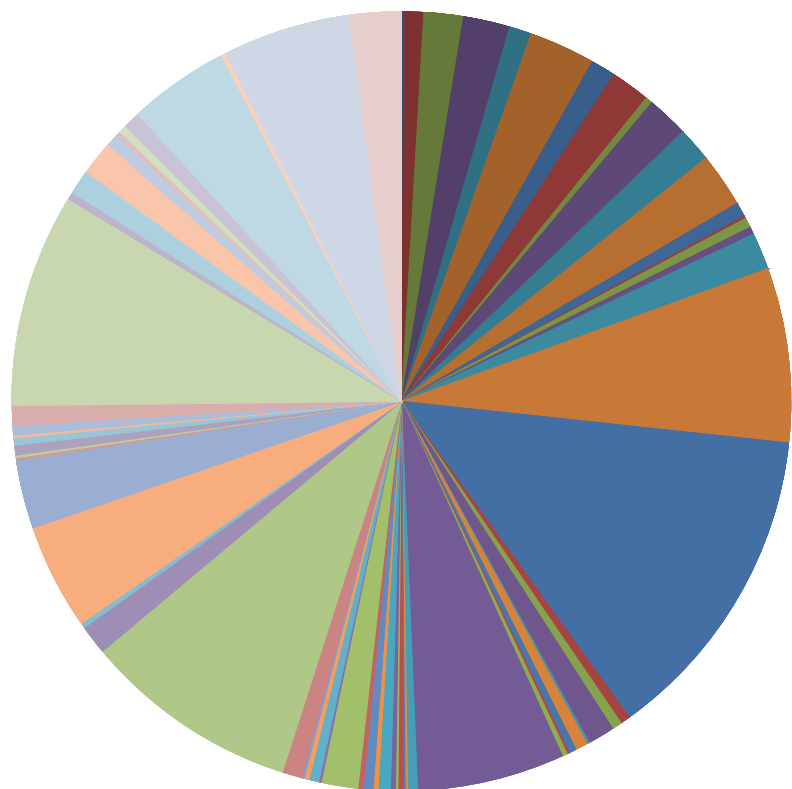
www.igs-ip.net

64 Contributors, 36 Countries

185 Streams



- Addis Ababa University - Ethiopia (2)
- Agenzia Spaziale Italiana - Italy (1)
- Agricultural University of Wroclaw - Poland (1)
- Alfred Wegener Institut - Germany (1)
- Ashtech - France (1)
- Astrogeodynamical Observatory - Poland (1)
- Astronomy and Space Science Institute - Korea (1)
- Brazilian Institute of Geography and Statistics - Brazil (9)
- Bucharest Technical University of Civil Engineering - Romania (1)
- Bundesamt fuer Eich und Vermessungswesen - Austria (2)
- Clark Fortune McDonald Associates - New Zealand (1)
- Croatian Geodetic Institute - Croatia (2)
- DIST Universita di Cagliari - Italy (1)
- European Space Operations Centre - Germany (4)
- Federal Agency for Cartography and Geodesy - Germany (37)
- Finnish Geodetic Institute - Finland (1)
- Florida International University Miami - U.S.A. (1)
- FOMI Satellite Geodetic Observatory - Hungary (1)
- Geodetic and Cartographic Institute - Slovakia (1)
- Geodetic Institute University Warszawa - Poland (1)
- GeoForschungsZentrum Potsdam - Germany (13)
- GeoNet - New Zealand (3)
- Geoscience Australia - Australia (22)
- GOP Research Institute of Geodesy Topography and Cartographie - Czech Republic (1)
- GPS Solutions Inc. - U.S.A. (1)
- GSOC/DLR German Space Operations Center - Germany (2)
- Institut Geographique National - France (3)
- Instituto Geografico Nacional - Spain (1)
- Instituto Geografico Portugues - Portugal (3)
- Instytut Geodezji i Kartografii Warszawie - Poland (1)
- Istanbul Technical University - Turkey (1)
- Istituto Nazionale di Ricerca Meteorologica I.N.R.I.M - Italy (1)
- L'equipe du reseau Banian - New Caledonia (2)
- Nanyang Technological University - Singapore (1)
- NASA Stennis Space Center - U.S.A. (1)
- National Geographic Information Institute - Korea (1)
- National Land Survey - Sweden (6)
- National Oceanic and Atmospheric Administration National Geodetic Survey - U.S.A. (7)
- Natural Resources - Canada (13)
- Naval Observatory - U.S.A. (1)
- NERC Space Geodesy Facility - United Kingdom (1)
- Point Inc. - Canada (2)
- Puerto Rico Seismic Network - Puerto Rico (1)
- Puget Sound Reference Network - U.S.A. (1)
- Regional Centre for Mapping of Resources for Development - Kenya (1)
- Regional Centre for Training in Aerospace Surveys - Nigeria (1)
- Rocco V. D'Andrea Inc. - U.S.A. (1)
- Royal Observatory - Belgium (1)
- Scripps Orbit and Permanent Array Center - U.S.A. (1)
- Solucoes em Posicionamento Global SPG - Brazil (1)
- Surveys and Mapping - South Africa (2)
- SwissTopo - Switzerland (1)
- Technical University Delft - The Netherlands (1)
- Teodonivel - Brazil (1)
- Trimbase Ltda - Brazil (1)
- Universidad de Cordoba - Argentina (1)
- Universidad del Zulia - Venezuela (1)
- Universidad de Rosario - Argentina (1)
- Universidade da Baira Interior UBI/CGUL/IDL - Portuga (1)
- Universidade Estadual Paulista UNESP/FCT - Brazil (4)
- University NAVSTAR Consortium - U.S.A (1)
- University New South Wales - Australia (1)
- University of New Brunswick - Canada (1)
- University Padova - Italy (2)



