

High-precision Positioning and Real-time Data Processing of UAV-Systems

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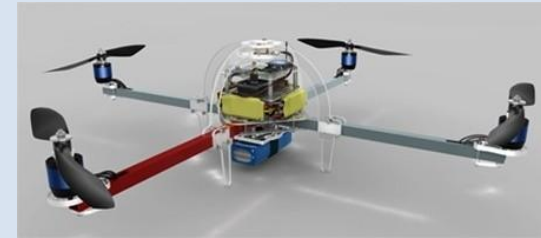
Institute for Geoinformatics – University of Muenster

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<http://purl.net/ifgi/copter>

Sensor platforms

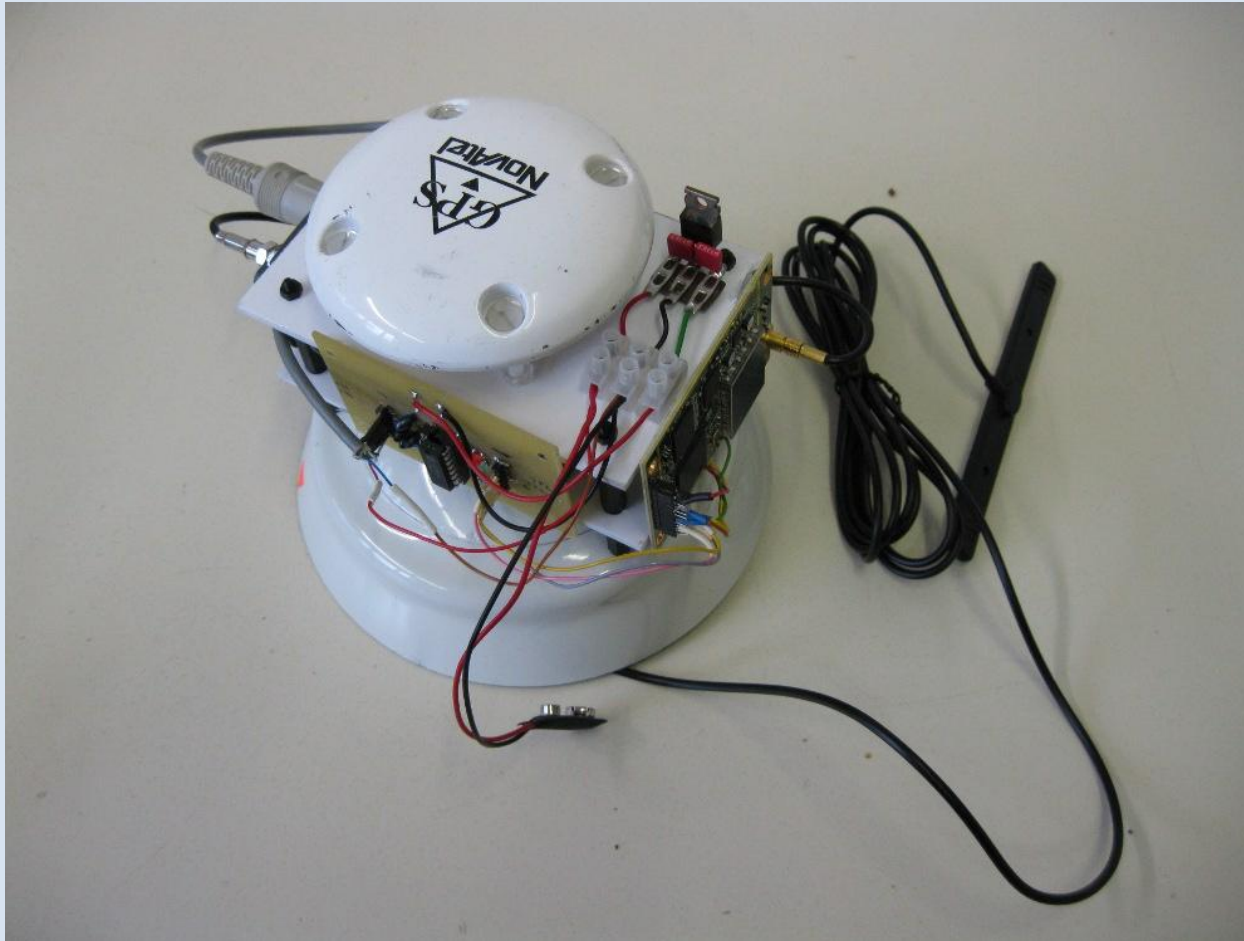
- Current available UAV systems use common GPS receivers
- Not addressing use cases where high position accuracy is inevitable
 - Creating orthophotos using Direct Georeferencing



