Singapore Empowers Land Transport Planners With Data Warehouse

Published: 18 October 2011

Analyst(s): Eric Thoo

The Land Transport Authority (LTA) of Singapore wanted to improve planning and be more agile by making fact-based decisions and taking a long-term view; therefore, it needed a data warehouse that could analyze 4.6 billion records in minutes rather than hours. Data warehouse and business intelligence (BI) leaders who face challenges can learn from some of the practices that helped the LTA to succeed in building its Planning for Land Transport Network (Planet) system.

Key Findings

■ Small, densely populated Singapore faces challenges with land transportation. Roads occupy 12% of its surface area, and the LTA collects up to 12 million public transport transactions per day for public transport.

■ During the implementation, most of the work centered on the deployment of the data warehouse infrastructure and the definition of a metadata model (now overseen by a metadata management program).

■ The time it takes for extraction, transformation and loading has improved by 67%. A query of 100 million records would have taken 18 hours to complete. Now, with Planet, it takes 15 minutes.

■ The LTA estimates that it saves 19% a year by using Planet compared with its old data and reporting systems.

Recommendations

■ Secure an executive sponsor. To succeed, Planet needed a sponsor with enough clout to secure funding and overcome the political and technical differences that inevitably arise in a large organization.

■ Ensure key business stakeholders actively participate. The LTA engaged business users early in the project conceptualization in order to establish a sense of ownership.
Choose tools and technologies with users in mind. The LTA recognized that the success of Planet depended on whether people actually use it. Thus, the LTA ensured the solution has the ease of use and scalability that would allow Planet to support a wide range of users.

What You Need to Know

Singapore's LTA won one of Gartner’s 2011 Business Intelligence Excellence awards for a data warehouse project that mines large amounts of data to help users set land transport policies and optimize operations. The system ingests up to 12 million public transport transactions per day, holds three years' worth of data, generates more than three times as many reports as the old system and reduced query time from 18 hours to 15 minutes. The LTA succeeded with this project because it paid attention to information governance and integration standards, and designed the system around user needs.

Case Study

Introduction

The LTA was set up under the Ministry of Transport to spearhead land transport developments in Singapore. The primary role of the LTA includes:

- Planning, designing, development, management and maintenance of the transit systems, roads and related facilities.
- Acting as agent and advisor to the Singapore Government on land transportation.
- Representing Singapore internationally in land transport.

The LTA has recently completed the first phase of such an initiative, which will save the agency millions of dollars a year and improve services to citizens. Data management leaders can learn valuable lessons about how to undertake these kinds of initiatives.

The Challenge

Most enterprises have the information systems to amass huge amounts of information. If they want to use that information to optimize or transform their business, they need to implement a new generation of data warehouses and other data management and BI technologies. These technologies increase the speed and number of queries that users can run against the data so that they can gain insights and make decisions in near real time. However, the projects can cost millions of dollars and take years to complete because they touch so many different parts of the organization and so many different IT systems.

The LTA is one of Singapore's largest government agencies with more than 4,500 employees. Engineering constitutes two-thirds of the LTA's staff, which operates out of many geographically dispersed locations.
Singapore faces particular challenges with regard land transportation because it is a small, densely populated country. Roads occupy 12% of its surface area, and the LTA collects up to 12 million ticketing transactions per day for public transport. Moreover, Singapore expects its population to grow from 5.1 million in 2010 to more than 6.2 million in 2020, with more than 10 million visitors per year. Singapore enjoys double-digit economic growth on top of an already-high per capita income. To address the demands that these trends will create, in 2008 the government unveiled a $50 billion Land Transport Master Plan to double the size of its land transportation network by 2020.

To execute the Master Plan, the LTA must:

- Maximize the accessibility, comfort, convenience and pricing of public transport.
- Analyze business data for planning, regulatory and operational reporting, and performance management of public transport operators.
- Fine-tune policies via data mining, along with traditional feedback methods, surveys and post-implementation comparison studies.
- Create a knowledgebase from which to derive new insights, including capturing tacit knowledge and making it explicit in a central information store.
- Help various roles, such as policy analyst, transport planner, research analyst, and transit regulators, to share knowledge and collaborate in making evidence-based decisions.

However, the rapid growth in public transport data has put a great deal of stress on the LTA’s information infrastructure. Policy planning for a wide range of business scenarios can require more than 100 queries, and running these queries would take more than 20 hours using traditional processing. System limitations allow planners to analyze only three months’ worth of data.

**Approach**

In August 2008, the LTA’s senior management, including the CEO and CIO, along with business and technical stakeholders, decided to create a large central data warehouse, called Planet. Planet would pool data from various business sources and support queries against three years’ worth of public transport transactions (4.6 billion records). The LTA embarked on a proof of concept. The proofs of concept were promising, so in March 2009, it decided to invest $12 million in a full-scale implementation of Planet (see Figure 1). The LTA worked with Wipro on the design and implementation, and the LTA chose data warehouse, data integration and data quality, and analytic technologies from Teradata, Informatica and SAP Business Objects respectively. Planet went live within 12 months.
During the implementation, most of the work centered on the deployment of the data warehouse infrastructure and the definition of a metadata model. The data transformation component accepts data from various sources and allows analytical users to create scenarios with real-time data. A data quality process ensures the completeness, accuracy and consistency of the data.

The LTA performed rigorous testing to ensure data accuracy and the ability to handle varying and complex business scenarios. In April 2010, Planet demonstrated a high level of performance with a large volume of data fed from various data sources in production. Planet went into production in July 2010. The project implementation team of Planet includes:

- BI and data warehouse technologists.
- People from the LTA’s project management office.
- Data warehouse consultants and implementers from Wipro and other technology partners.
BI practitioners like policy analysts, transport planners, research analysts and transit regulators.

