Where
A new geodetic software being developed at the Norwegian Mapping Authority

Geir Arne Hjelle

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A short history

The **Where** project was started in the fall of 2015 with the goal of building software that can analyse and combine data for **VLBI**, **SLR**, **GNSS** and **DORIS**.

- **Where** builds on ideas and experiences from the **Geosat** software
- The **Where-team** consists of five researchers at the Norwegian Mapping Authority (NMA):
  - Michael Dähnn (GPS)
  - Ingrid Fausk (SLR)
  - Geir Arne Hjelle (VLBI, GPS)
  - Ann-Silje Kirkvik (VLBI)
  - Eirik Mysen (VLBI)
- NMA is currently building / expanding the observatory at Ny-Ålesund
The new Ny-Ålesund observatory

Figure 1: VLBI antennas were installed last week
Current status

- All models from the *IERS Conventions* are implemented for *VLBI* and *SLR*
  - Many of the models can be reused for the other techniques
  - We participated in a *VLBI Analysis Software Comparison Campaign* organized by Onsala with *Geosat*, and are currently testing *Where* against these results
  - We are almost done with an orbit integrator for *SLR* satellites
- We are currently working on Precise Point Positioning (PPP) for *GPS*
- We have only done very simple tests for *DORIS* data so far
Technology

The **Where** software is mainly being written in *Python*

- Solid, flexible and fast libraries like *numpy*, *astropy*, *matplotlib* and *scipy* are available
- We use a **HDF5**-based format for storing data while the program is running
- *Python* has effective interfaces to *C* and *Fortran* code, and we can use the **Sofa** and **IERS** software libraries directly
Technology – plans

- Parsers
- Apriori
- Editors
- Models
- Filter
- Writers

Flowchart showing processes:
- Input to VLBI
- Read to Edit to Orbit to Calculate to Estimate to Filter to Write

Output to Orbit Models
Future plans

At the moment, the highest priorities for Where are

- finishing the VLBI analysis
  - The filter / estimation module
  - Proper output and reporting
- finishing the SLR analysis
  - The orbit integrator needs some more work
- finishing PPP for GPS and starting to look at Galileo and possibly Glonass
  - Orbit integration for GNSS-satellites
Where is *DORIS*?

Unfortunately *DORIS* has been put somewhat on hold due to lack of resources. However,

- we implemented a *DORIS*-Rinex 3-parser in an early prototype of the software
- we did some experimental analysis in the old *Geosat* software
- we hope to do some simple tests quite soon
  - use Rinex 3-data and given orbits
- the proper implementation of *DORIS* will be after *VLBI* is finished
  - many models can be reused from the other techniques