Approach for improving position accuracy

- Micro- or small-sized UAV systems
- Improvement using Real Time Kinematic
- Prototypical realization using a Microdrones md4-200
 - Overview of the used hardware
 - Conceptual design of data processing software

Teaser of the used hardware



Possible use case

- Improve/Enable Direct Georeferencing
 - Currently limited due to several aspects
 - Exterior orientation (e.g. low-cost GPS/GNSS, IMU)
 - Alignment of time of image acquisition and positioning
 - Focus on improving absolute positioning using advanced GNSS techniques + timestamp synchronisation
- Stabilize flight trajectory
 - Decrease the position delta between planned and actual image position

Improving position accuracy on-the-fly

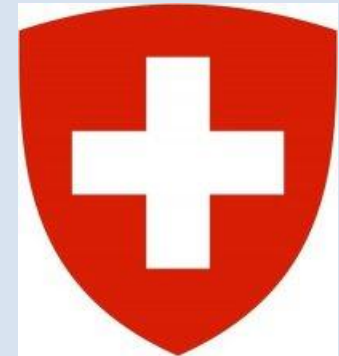
REAL TIME KINEMATIC

Real Time Kinematic

- Specialized form of Differential GNSS
- Ground based Augmentation System
- Takes phase observations into account for error estimation
- Based on correctional signals from national services



