FLAMINGO: Encapsulation of High Accuracy Positioning Service for Smartphones and IoT

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NSL

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What is FLAMINGO?

- **FLAMINGO** (Fulfilling enhanced Location Accuracy in the Mass-market through Initial GalileO services) will be a high accuracy positioning service to be used by mass market devices.

- Comprises positioning services, high-capacity architecture and interfaces for easy integration.

- 9*-organisation collaborative venture, led by NSL, with the best of European GNSS capabilities:
  - PPP and RTK infrastructure, products, service provision and user solution.
  - The target is accuracies of **50 cm or better**.

- We will demonstrate its use and facilitate uptake:
  - 3x city-wide, long-duration demonstration events.
  - Dedicated hackathon and participation in other hackathons.
  - Supporting other initiatives, eg Task Force – EU GNSS Task group.
We have a Duty of Care

- I just sold my Leica GG03/CS10, I had for 5 years with 2 cm RTK readings on Navstar/Glonass! I would like to have my MI 8 giving promised 50 cm accuracy!
- Why aren’t I getting 30cm?
- Dual frequency isn’t switched on. How do I activate?
- Instead of getting the alleged 30cm it has an accuracy worse than 15m!

And it’s not just Smartphone marketing – SBAS 3cm on a Smartphone – really??
The GNSS Mass Market Context

- **Mass-market:**
  - Products and services for consumption by very large numbers of people.
  - GNSS positioning services easily accessible by the general public.
  - Widely produced, low-cost and common receivers and antennas.
  - Smartphones, wearables and IOT
GNSS Raw Measurements within Smartphones

Beidou
39 SVs

GLONASS
24 SVs

GPS
31 SVs

12 L5

22 E5

Galileo
22 SVs
GNSS Raw Measurements within Smartphones

- GPS: 31 SVs
- GLONASS: 24 SVs
- Galileo: 22 SVs
- Beidou: 39 SVs

Increased Availability
Improved Accuracy

Huawei Mate 20xx
Xiaomi Mi 8

Highest Accuracy
## GNSS Check

<table>
<thead>
<tr>
<th>Model</th>
<th>Android version</th>
<th>Automatic Gain Control</th>
<th>Navigation messages</th>
<th>Accumulated delta range</th>
<th>HW clock</th>
<th>L5 Support</th>
<th>Global systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Huawei Mate 20 X</td>
<td>9.0</td>
<td>no</td>
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<td>yes</td>
<td>yes</td>
<td>yes</td>
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<tr>
<td>Huawei Mate 20 RS (Porsche Design)</td>
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<td>yes</td>
<td>yes</td>
<td>GPS GLONASS GALILEO BeiDou</td>
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<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>GPS GLONASS GALILEO BeiDou</td>
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<td>Huawei Mate 20</td>
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<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>GPS GLONASS GALILEO BeiDou</td>
</tr>
<tr>
<td>Huawei Mate RS (Porsche Design)</td>
<td>8.1</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>no</td>
<td>GPS GLONASS GALILEO BeiDou</td>
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<tr>
<td>Pixel 3 XL</td>
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<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>GPS GLONASS GALILEO BeiDou</td>
</tr>
<tr>
<td>Pixel 3</td>
<td>9.0</td>
<td>yes</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>GPS GLONASS GALILEO BeiDou</td>
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</table>

- **Pseudorange**
- **Carrier phase**
- **L5/E5a**
Issues: Mass Market Uptake

- New capabilities introduced in GNSS – more satellites and signals -> greater potential
- Android released raw measurements API
- Broadcom released BCM47755 dual frequency chipset
- Manufacturers starting to implement access to raw measurements and use new chipsets
- Industries and institutions are facilitating how to fully benefit (Google, GSA, etc)
- We still need
  - Early adopters
  - Device churn
  - Positioning Services and solutions
  - User Applications
  - Acceptance
Why do we need higher accuracy in mass market devices?

Typical Smartphone
3-5m

Flamingo
0.5-1m
Can we meet the accuracy?

- The Smartphone is an entertainment (communications?) device
- GNSS is a low priority, lots of RF interference, the antenna is buried (and shared), minimising power consumption is high priority
- Also limited by user control
- Also limited by the environment, most people are in cities
- All in all, Smartphones are not nice GNSS devices
Can we meet the accuracy? NB static, ideal environments!!
Applications of a high accuracy positioning service?