Usage of Realtime GNSS

Resources from IGS & EUREF

Disseminated via NTRIP

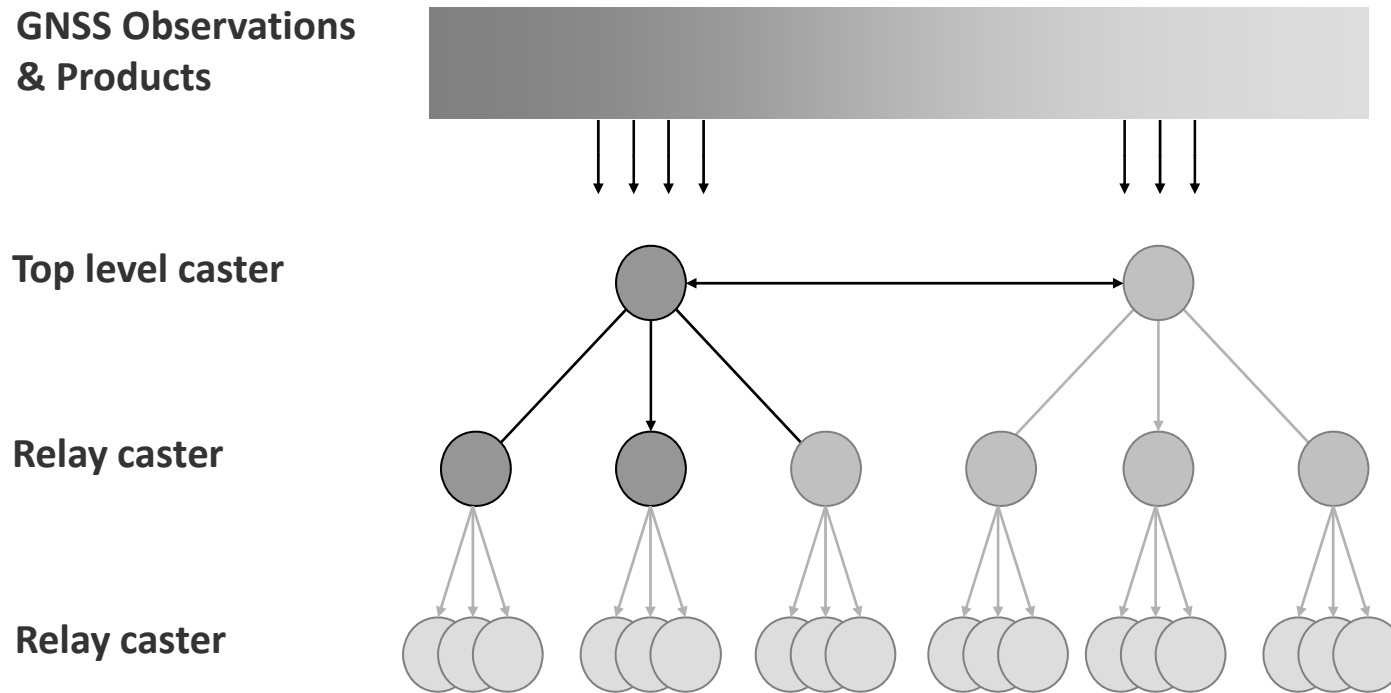
68 Countries from latest

1000 User registrations

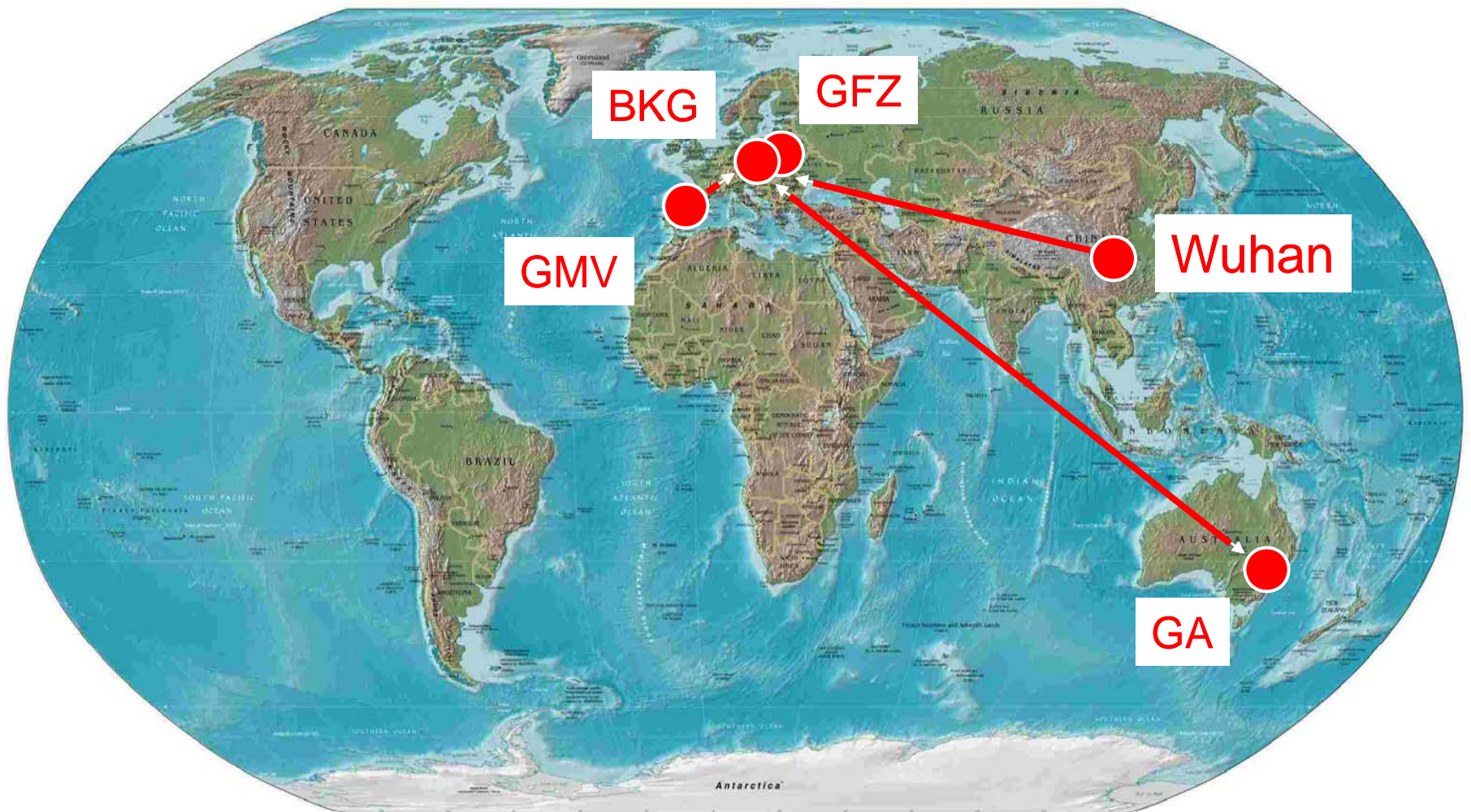
Status March 25, 2010

- | | | | | | | | |
|------------------|-----------------|--------------------|------------------|-------------|--------------|----------------|-----------------|
| ■ Albania | ■ Argentina | ■ Australia | ■ Austria | ■ Belgium | ■ Brazil | ■ Bulgaria | ■ Canada |
| ■ Chile | ■ China | ■ Croatia | ■ Czech Republic | ■ Denmark | ■ Ecuador | ■ Egypt | ■ Estonia |
| ■ Finland | ■ France | ■ Germany | ■ Greece | ■ Hong Kong | ■ Hungary | ■ Iceland | ■ India |
| ■ Indonesia | ■ Iraq | ■ Ireland | ■ Italy | ■ Japan | ■ Kazakhstan | ■ Kenya | ■ Latvia |
| ■ Lothian | ■ Macedonia | ■ Malaysia | ■ Mexico | ■ Moldova | ■ Morocco | ■ Netherlands | ■ New Caledonia |
| ■ New Zealand | ■ Nigeria | ■ Northern Ireland | ■ Norway | ■ Poland | ■ Portugal | ■ Puerto Rico | ■ Romania |
| ■ Russia | ■ Saudia Arabia | ■ Serbia | ■ Singapore | ■ Slovakia | ■ Slovenia | ■ South Africa | ■ South Korea |
| ■ Spain | ■ Sri Lanka | ■ Sweden | ■ Switzerland | ■ Taiwan | ■ Thailand | ■ Turkey | ■ Ukraine |
| ■ United Kingdom | ■ Uruguay | ■ USA | ■ Venezuela | | | | |