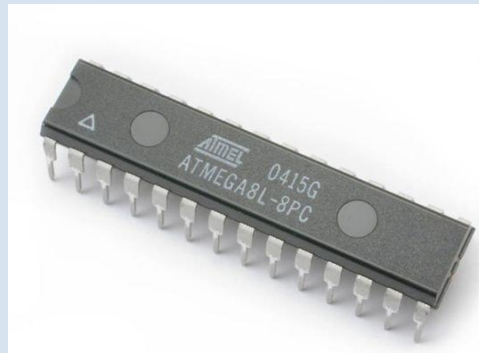
APOS



swipos

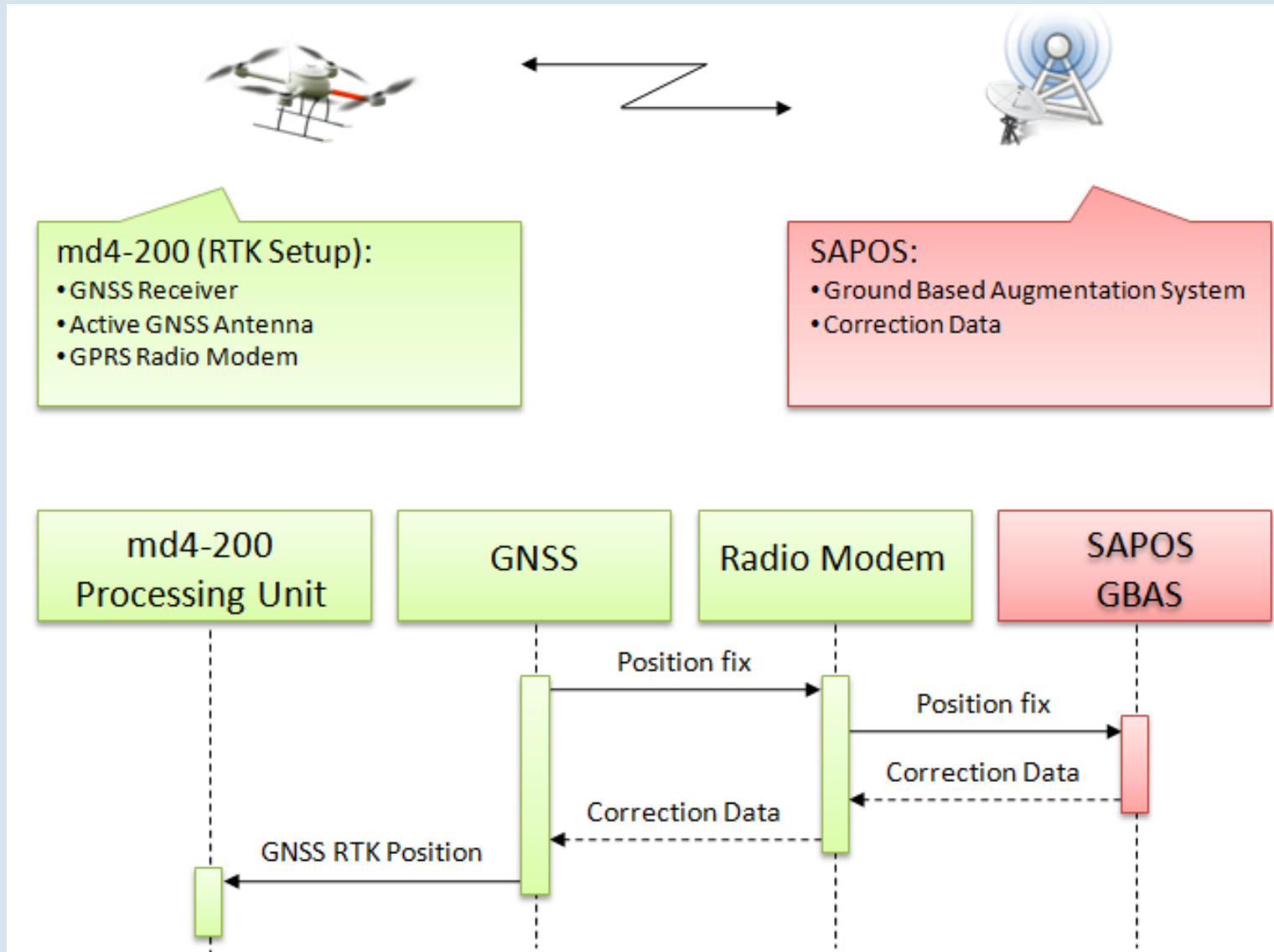
Real Time Kinematic

- What do you need?
- In general: rather cost-intensive hardware
 - GNSS receiver + antenna – processing of RTK corrections
 - Radio modem (e.g. GPRS) to retrieve correction signals
 - Processing unit for data communication