- Number of users and accuracy captured along with various different requirements captured (TTFF, availability, user experience/tolerance)
- < 50cm accuracy was concluded as target for FLAMINGO

Applications enabled by FLAMINGO (horizontal accuracy 10-50 cm)

Applications benefitting from FLAMINGO (horizontal accuracy around 1m)

Applications with limited market size (market size below 100,000)
Demonstrations & Hackathons
Applications – demonstrator level

- Survey/GIS data collection
- Pedestrian navigation (impaired vision)
- Fitness
- Vehicle navigation
- Tracking
- Augmented reality
Encapsulation Stage 1 – Raw Measurements to standard GNSS formats
Encapsulation Stage 2: http://flamingosdk.com/ (NOW AVAILABLE)
Returns the current state of the Flamingo service on the device. True identifies that the user has access to the service and service is running. False – the flamingo service is not running.

`isFlamingoCallbackRegistered`

```java
public boolean isFlamingoCallbackRegistered (FlamingoLocationCallback
flamingoLocationCallback)
```

Checks if given FlamingoLocationCallback class has been registered to obtain FlamingoLocation updates from the service.

`registerFlamingoService`

```java
public register FlamingoService ( :
String applicationId,
String password,
String companyId,
Context context,
```

### Summary

<table>
<thead>
<tr>
<th>Public Constructors</th>
</tr>
</thead>
<tbody>
<tr>
<td>FlamingoManager (ArrayList mFlamingoLocationCallbackList)</td>
</tr>
<tr>
<td>Constructs a flamingo manager with an initial list of callbacks.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Public Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>boolean</td>
</tr>
<tr>
<td>boolean</td>
</tr>
<tr>
<td>FlamingoLocationCallback flamingoLocationCallback</td>
</tr>
<tr>
<td>);</td>
</tr>
<tr>
<td>boolean</td>
</tr>
<tr>
<td>String applicationId,</td>
</tr>
<tr>
<td>String password,</td>
</tr>
<tr>
<td>String companyId,</td>
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<tr>
<td>ApplicationType applicationType,</td>
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<tr>
<td>Context context,</td>
</tr>
<tr>
<td>FlamingoLocationCallback flamingoLocationCallback</td>
</tr>
<tr>
<td>);</td>
</tr>
</tbody>
</table>
FLAMINGO will only work on Android 7+ smartphone devices. The service is designed to work on all supported devices, which are listed here, but the following list of smartphones are confirmed to work with FLAMINGO.

| Model                      | Android Version | Code Signal | Carrier Signal | Dual Freque
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Huawei P10</td>
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<td>Yes</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>Samsung S8 with Exynos chipset</td>
<td>7.0</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Xiaomi Mi 8</td>
<td>8.1</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
FLAMINGO and the SDK – ease of use

From Android Location...

```java
public void onLocationChanged(Location location) {
    if (location != null) {
        Log.i(TAG, msg: "Latitude : " + location.getLatitude() + "\nLongitude : " + location.getLongitude());
    }
}
```

... To Flamingo Location

```java
public void onFlamingoLocationReceived(FlamingoLocation location) {
    if (location != null) {
        Log.i(TAG, msg: "Latitude : " + location.getLatitude() + "\nLongitude : " + location.getLongitude());
    }
}
```
Encapsulation Stage 2: FLAMINGO and the SDK

```java
mFlamingoManager = new FlamingoManager(new ArrayList<FlamingoLocationCallback>());
mFlamingoManager.registerFlamingoService(applicationId, password, companyId, getApplicationContext(), new FlamingoCallbackExample());

if (!mFlamingoManager.getFlamingoRegistrationStatus() == FlamingoRegistration.FULL_ACCESS) || mFlamingoManager.isFlamingoRunning()) {
    mFlamingoManager.stopFlamingoService();
    // Use Google Location
}

mFlamingoManager = new FlamingoManager(new ArrayList<FlamingoLocationCallback>());
mFlamingoManager.registerFlamingoService(applicationId, password, companyId, getApplicationContext(), new FlamingoCallbackExample());

if (!mFlamingoManager.getFlamingoRegistrationStatus() == FlamingoRegistration.FULL_ACCESS) || mFlamingoManager.isFlamingoRunning()) {
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    // Use Google Location
```
Thank you

william.roberts@nsl.eu.com

Keep up to date at >
https://www.flamingognss.com/

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Yes, accuracy matters!