Software solutions for GNSS infrastructure monitoring

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Alberding GmbH

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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

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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

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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.

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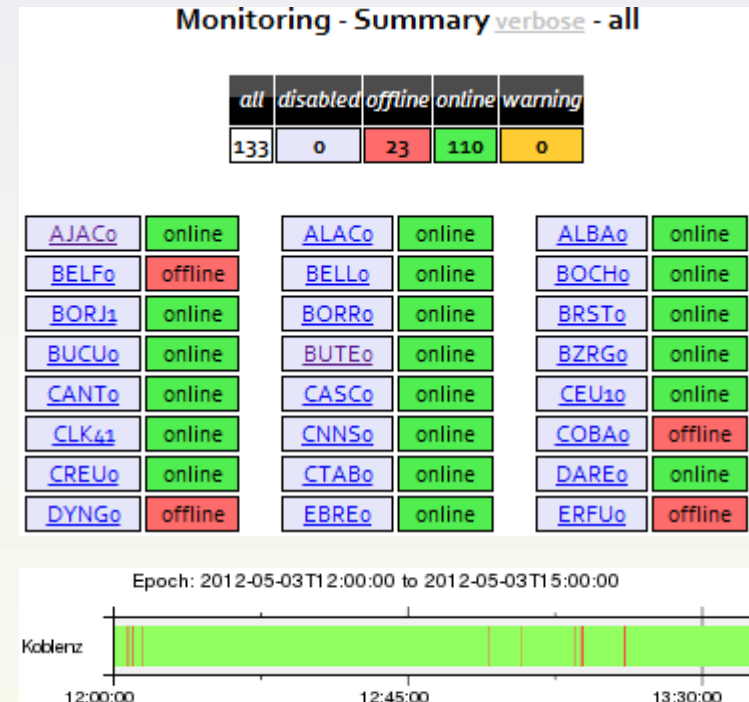# Infrastructure monitoring

1 Reference station data

2 Data distribution via Ntrip

3 Rover performance

Ntrip Caster monitoring

- **Availability**
  - Ntrip Caster
  - Ntrip streams

- **Client connections**
  - Connection time, up-time
  - Data transferred

- **Incoming/outgoing traffic**

- **Outage/usage statistics**

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Ntrip stream monitoring

- **Real-time data content analysis**

  InspectRTCM

  – 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

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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**
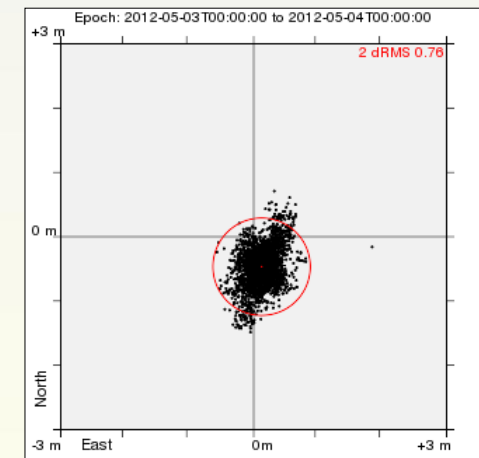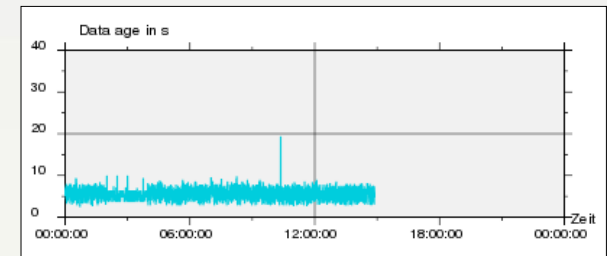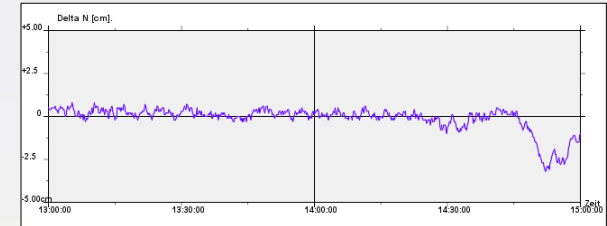
Rover performance monitoring cont'd

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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