NTRIP Broadcaster Network

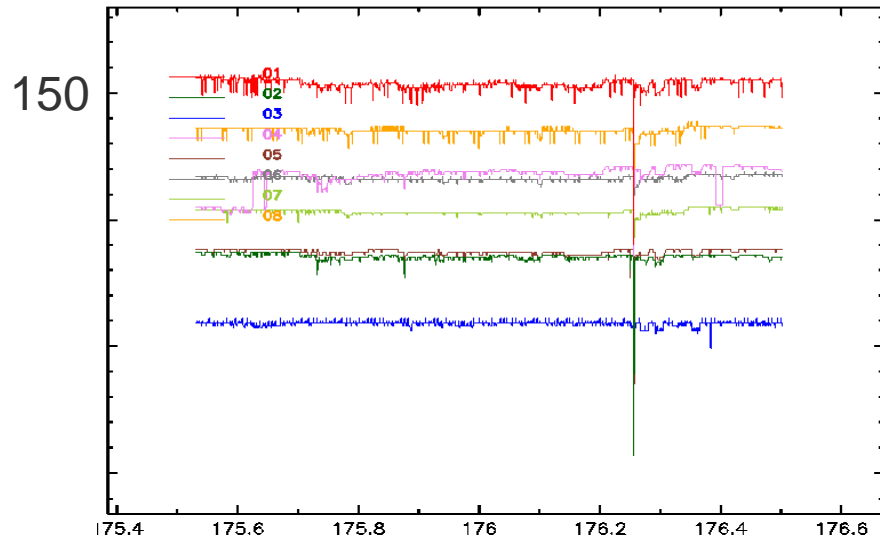


Real-time IGS Ntrip Relays



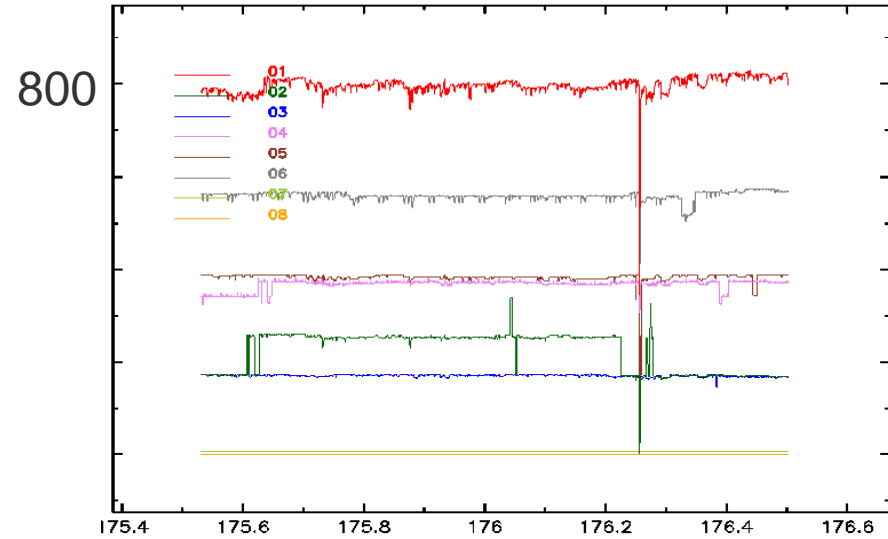
Coming up: NRCan

Streams



24 h Sliding Window

Users



24h Sliding Window

IGS Ntrip Broadcaster Workload

01	BKG	Germany	www.igs-ip.net:2101
02	Wuhan	China	ntrip.gnsslab.cn:2101
03	GA	Australia	192.104.43.25:2101
04	GFZ	Germany	139.17.3.112:4080
05	GMV	Spain	igs-ip.gmv.com:2101

Subversion Server @ software.rtcn-ntrip.org

- Open Source software development for Ntrip
- Concerns BNC, BNS, POSIX ntripclient/server/caster
- Includes bugtracker



Wiki Server

Hypertext system for software which supports:

- RTCM v2/v3
- NTRIP v1/v2
- SSR Messages

BNC, feeding an engine or a RINEX archive

The screenshot displays the BKG Ntrip Client (BNC) Version 1.7 interface. The main window is titled "BKG Ntrip Client (BNC) Version 1.7" and has a menu bar with "File" and "Help". Below the menu bar are several tabs: "Proxy", "General", "RINEX Observations", "RINEX Ephemeris", "Broadcast Corrections", "Feed Engine", "Serial Output", "Outages", and "Miscellaneous".

The "RINEX Observations" tab is active, showing a "Directory" field with the path "c:\temp\rinex", an "Interval" dropdown set to "1 day", and a "Sampling" dropdown set to "0 sec". There is also a "Skeleton extension" field with "SKL" and a "Script (full path)" field. A "Version 3" checkbox is present and unchecked. Below these fields, it says "Saving RINEX observation files."

