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Real Time Monitoring of GPS-IGU orbits and clocks as a tool to disseminate corrections to GPS-Broadcast Ephemerides

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Nowadays RTIGS and NTRIP have become standards for real time GNSS based positioning applications. The IGS (International GNSS Service) Real-Time Working Group disseminates via Internet (RTIGS) raw observation data of a subset of stations of the IGS network. This observation data can be used to establish a real-time integrity monitoring of the IGS predicted orbits (Ultra Rapid (IGU-) Orbits) and clocks, according to the recommendations of the IGS Workshop 2004 in Bern and in a further step correction terms for improving the accuracy of the GPS broadcast ephemerides can be calculated.

The Institute for "Geodesy and Geophysics" of the TU-Vienna develops in cooperation with the IGS Real-Time Working Group the software "RTR- Control", which currently provides a real-time integrity monitoring of predicted IGU Satellite Clock Corrections to GPS Time. The real-time orbit calculation and monitoring of the predicted IGU satellite orbits is currently in a testing phase and will be operable in the near future. A kinematic model and calculated ranges to the satellites are combined in a KALMAN-Filter approach. Currently the most recent GPS- Satellite Clock Corrections are published in Real Time via Internet. A 24 - hour clock RINEX file and the IGU SP3 files modified for the associated clock corrections are stored on the ftp-server of the institute.

To perform the task of calculating corrections to the broadcast ephemerides three programs are used, which are BNC (BKG Ntrip Client) and BNS (BKG Ntrip State Space Server) from BKG (Bundesamt für Kartographie und Geoinformation) as well as RTR-Control. BNC receives the GPS-broadcast ephemerides from the Ntrip-Caster and forwards them to BNS. RTR-Control calculates the satellite clocks and in future also the satellite orbits and forwards them in SP3-format to BNS. BNS calculates the correction terms to the broadcast ephemerides and delivers it in RTCM 3.x format (proprietary message 4056) back to the Ntrip-caster. Subsequently message 4056 can be provided to the RTK-user.

The user group interested in a rigorous integrity monitoring of IGU- orbits and clocks comprises on the one hand the components of IGS itself to qualify the issued orbital data and on the other hand all users of the IGS Ultra Rapid Products (e.g. for PPP in Real Time). Furthermore the improvement of the broadcast ephemerides can be seen as a further step towards the GNSS State Space correction approach.