Galileo Science Colloquium 2015

MagicPPP in your Pocket: a Smart, Portable and Efficient Multi-GNSS High-accuracy Solution

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SESSION 1A: N1 MultiGNSS

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INNOVATING SOLUTIONS

OUTLINE

magicGNSS overview and history

Presenting MultiGNSS PPP Android App

Demonstration

Conclusions and future work

magicGNSS OVERVIEW AND HISTORY

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WHAT IS magicGNSS?

- *magicGNSS* is a suite of **GNSS tools and services** which have been developed and tailored by GMV throughout the years.

- *magicGNSS* offers **three services**:
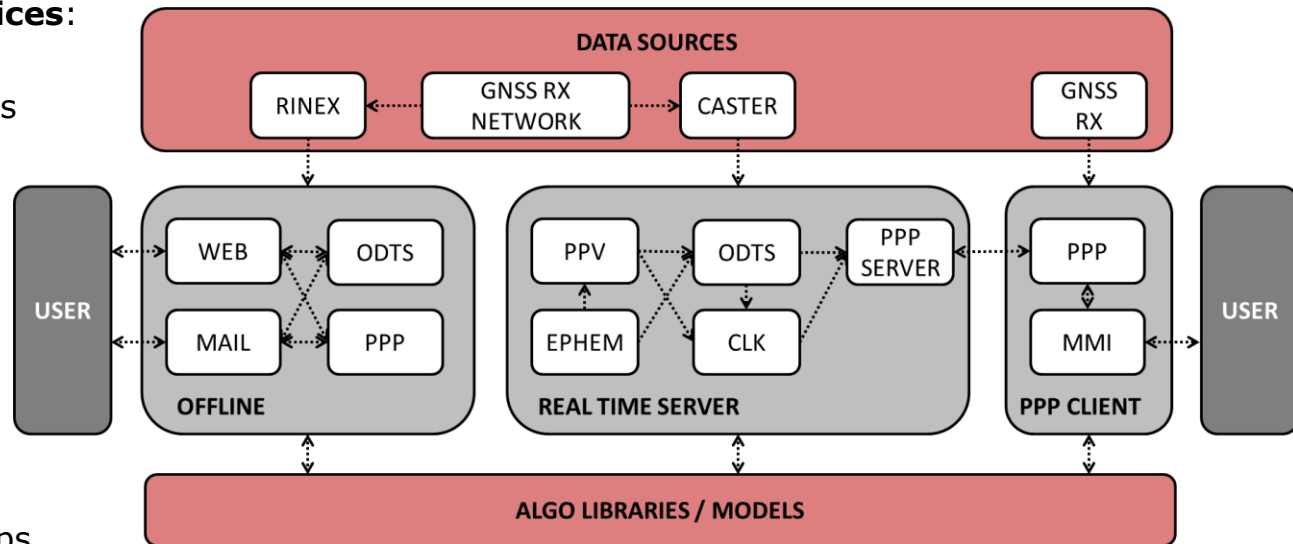 - **Post-processing service**
    - ODTS, PPP, Analysis Tools
    - Web and mail
  - **Real-Time product server**
    - Precise Orbits and Clocks in Real-Time
  - **Real-Time PPP client**
    - Precise positioning solution
    - Protection Level
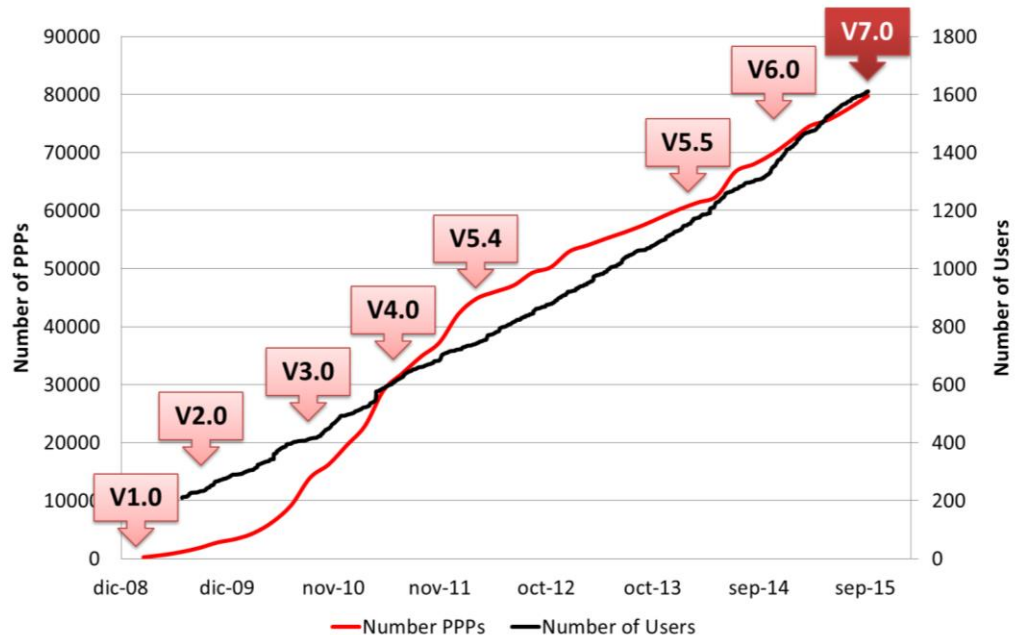   - Desktop and Android Apps