A table lists the streams being processed:

Streams:	resource loader / mountpoint	decoder	lat	long	nmea	ntrip	bytes
1	euref-ip:2101/ACOR0	RTCM_3.1	43.36	351.60	no	1	6.811 kB
2	euref-ip:2101/ALBH0	RTIGS	48.39	236.51	no	1	10.406 kB
3	euref-ip:2101/AUCK0	RTCM_3.0	-36.60	174.83	no	1	7.581 kB
4	euref-ip:2101/WHIT0	RTCM_3.0	40.57	23.00	no	1	7.585 kB

Below the table is a "Log" tab and a "Throughput" tab. The "Throughput" tab shows a bar chart with the y-axis labeled "kbps" ranging from 0 to 5. The x-axis lists various station identifiers. The bars represent the throughput for each station.

At the bottom of the main window, there are buttons for "Add Stream", "Delete Stream", "Start", and "Stop", along with the text "Help=Shift+F1".

A secondary window is open on the right, showing the "Miscellaneous" tab. It has a table with two columns: "ntrip" and "bytes".

ntrip	bytes
10.939	kB
10.854	kB
9.59	kB
12.015	kB
7.751	kB
13.808	kB

Below this table is another "Throughput" tab and a "Latency" tab. The "Latency" tab shows a bar chart with the y-axis ranging from 0 to 7 seconds. The x-axis lists station identifiers. The bars represent the latency for each station.