- **Payload!**

Real Time Kinematics



Benefitting from improved positioning

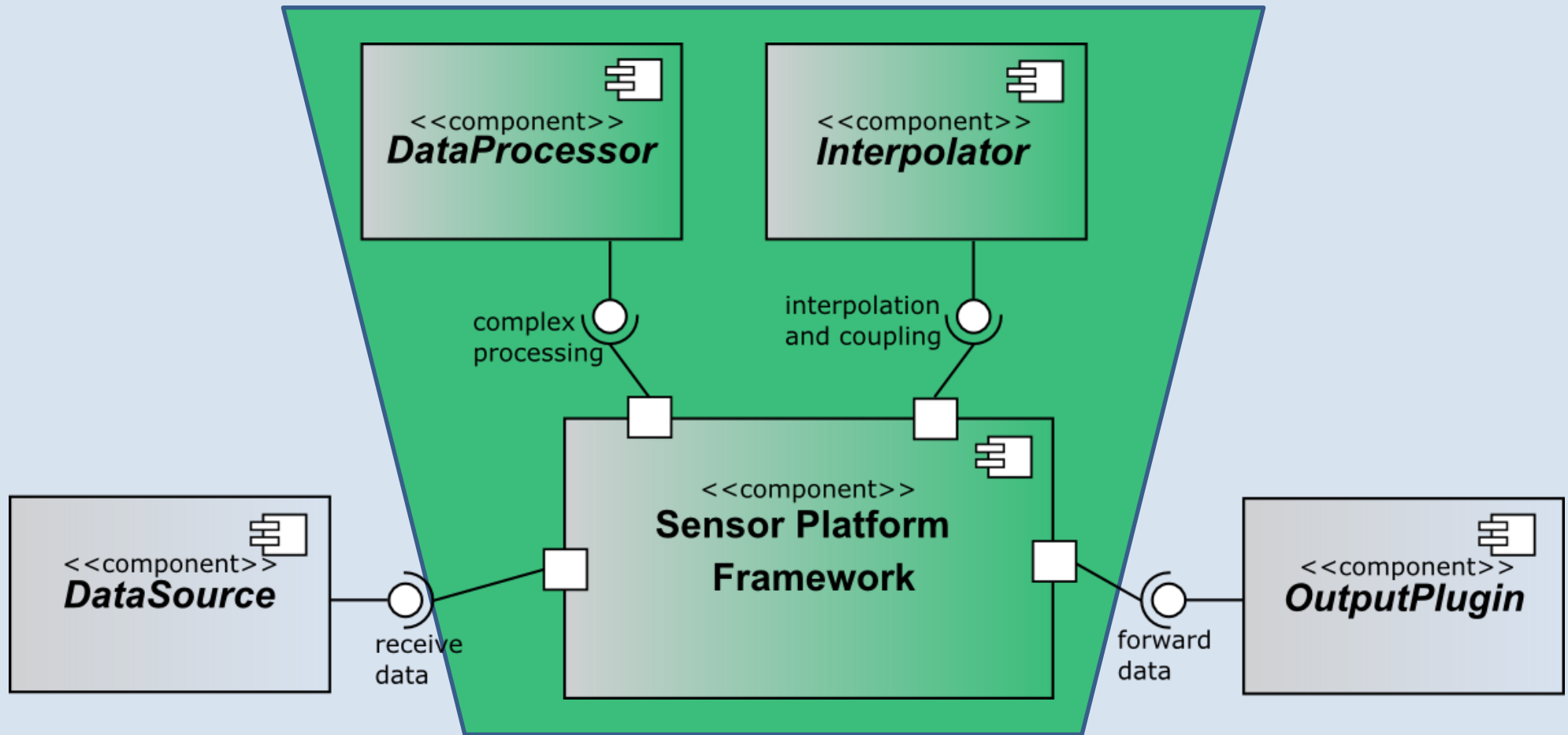
DATA PROCESSING

Software approach

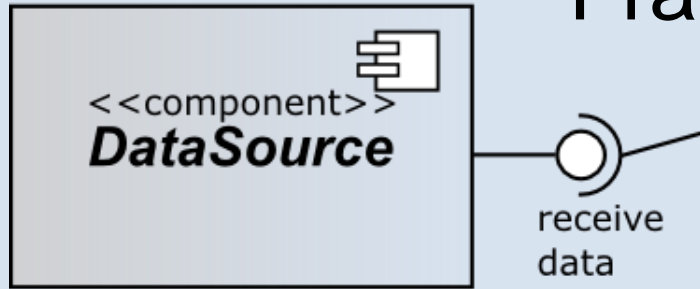
- Software running on groundstation
 - Support for different UAV platforms
 - Synchronization of multiple data streams to enable real-time measurement capabilities
 - Modulized architecture to foster reusability
- Realized using **Software Framework**