- **Architecture:**
  - 3 service modules
  - 1 common algorithm library

MOTIVATION

- *magicGNSS* post-processing service
  - **Provide the GNSS community** with a set of useful and **easy-to-use GNSS tools**
  - Keep **GMV's POD and PPP knowledge at state-of-the-art** level
  - **Develop GMV's POD proprietary SW**

- *magicGNSS* real-time service
  - Answer to IGS' call on 2008 for **IGS Real-Time Pilot Project**
  - Apply **post-processing knowledge** to the **real-time environment**
  - Once RT servers were ready other related objectives appeared:
    - Complete the **RT chain developing a RT PPP Client**
    - Migrate the PPP algorithm to a **portable devices**
    - Analyse feasibility of **low cost PPP** solution for the mass market

Post-Processing Service

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UNCLASSIFIED INFORMATION

magicGNSS V7.0

- MultiGNSS support: GPS, GLONASS, Galileo, BeiDou and QZSS

- Implemented the single frequency PPP processing

- Developed Android PPP client App

- Designed PL computation engine at PPP, based on a proprietary algorithm

- Generation of Long-Term multi-GNSS Ephemeris for A-GNSS

- GAP Bridging to speed up PPP reconvergence

- Created Web API for the integration of Post-processing PPP with third party applications

- Real-Time Station monitoring Tool

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WEB SERVICE & PPP BY MAIL

- Web service (**magicgnss.gmv.com**) which enables a registered user to run a set of different multi-GNSS tools:

  – **Multi-GNSS ODTS** processing based on IGS stations or previously uploaded user stations

  – **PPP** computed using as reference IGS products or GMV's products

- PPP can be executed by mail sending mail to **magicppp@gmv.com**

- Apply for an account!

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REAL TIME SERVICES

- Two main objectives:
  - Generation of precise multi-GNSS **orbits and clocks**
  - Generate **ephemeris corrections in** RTCM format to feed RT PPP Clients to generate a HA positioning solution in real-time

