

liveTRACE taking RFID into the future



Overview

Radio Frequency Identification (RFID) is a burgeoning technology used to uniquely identify items and products across a range of industries world-wide and is used in applications such as supply chain and inventory management, logistics, transport, access control for secure facilities and tracking of military equipment. The millions of transaction records produced by RFID provide fertile grounds for analysis and opportunities for visualisation.

Australian Beef

By value, Australia is the largest exporter of beef in the world and is only second by volume to Brazil. Valued at around 5 billion Australian dollars annually it is an industry worth protecting from disease outbreak, chemical residues or other risks. Asian and European markets are understandably sensitive to these risks and as a result, increasingly demand and are prepared to pay premium prices for beef with lifetime traceability (the capacity to not only identify the animal but also each property it has lived at and all other animals it has had contact with during its life). Australian beef producers responded to this imperative by initially voluntarily subscribing to the National Livestock Identification System (NLIS) in 1999. Progressively through to 2005, all Australian beef producers have been required, finally by law to identify their cattle by RFID devices. Each movement of an RFID device (and therefore the associated animal) is recorded in the NLIS database with movements entered directly via the web by farmers, saleyard and feedlot operators and other processors. This enabled tracing of individual animals, however it was difficult to identify commonalities between multiple animals or analyse the data with any real degree of sophistication.

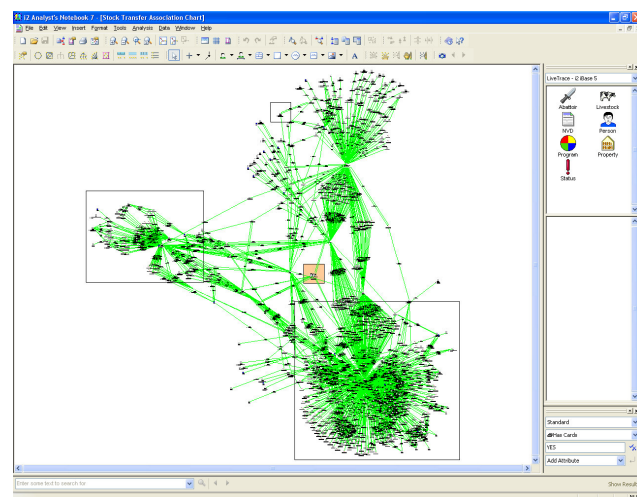


Cattle being scanned at a market

Development

Insight Analysis & Consulting (IAC) saw an opportunity to apply the i2 software to analyse the NLIS data. As a major user of NLIS, the Victorian Department of Primary Industries (DPI) was approached and engaged IAC to implement an iBase SSE solution to analyse the NLIS data. In addition to NLIS, DPI suggested that we also integrate their property registration database (PITR) and animal disease management database (ADMIS). This enabled DPI to not only trace the lifetime histories of animals and identify associations between cattle, but also to complement the analysis with detailed information about the properties they had been in contact with. For example, DPI can now analyse cattle transfers from farms with soil contaminants or other residues.

The solution consists of a suite of i2 tools, including iBase SSE, Analyst's Notebook and the iBase GIS Interfaces. iBase SSE was considered the best option for this application given the volume of data and the needs of the client to prepare link analysis, timeline charts, maps as well as enable users to create their own customised reports and queries. iBase SSE also enabled users to analyse the data without disruption to the NLIS data or the other data sources which were required to continue to operate as standalone systems. During the development of the system IAC worked closely with DPI's epidemiological staff and members of the NLIS tracing team who provided input into the format and content of the required charts, queries, reports and maps. The system became known as "liveTRACE".



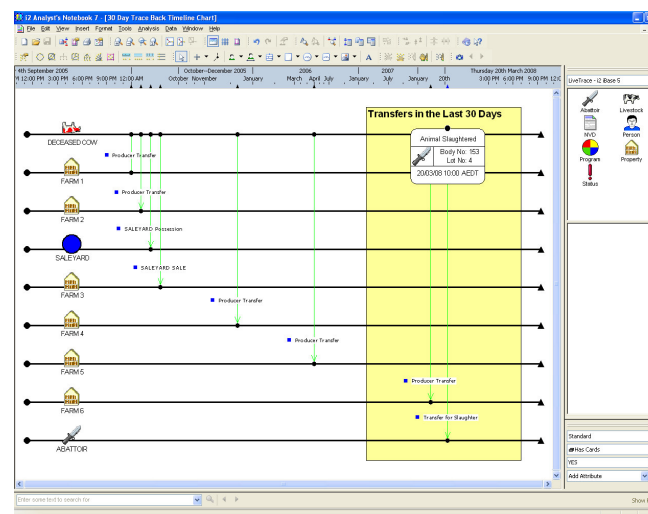
An example of a trace forward analysis chart

liveTRACE

Each night liveTRACE automatically imports all movements for the previous day recorded on the NLIS system then combines it with daily updated copies of ADMIS and PITR.