Framework Approach

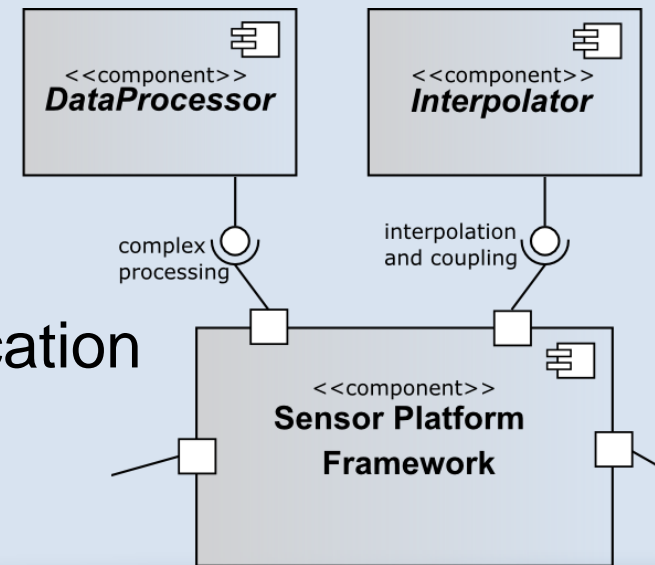
- Architecture

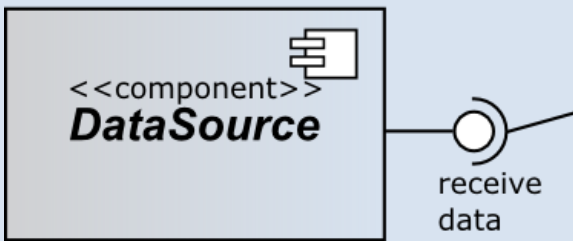


Framework Approach



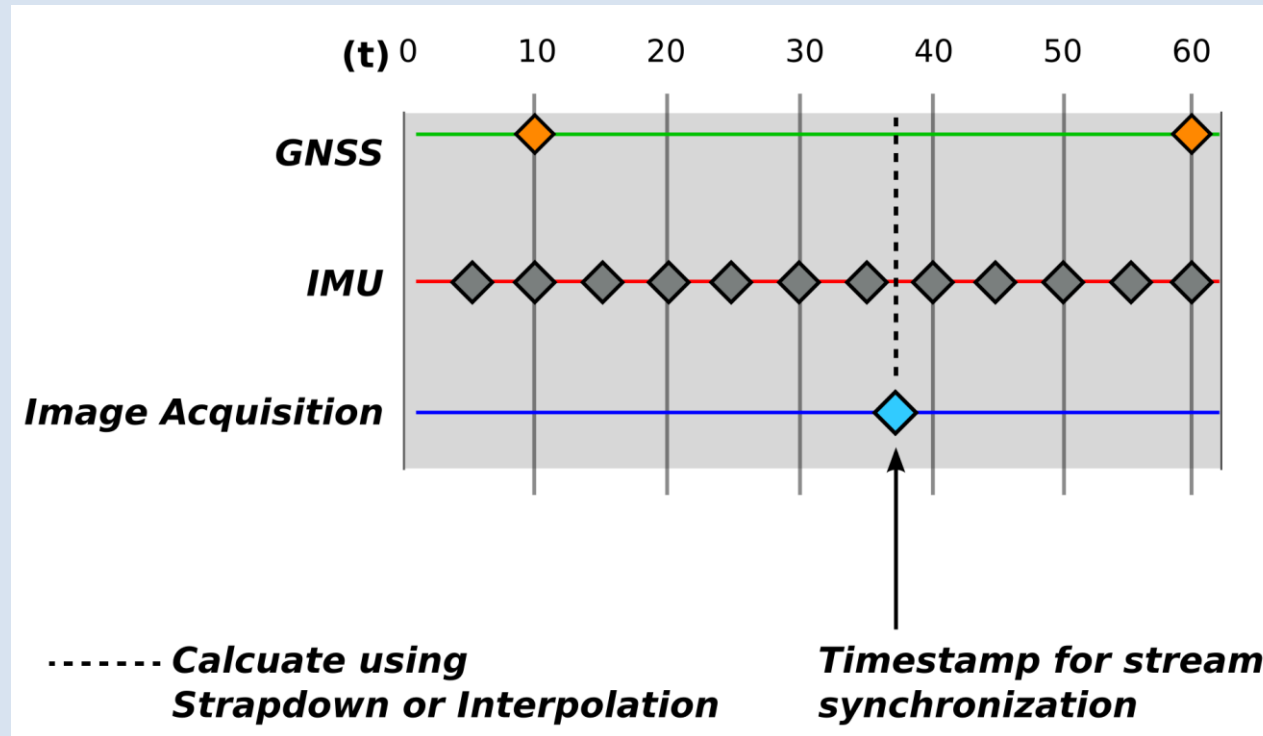
- Synchronization of sensor streams
 - Why synchronize streams?
 - Knowledge of exact position at time of image acquisition
 - Currently: interpolation mechanism
 - Abstract – easily adjustable for application