- **RT input data from** the **IGS MGEX. ~80 stations data** are processed providing **worldwide coverage**
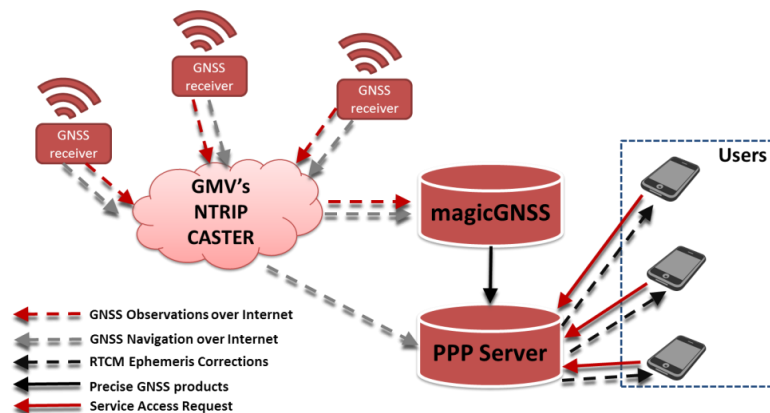
MGEX Network
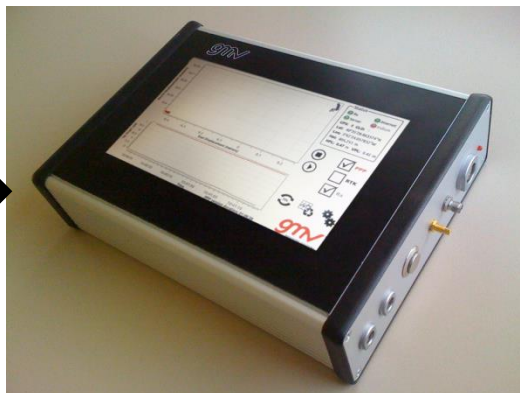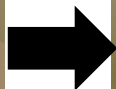
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ANDROID APP

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magicGNSS' REAL TIME PPP EVOLUTION

- **RT PPP Client** is a module able to compute **HA user position in real-time** using:
  - RTCM **observations and ephemeris** coming from a GNSS receiver
  - RTCM **ephemeris corrections** coming from the PPP server

- Evolution: from laptop to portable device with LCD to an **Android** Device
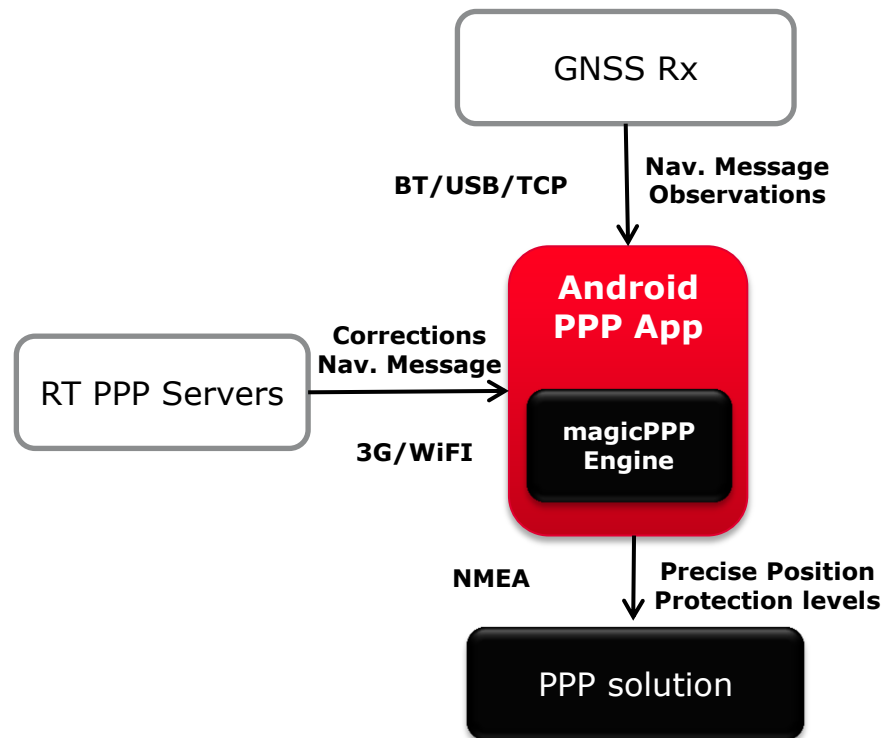

2010

2012

2015

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HIGH-LEVEL APP ARCHITECTURE

- Real-Time Communications
  - Observations received via **USB, Bluetooth or TCP/IP**
  - HA Products received via **TCP/IP**. Protocol based on **RTCM standard**

- Integration of the Android App
  - **With magicGNSS web**. Upload recorded RINEX to your account to post-process and analyse it.
  - With **Google Earth**.

