Software solutions for GNSS infrastructure monitoring

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About us

- GNSS software development company
- Founded in 1994, based near Berlin, Germany
- Fields of experience
  - GNSS data processing and analysis
  - Development of system solutions for GNSS infrastructure operators (e.g. beacon.net)
  - Internet-based data communication (Ntrip development)
  - Operation of Internet Casters for GNSS data streaming
  - Development of monitoring systems
  - PPP technology development
  - Development of customised software and hardware solutions
  - Standardisation (RTCM SSR, MSM, Ntrip 2.0)
  - Consulting

GNSS reference stations in Europe

- EPN: 244 stations
  - Realise and maintain the European Reference Frame
  - Science driven network
  - Very stable over a long period of time
  - >100 stations provide real-time streams
- 1000s of other GNSS reference stations
  - Regional or local densification of EPN
  - Many operated by the same national organisations as the EPN stations
  - Basis of DGNSS and network RTK services

GNSS networks = Critical infrastructures

- Application areas relying on GNSS infrastructures:
  - Surveying and geodesy
  - GIS and mapping
  - Precise farming
  - Transportation
  - Construction
  - Navigation
  - Traffic management
  - Geophysics
  - Meteorology and climate research
  - Forestry
  - etc.

Service quality

- What is service quality?
  - Accuracy
  - Availability
  - Continuity
  - Time to fix integer ambiguities (TTFA)
  - Integrity
  - Compatibility
  - Interoperability

- How do you assess the quality of your network?
- Can you guarantee high service quality?
- Do you **monitor** your GNSS infrastructure?
  - With the same software algorithms you are generating the data with?

General features of Alberding monitoring sw

- **Web-based graphical user interface**
  - Textual information
    - Colour-coded status tables, statistical information, detailed data history
  - Graphical information
    - Bar graphs, time series and scatter plots, skyplots
    - Map display of station distribution
  - Documentation (PDF export)
- **Automated alarming**
  - User defined threshold values
  - SMS and/or E-mail alerts
- **Data archiving**
  - Text files or SQL database

Infrastructure monitoring

1. Reference station data
2. Data distribution via Ntrip
3. Rover performance

Reference station monitoring

- **Availability**
  - Communications network outages
- **Tracking performance**
  - No of tracked SVs (GPS/GLO/GAL)
  - Elevation, azimuth
  - SNR, DOP
- **Reference antenna stability**
  - PPP (Precise Point Positioning) solution **New!**
  - Independent from the production service

Immediately detect status changes or performance degradation.

➡ Notify network operators.

Infrastructure monitoring

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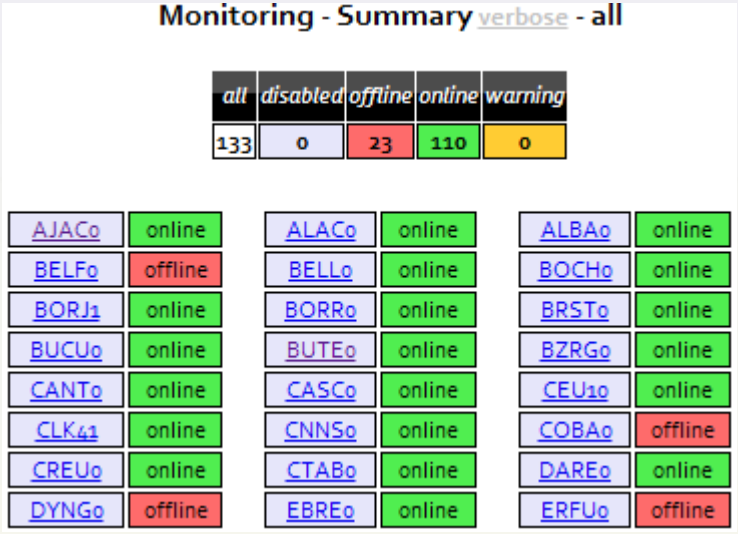
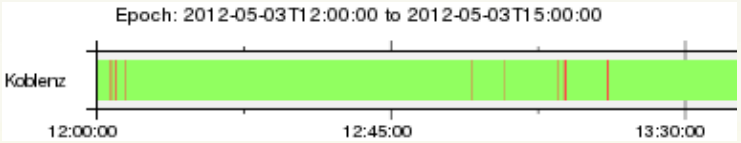
Ntrip Caster monitoring

