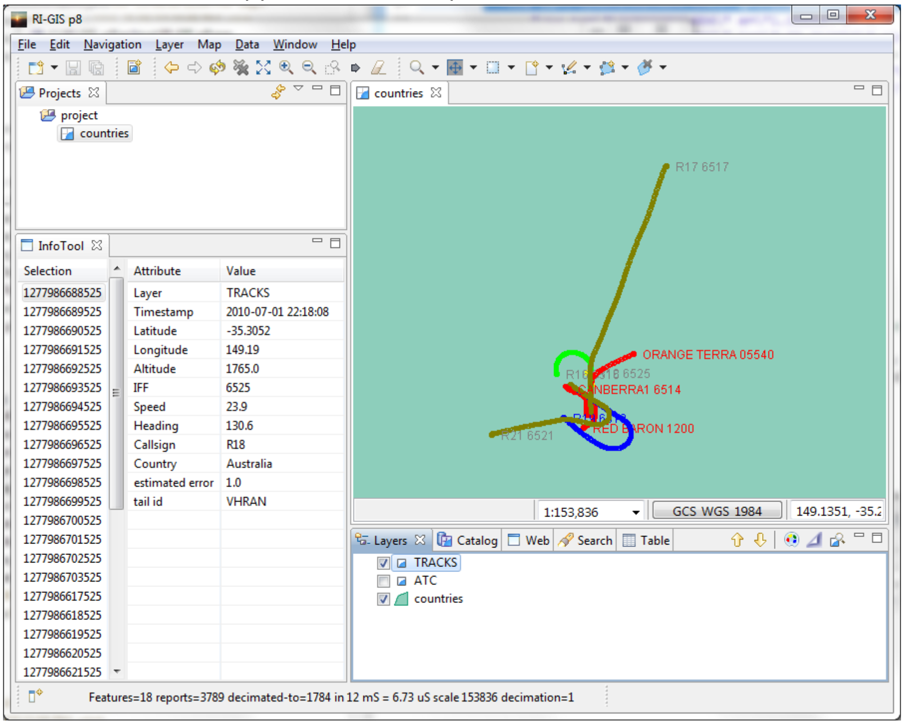

# IR-GIS

***Innovative Realtime Geographic Information System***

**An Innovative Realtime Geographic Information System supplying high performance, multi-threaded, highly scalable real-time layers in a compliant 2 Dimensional Geographic Information System.**

- Ideal for processing small to very large scale vehicle tracking messages, e.g. shipping, truck lines, buses, transport companies, and Air Traffic Control systems.
- Built on Open standards: Open Source (udig/apache), OGC, JMS, and eclipse RCP.
- Map layer sources offer: real-time tracks and position reports, ESRI shape files, images, databases, Open Geographic Consortium compliant Web Feature Service and Web Map Service servers.
- Complete multi-threaded design to take advantage of modern CPU architectures.
- Multi-threaded, high performance, highly scalable real-time live data position display.
- Concurrent and multiple real-time live data layers coexist with concurrent traditional map layers.
- All map layers, including the real-time layers are styled using the Style Layer Descriptor OGC standard.
- SLD provides dynamic Styling for the real-time layer on the fly.
- Real-time data is fed directly to IR-GIS via JMS.
- JMS supports failover and load balancing.
- Extensible message formats with attributes visible in the Info selection Tool and participating in the display styling.
- The IR-GIS client contains a tracker that can associate unidentified position reports (dots) with features (vehicles) by correlating the attributes, time and location with previous position reports.
- Highly configurable views and perspectives.
- Australian based support and development.




**Aircraft tracks near Canberra Airport showing styling and the Info Tool selection with track attributes.**

Labels may be derived from a combination of attributes and literals, and colour is formed from rules involving those attributes.

Maps may be comprised from multiple layers.

Many Geographic Coordinate Systems supported, including WGS84.

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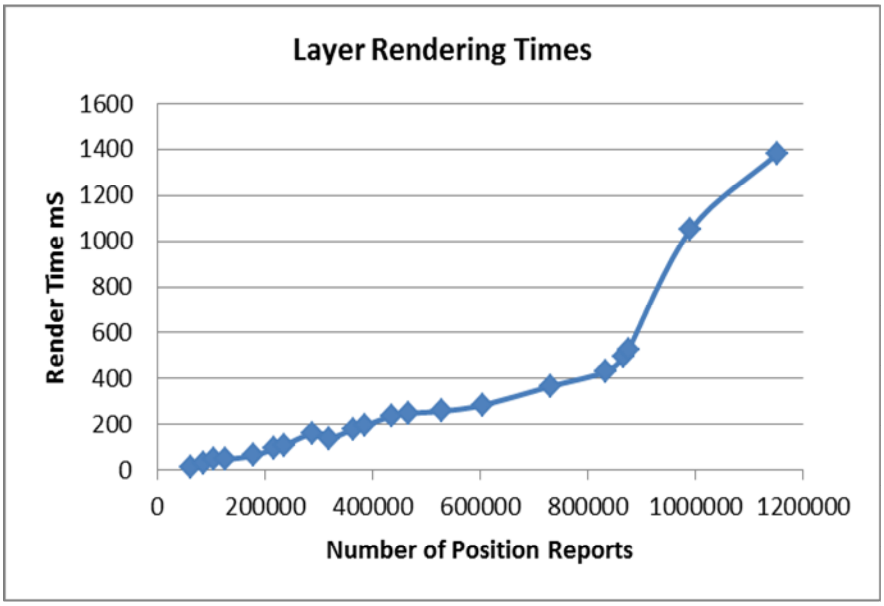
## Performance Specifications