- Devices
  - Compatible with all Android devices with **Android OS 4.3+**

GNSS Rx

Nav. Message Observations

BT/USB/TCP

Android PPP App

magicPPP Engine

RT PPP Servers

Corrections Nav. Message

3G/WiFI

NMEA

Precise Position Protection levels

PPP solution

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magicGNSS' REAL-TIME PPP CLIENT APP

- Current *magicPPP* client supports:
  - **multiGNSS Dual** and **single frequency PPP** processing
  - **GAP bridging** to speed up re-convergence
  - **Protection Level** computation
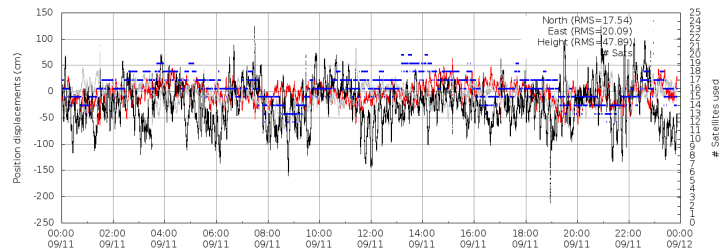 - **Quickstart.** Configure a fine start position for instantaneous convergence
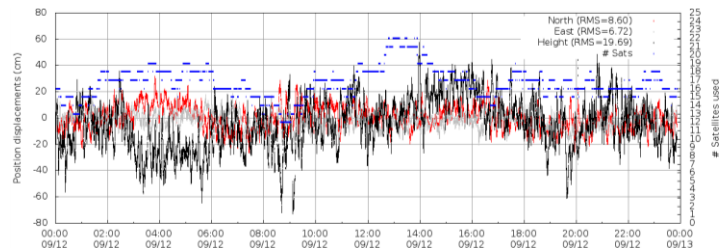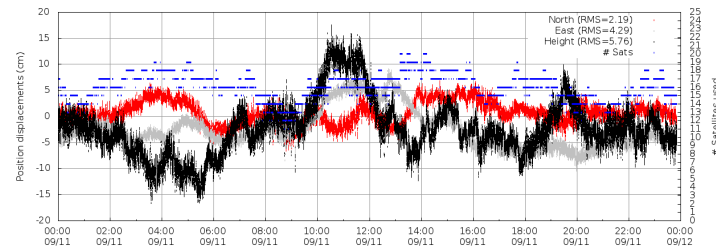
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magicGNSS' PPP PERFORMANCE

- Perform a **continuous monitoring of the solution.** Several PPP client running with different configurations and receivers:

  - Double Frequency PPP
    - 3cm HRMS
    - 6cm VRMS

  - Single Frequency PPP
    - 15cm HRMS
    - 25cm VRMS

  - SF PPP Low Cost Rx
    - 25cm HRMS
    - 50cm VRMS

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DEMONSTRATION

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DEMONSTRATION

Show the magicPPP for Android video demonstration at:

http://magicgnss.gmv.com/magicppp_demo.html

CONCLUSIONS AND FUTURE WORK

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CONCLUSIONS AND WAY-FORWARD

- A **fully functional real-time PPP application for Android OS** has been developed.

- **Single-frequency PPP is also implemented.** This capability together with the use of Low Cost receivers represent the cornerstone for near-**future Low Cost PPP** techniques.

- Future evolutions of the system
  - **Fine tuning** the PPP for **low cost receivers**
  - Processing of the **GNSS data** gathered by the **chipset of the mobile and tablets**
  - Continue evolving the ODTS and PPP engine to **improve multiGNSS performances**

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THANK YOU

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