- **Availability**
  - Ntrip Caster
  - Ntrip streams
- **Client connections**
  - Connection time, up-time
  - Data transferred
- **Incoming/outgoing traffic**
- **Outage/usage statistics**





Ntrip stream monitoring

- **Real-time data content analysis**
  - Detect consistency problems of your Ntrip streams
  - Periodic data sampling
  - Decoding RTCM 2.x, 3.x, CMR and CMR+ to human readable ASCII data
  - RTCM 3.x SSR and MSM is now supported **New!**
  - Alert network administrators if corrupt data found

InspectRTCM

Ntrip monitoring cont'd

- **Release warning messages**
  - NABU (Notice Advisory to Broadcaster Users)

- **Reference**
  - Alberding GmbH hosts and monitors BKG Ntrip Casters:

    igs-ip.net, products.igs-ip.net, mgex.igs-ip.net, euref-ip.net, egnos-ip.net and **gref-ip.de**

Professional Ntrip Caster

- Alberding Ntrip Caster
  - Supports Ntrip 2.0
  - Supports UDP
  - Low latency
  - High reliability
  - Web interface
  - Stream monitoring
  - NABU messages
  - Rebroadcasting GNSS data from other Casters
  - Designed to run on LINUX

Infrastructure monitoring

1. Reference station data
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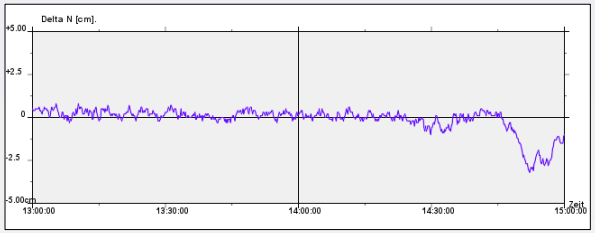
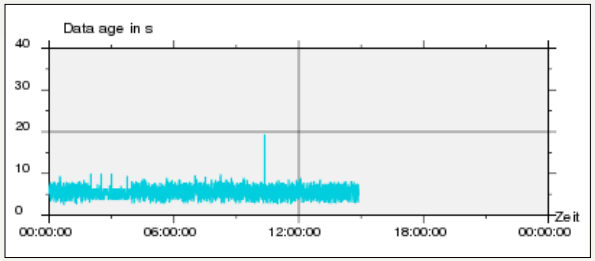
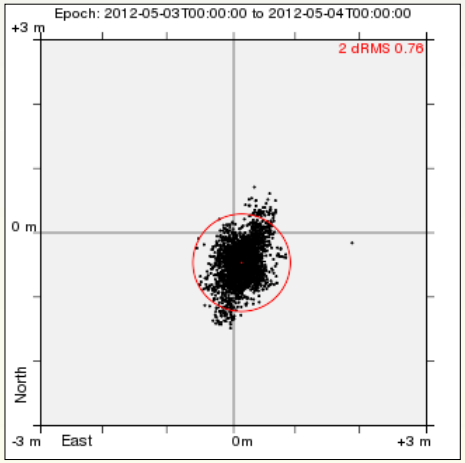
Rover performance monitoring

- Monitor real user receiver performance
- Monitoring station = fixed rover
- Precisely determined station coordinates
- User defined position solution
- Position output in standard format (NMEA)

- **Availability**
- **Tracking performance**
  - No of SVs, DOP
- **Position accuracy**
  - Time series graphs (N,E,U, 3D)
  - Scatter plots
  - Quality indicator (Fixed, Float, DGNSS, Abs)
  - Statistical tables (RMS, etc.)
- **Correction data age**







Rover performance monitoring cont'd

We provide complete solutions including monitoring hardware.

- **Alberding A17**
  - Multi-constellation RTK GNSS receiver
  - GPRS modem
  - 800 MHz computer
  - Outputs computed position in NMEA
  - Supports Ntrip via GPRS or LAN
  - Remote control via web interface

Alberding advantages

- **Advantages of the Alberding infrastructure monitoring solutions**
  - Independent from GNSS receiver manufacturers
  - Reliable
  - Cost effective
  - Web-based solutions running on Internet servers
  - Custom specific adaptations possible
  - Available as a service or a complete solution

Thank you for your attention!

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