At the bottom of the secondary window, there are buttons for "Add Stream", "Delete Stream", "Start", and "Stop", along with the text "Help=Shift+F1".

BKG Ntrip Client (BNC) v2.1

BKG Ntrip Client (BNC) Version 2.0

File Help

Observations RINEX Ephemeris Broadcast Corrections Feed Engine Serial Output Outages Miscellaneous **PPP Client**

Mountpoint

Options Static Use phase obs Estimate tropo Use GLONASS

Ref. coordinates X Y Z

NMEA File (full path) Port

Coordinates from Precise Point Positioning (PPP).

Streams:	resource loader / mountpoint	decoder	lat	long	nmea	ntrip	bytes
1	www.igs-ip.net:2101/CLK11	RTCM_3.0	50.00	10.00	no	2	35.6 kB
2	www.igs-ip.net:2101/FFMJ1	RTCM_3.0	50.09	8.66	no	2	32.779 kB
3	www.igs-ip.net:2101/RTCM3EPH	RTCM_3	50.09	8.66	no	2	30.429 kB

Log Throughput Latency **Static PPP**

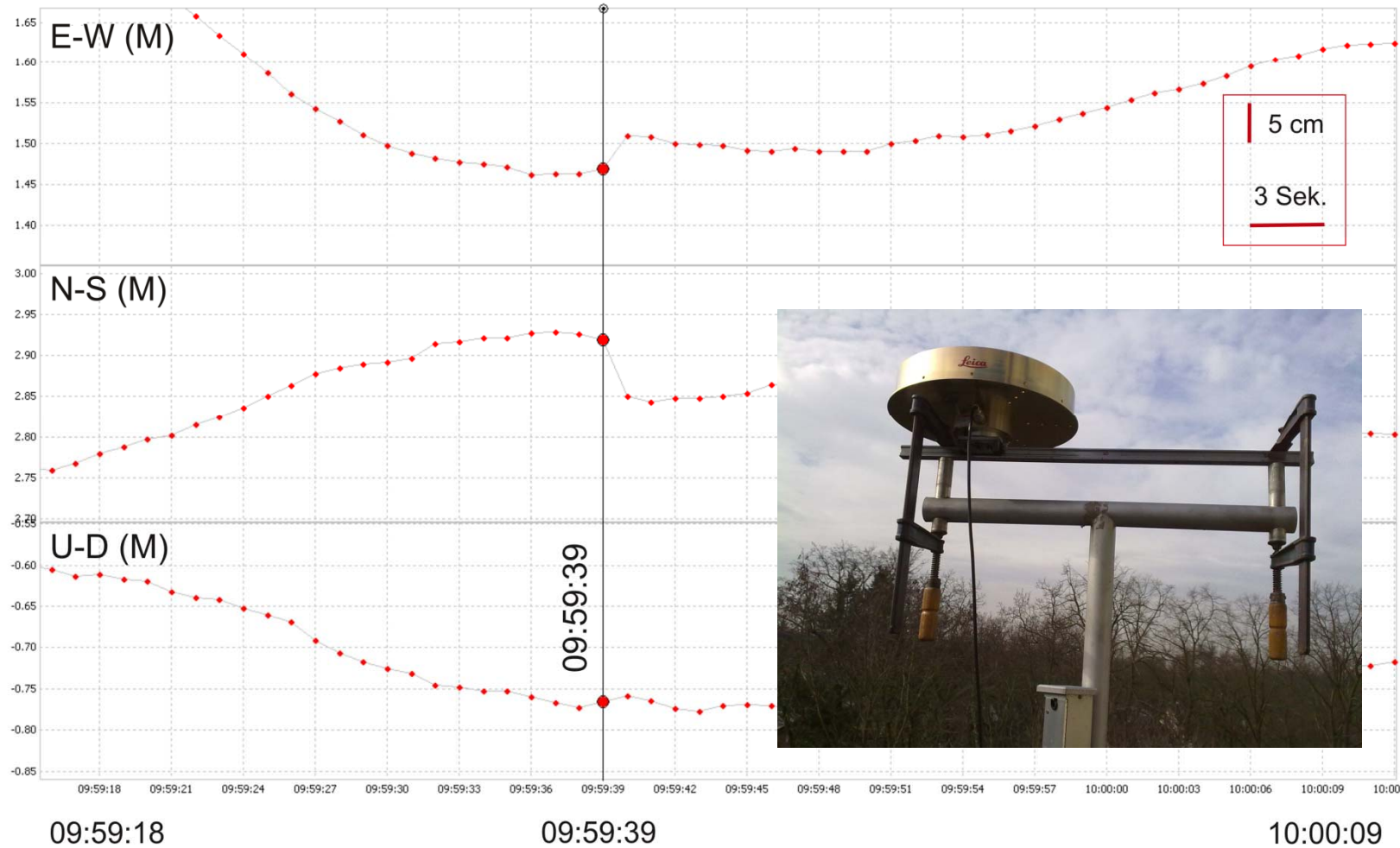
5.10 m
0.00 m
-5.10 m

N EU Start 16:01:44
16:02 16:03

Add Stream Delete Stream Start Stop Help=Shift+F1

PPP for Monitoring of Natural Hazard

Horizontal Displacement: 10 cm





PPP with EUREF & IGS

Configuration

BNC/PPP software on laptop.

Communication with receiver via Blue Tooth.

Wireless Internet connection via GPRS.

Standardization

RTCM SC104.

Make PPP option with orbit/clock correctors part of the receiver firmware.

Then: PPP with BNC to become obsolete.

