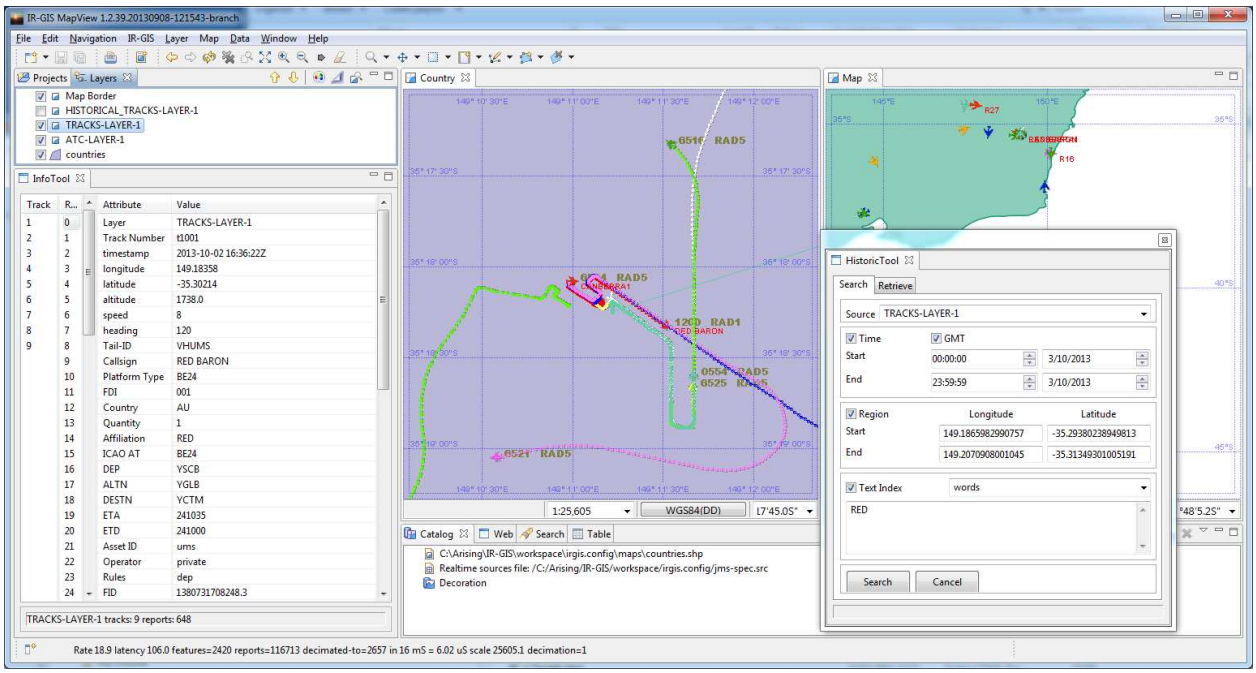
IR-GIS

Innovative Realtime
Geographic Information System

An Innovative Real-time Geographic Information System supplying high performance, multi-threaded, highly scalable real-time layers with persistence and recall providing 2 Dimensional ISR with maps sourced from OGC compatible servers.

- Two products IR-GIS® MapView and IR-GIS® Historical Pullback Server (HPS) work in concert with each MapView operating largely independently for scalability.
- Ideal for recording and displaying from small to very large scale and/or high speed vehicle tracking messages, e.g. shipping, truck lines, buses, transport companies, and Air Traffic Control systems or a simultaneous combination of several message types.
- Built on Open standards: Open Source (udig/apache), OGC, JMS, Java and eclipse RCP.
- Map layer sources offer: real-time tracks and position reports, shape files, images, Open Geographic Consortium compatible Web Feature Service and Web Map Service servers.
- Complete multi-threaded, highly scalable design to take advantage of modern CPU architectures.
- 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.
- SLD provides dynamic Styling for the real-time layers on the fly.
- Real-time data is fed directly to IR-GIS® MapView and IR-GIS® HPS via JMS.
- JMS supports failover, load balancing and message delivery in a real-time fashion.
- The IR-GIS® HPS and MapView client contain a tracker that associate unidentified position reports (dots) with features (vehicles) by correlating the attributes, time and location with previous position reports.
- IR-GIS® HPS can record and index many thousands of Position Reports per second.
- IR-GIS® HPS provides geographical, time and text-based index searches of the historical data for retrieval and display in IR-GIS® MapView.
- User Extensible message formats with attributes visible in the Info selection Tool and participating in the display styling.
- Highly configurable views and perspectives.
- Australian based support and development.
- Technical Readiness Level 9 – operational for 3 years in an ISR collection environment.



Aircraft tracks near Canberra Airport showing styling, the Info Tool selection of tracks, reports and attributes, split maps and Historical retrieval tool.

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 of real-time sources. Very rich attributes available for display or searches.

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Performance Specifications 32 bit on i7 – 2010

Targeted number of Feature messages to parse per second	4,800
Targeted 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	9,600
Recommended maximum number of Position Reports to draw per layer	1,152,000
Performance benchmark for dual ATI Radeon HD 5870 1GByte GPU and i7 Q 820 CPU 4-core/8-threads clocking at	1.73 GHz

Performance Improvements 64-bit 24 core Xenon Gen 2 desk top - 2013

Targeted features/vessels per layer	30,000
Track length displayed on 30,000 feature layer	6 hours
Rendering time for 30,000 feature layer	< 60 milliseconds
Number of concurrent feature layers limited by data sources, memory and CPU.	2 * 30,000 and 3 * 8,000 and 3 * 9,000 and sundry smaller real-time layers.
Typical memory for 2 * 30,000 * 6 hour features/tracks + 3 * 8,000 * 6 minute feature/tracks + 3 * 9,000 * 6 minute feature/tracks at end of 8-hour day	13 Gbytes
CPU usage	< 10 %

Technical Background

The innovative real-time GIS product IR-GIS® MapView 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, and Identifying, Detail and Dynamic Attributes derived from the Position Reports.

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, and two features types are handled: those that a pre-identified, such as output by an ATC tracker, and those that are not: such as raw Aircraft or Boat Position Reports.

Both IR-GIS® MapView and HPS contain a tracker that can turn raw un-identified Feature Position Reports into Tracks after identifying that several Position Reports belong to the same Feature. In MapView 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 Attributes 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 probability distribution of Position Report Attributes and geo-location to identify which Feature to associate the Position Report to form tracks.

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 systems 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.

All Attributes 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.

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 Dynamic Attribute because the style evaluation will be performed at rendering time. E.g. the Dynamic Attribute Speed may be used to colour the track, this styling would be evaluated every time the Position Report is plotted, whereas styles involving regular Identifying and Detail Attributes 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 Pullback Server to keep the archive sizes minimal.

The IR-GIS® real-time layers were designed to support in excess of 4800 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 rendering time gracefully degrades when the load is increased. The screen refresh time is configurable and the default update interval is one second.

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

Our customer reference is available on request.