With 62 million devices and 61 million transfers, importing the initial NLIS data was a huge task made considerably faster and easier by the "Bulk Import" option which was released as part of the iBase 5 upgrade. This sped up the import process by a factor of approximately 30 times. The database is currently over 500 gigabytes in size and is the largest application of iBase ever developed.

The primary inquiry, bearing in mind the aim of protecting the national herd from exotic disease outbreak, is the ability to "traceback" suspected animals over an incubation period, to identify all other animals with which they had contact. These animals can then have a function performed on them known as "traceforward" which identifies all animals which they, in turn, had contact with.



An example of a timeline chart showing a trace back

Other desirable functions included the ability to provide lifetime traceability status, the identification of lifetime traceability gaps (which can diminish the value of the animal through an uncertainty about the identities of its cohort animals), finding paths between disparate animals (the capacity to identify commonalities in the histories of animals), disease outbreak monitoring and prevention as well as operational disease outbreak management in a genuine outbreak. Higher level analysis of climatic effects, broader analysis of livestock movements and virtually any other type of analysis are also facilitated by the liveTRACE tools.

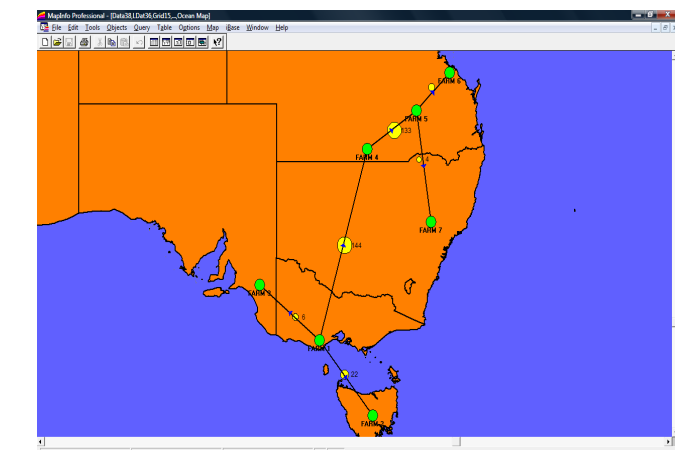
Because Australia is relatively disease free, a fictitious disease outbreak is used by the national and other state authorities during regular exercises to assess response readiness should such an outbreak occur. A typical scenario could be: "A cow is detected on a given farm in Victoria with a disease with a 36 hour incubation period". Immediately charts can be produced to show all animals which it has been in contact with in the preceding period deemed appropriate and the properties it has been at during that period. Any lifetime traceability "gaps" are investigated in the normal manner by field staff with the assistance of easy to read "timeline" charts produced by liveTRACE and showing the period requiring clarification.

All other cows which have come in contact with the suspect animal can then be identified by traceforward analysis. The properties where these animals are located are identified and normal quarantine and other procedures are put in place to minimise the spread of the disease. In addition to charts and reports, maps can be produced to show the spread of the disease and the properties affected.

By this stage the spread of the disease has been stemmed. No further movements of animals are permitted and normal disease management procedures control any possible further spread. Of course this is a highly hypothetical example as it would be unlikely that only one cow would exhibit symptoms or signs. This would require a number of animals' histories to be

analysed simultaneously and these functions can be performed in liveTRACE within minutes of being advised of the identity or location of the suspected animal or animals. This functionality has been tested in exercises simulating real exotic disease outbreaks with great success which has led to recommendations by a senior epidemiologist for national adoption of the liveTRACE tools.

Naturally training of DPI staff was required to familiarise operators of the system with the concepts of analysis and techniques required to operate the system. This has afforded them the ability to develop individual queries and reports to develop any line of inquiry they wish to pursue. liveTRACE has unlocked an extremely valuable resource to greatly assist in the prevention of disease outbreak in this island nation and to more speedily and appropriately respond should such an outbreak occur.



Spatial analysis of movements between properties

The Future

Whilst this example of applying iBase to an RFID application involves the tracking and analysis of cows, there is no reason to limit its capacities to that area alone. It is anticipated that, in the future, RFID data will be kept on other species. Pigs, sheep and goats will soon be subject to similar recording requirements in Australia affording an opportunity to accurately track and analyse various aspects of their cultivation and interaction with other species such as cattle and sheep. Other countries either have or are considering introduction of systems similar to NLIS and developing these to analyse and prevent exotic diseases all over the world.

The burgeoning industry of radio frequency identification with its increasingly sophisticated technology will, in the very near future, afford innovative operators opportunities to develop visualisation tools to analyse the databases which the recording of these items generate.

liveTRACE is just one example of the ability of iBase to be applied to RFID data.

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