Reference Systems Support

IGS05/ITRF2005

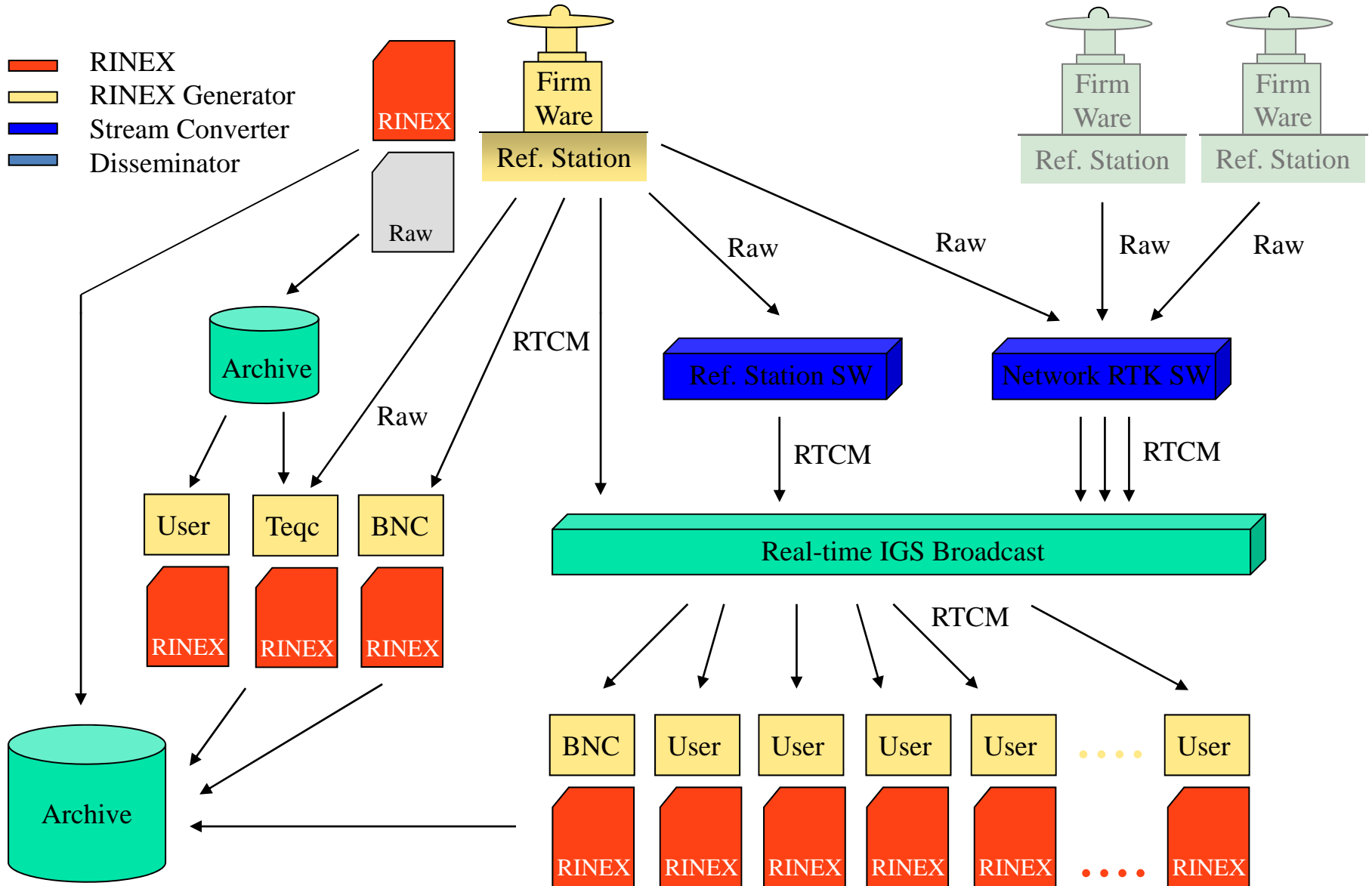
ETRS89/ETRF2000

SIRGAS95/2000

NAD83

GAD94

GNSS Real-time and RINEX Observation Data Flow



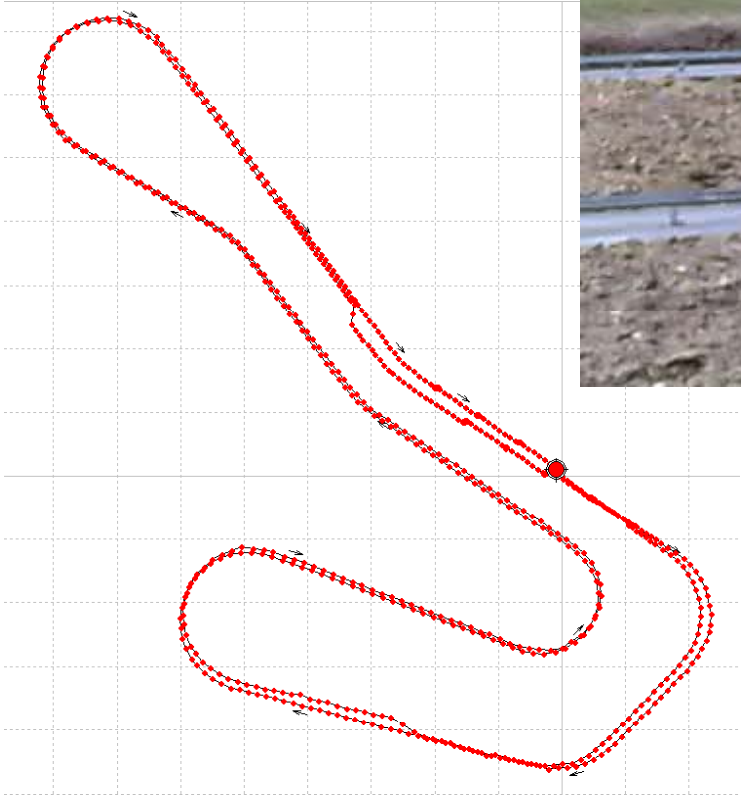


← GNSS Antenna

Kinematic PPP tests
Tractor on rails

PPP Test Bed

Precision Agriculture



RT1 Splinter Meeting, Rm 024, 17:30:

Real-time User Requirements and Applications

- 1. User community for RTPP products and user requirements (product types, signal types, accuracy, latency)**
- 2. Applications of RTPP products**
- 3. Formats overview and data and product dissemination/reception options**
- 4. Tools available to users**
- 5. Feedback from users and potential users of the products**