Framework Approach

- Basis is description of *Plugin Behaviour*
 - Input/Output phenomena using XML descriptions
 - When to determine a position?



Applying in real-world situations

RESULTS AND FUTURE WORK

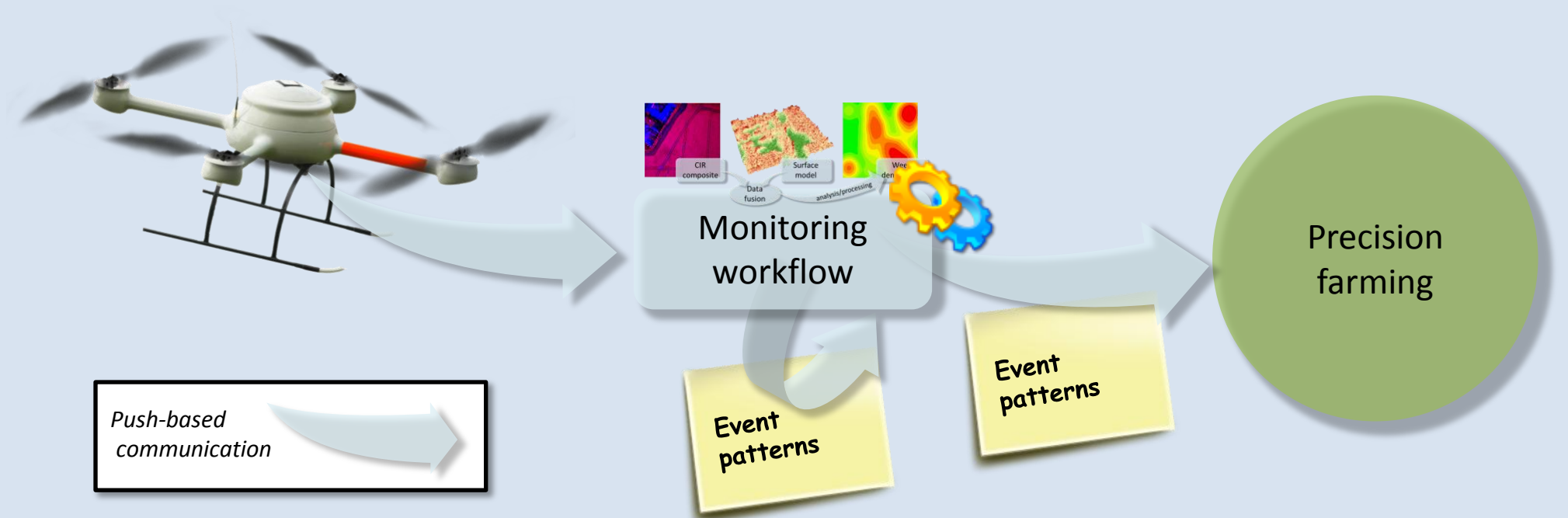
Hardware integration

- Currently only common DGPS receiver used
- Future work involves an RTK-enabled L1/L2 GPS/GLONASS receiver
- Problem of moved centroid
 - Hardware optimization
- Implementation of Direct Georeferencing workflow
- Move to md4-1000 to gain more payload

Hardware integration



Use case – precision farming





Source Code available at:



WHAT IS MISSING?

Thank you for your kind attention!

Questions?

<http://purl.net/ifgi/copter>

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