| | |
|---|---|
| Targeted number of Feature messages to parse per second | 4,800 |
| Targeted maximum number of Position Reports to draw per layer using 1 second update and 4 minute tails. | 900,000 |
| Rendering time for 4,800 Features and 900,000 reports (scales linearly) | 500 milliseconds |
| Recommended maximum number of Features to parse per second per layer | 4,800 |
| Recommended maximum number of Position Reports to draw per layer | 1,152,000 |
| Number of Features, Position Reports and layers | Limited by memory and CPU |
| Performance benchmark for dual ATI Radeon HD 5870 1GByte GPU and i7 Q 820 CPU 4-core/8-threads clocking at | 1.73 – 3.06 GHz |




IR-GIS was designed for high volume real-time. It is capable of Rendering 900,000 Position Reports per layer in 500 milliseconds.

The Layer Rendering Time performance graph shows a knee near 900,000 reports, and that the degradation is linear to 1,200,000 Position Reports which are rendered within 1400 mS.

## GNU LGPL Declaration.

IR-GIS is based on the udig platform, which is provided free under the GNU LGPL. This code base contains the modified, and hence derivative works plugin: net.refractions.udig.project, which has been modified to support real-time layers in a backwards compatible fashion with the existing udig map layers and features.

The remaining udig packages are unmodified.

The IR-GIS plugins are the Intellectual Property of Arising Technology Systems.




## Technical Background

The innovative real-time GIS product IR-GIS provides real-time layers that are rendered on 2-Dimensional maps that can be sourced from: shape files, images, database and OGC compliant WFS 1.0 and WMS 1.0 Map servers.

A JMS Topic is used as a data source for each real-time layer, and the messages are parsed and converted into visual representation. The real-time message components are parsed into: Features, Position Reports, Attributes, Details and Dynamic Details derived from the Feature's kinematics.

A Feature is synonymous to a moving platform, such as a boat, a car or aeroplane, while a Position Report is the reported position of that Feature at a known time. IR-GIS handles two types of Features: those that a pre-identified, such as output by a tracker, and those that are not: such as raw Position Reports.

IR-GIS contains a tracker that can turn raw un-identified Feature Position Reports into Tracks after identifying that several Position Reports belong to the same Feature. Lines can be drawn between these associated Position Reports to form Tracks using the Style Layer Description Line Styles specified for the corresponding real-time layer.

The Dynamic Details are derived from the Position Report which represents a Position reported at a specific time, and typically contains: time, position: latitude, longitude and altitude, course: heading and speed, and sensor: range and bearing - when available.

The tracker uses a combination of Position Report Attributes to identify with which Feature to associate the Position Report.

Amplifying Details add extra descriptions to the Feature, such as: colour, height, and shape, and can participate in SLD styling when rendered.

In the case of an Air Traffic Control system the Mode-C Secondary Surveillance Radar squawk code would be an identifying Attribute, as would the mode-S code of an ADSB squitter, whereas an aircraft type would be an amplifying Detail.

Kinematic Details are derived from motion, such as course: speed and heading, sensor: range and bearing, and the geo-location details of position: time, latitude, longitude and altitude.

All Attributes and Details can be displayed in the information tool, and participate in the styling of Position Report for: marks and lines, and they can be rendered in labels.

The head-mark is the (current) last Position Report and can be labelled from the Attributes, or a literal, as the Feature moves. For example, the speed may be used to select a colour scale for the lines and marks.




The styling follows the OGC standard Style Layer Descriptor (SLD) and provides: mark, head graphics, colour, line, and label styles. For performance reasons the real-time layers do not use the painter-algorithm for styling, but rather the first style that matches a Feature component: mark, head graphic, line or label, is used. A default "Else rule" can be specified in the SLD to act as a back-stop capturing cases where there are no other matching rules.

Message parsing is assigned on separate thread pools to the layer renderer. Where ever possible the style components are pre-evaluated at the time a Position Report is created so the cost of styling in those cases is attributed to the message parsing thread and not to the layer rendering thread. There is a higher cost to styling when the SLD references a kinematic attribute because the style evaluation will be performed at rendering time. E.g. the kinematic Detail: speed may be used to colour the track, this styling would be evaluated every time the Position Report is plotted, whereas regular Attributes and Details are evaluated at the time of input.

Feature Attributes and Details derived from the real-time messages are cached for fast re-use, and redundant data is not stored keeping the memory footprint minimal. The same policy is adopted in the historical archiver to keep the archive sizes minimal.

The IR-GIS real-time layers were designed to support in excess of 2400 Feature reports per second and including over 600,000 Position Reports that are retained for display while providing sub-second display rendering times. The layers are rendered concurrently so the display is only limited by the spare CPU and thread capacity of the underlying processor architecture

The display rendering takes less than one second on an Intel i7-Q820 running at its maximum clock speed of 3.06 GHz and with one layer receiving 4800 Features per second and the Renderer drawing 1,152,000 Position Reports.

The rendering time gracefully degrades when the load is increased.

The screen refresh time is configurable and the default interval is one second.

It is our opinion that this product is highly scalable and suited to high volume real-time traffic.