Results

Planet gives users new ways to view the data gathered. The system’s storage capacity has increased to three years’ worth of records for public transport transactions, compared to three months’ worth with the old system. The time it takes for extraction, transformation and loading has fallen 67% while the time required for queries has dropped 99%. A query of 100 million records would have taken 18 hours to complete before Planet; now they take 15 minutes. Planet offers rich features, such as ad hoc queries and predictive modeling. Within the first three months of operation, users ran more than 4,000 new queries and created more than 70 new reports (in addition to 30 legacy reports) for policy reviews, analysis of new transport schemes and trend patterns to optimize resources (see Figure 2 for Planet's capabilities).

Figure 2. Capabilities of Planet

The transaction data that feeds into Planet includes information about ridership and journey times. Planet's analytics enable users to:
Formulate, validate and refine land transport policies.

Locate transport facilities, such as seats and shelters.

Optimize operations, such as passenger loading and frequency.

Support the LTA’s metrics-based regulatory framework.

The LTA estimates that it saves 19% per year by using Planet rather than its old data and reporting systems. Planet also uses 13% fewer man hours every year.

The LTA next plans to use Planet to analyze areas of congestion in the land transport network with spatial analytics. In addition, intermodal data can be analyzed with advanced predictive algorithms of travelling patterns whether by car, bus or train, and the impact of traffic on commuting. With Planet, the LTA can set strategic plans for the next generation via a more complete view of the land transport planning model and landscape. Planet will also enable the LTA to model transport and optimize land use. To complete these tasks, the LTA will need to:

- Develop new analytics skills.
- Promote data sharing.
- Increase the productivity of Planet users.

Since its implementation, the usefulness of Planet has gone beyond the LTA. Anonymized data from Planet is highly sought after by international academia for research into urban transport studies and third-party developers to co-create new information services.

Critical Success Factors

Managing varying user need. The range of use cases for Planet involves different kinds of users performing different kinds of tasks. The LTA must coordinate this work to make the most efficient use of Planet. Therefore, the LTA captured and centrally stored the extensive, complex business rules governing the various business scenarios.

Establishing data management framework. The LTA created a data management steering committee to classify data collections, establish data ownership and define an enterprise metadata taxonomy. These disciplines promote cooperation among different user groups.

Formulating system interface standards. Planet involves the integration of multiple systems, and the LTA had to create standards for the interfaces between these systems. The process involved rounds of discussion to ensure a good understanding of the overall design so that standards and procedures would facilitate seamless system integration while ensuring Planet remains flexible and secure.

Lessons Learned

Secure an executive sponsor. Planet involves many different departments both within the business and within the IT organization. To succeed, Planet needed a sponsor with enough clout to secure
funding and overcome the political and technical differences that inevitably arise when a project cuts across a large organization.

Ensure key business users actively participate. The LTA engaged business users early in the project — in the decision to build Planet — in order to establish a sense of ownership. And it continued to engage users throughout the project, such as by creating a proactive user training program instead of waiting to deliver training when people decide they want to use Planet.

Choose tools and technologies with users in mind. The LTA recognized that the success of Planet depended on whether people actually use it, and people would decide to stop using Planet any time it didn’t meet their needs. Therefore, the LTA chose technologies for Planet not simply to meet the requirements for the first phase of the project, but with an eye toward later phases as well. Thus, the LTA ensured the solution has the ease of use and scalability that would allow Planet to support a wider range of users and larger amounts of data than Planet would need when it first went into production. The LTA also chose products whose vendors provide reliable support to minimize disruption to users from outages, bugs and other unforeseen difficulties. Above all, the LTA asked vendors to run proofs of concept to ensure the technology could do what users needed.

Choose a strong partner to help design and implement the system. As big as the LTA is, it recognized that it didn’t have all the skills and resources it needed to launch Planet. It looked for a system integrator with a track record in implementing data warehouses and analytics, and one with services particularly geared toward the type of project the LTA envisioned.

Recommended Reading

Some documents may not be available as part of your current Gartner subscription.

"Data Warehouse Justification vs. Tactical Uses of Unintegrated Information"

"Asia/Pacific Summit Highlights Opportunities to Increase the Value of the Data Warehouse"

"Agile Techniques Augment But Do Not Replace Business Intelligence and Data Warehouse Best Practices"

"The State of Data Warehousing in 2011"

"Magic Quadrant for Data Warehouse Database Management Systems"

"Case Study: CoreLogic Delivers an Industry Analytic Service"

"Aster Data Purchase Shows Teradata's Vision Is Deeper Than 'Big Data'"

"'Big Data' Is Only the Beginning of Extreme Information Management"
Regional Headquarters

Corporate Headquarters
56 Top Gallant Road
Stamford, CT 06902-7700
USA
+1 203 964 0096

Japan Headquarters
Gartner Japan Ltd.
Aobadai Hills, 6F
7-7, Aobadai, 4-chome
Meguro-ku, Tokyo 153-0042
JAPAN
+81 3 3481 3670

European Headquarters
Tamesis
The Glanty
Egham
Surrey, TW20 9AW
UNITED KINGDOM
+44 1784 431611

Latin America Headquarters
Gartner do Brazil
Av. das Nações Unidas, 12551
9° andar—World Trade Center
04578-903—São Paulo SP
BRAZIL
+55 11 3443 1509

Asia/Pacific Headquarters
Gartner Australasia Pty. Ltd.
Level 9, 141 Walker Street
North Sydney
New South Wales 2060
AUSTRALIA
+61 2 9459 4600

© 2011 Gartner, Inc. and/or its affiliates. All rights reserved. Gartner is a registered trademark of Gartner, Inc. or its affiliates. This publication may not be reproduced or distributed in any form without Gartner’s prior written permission. The information contained in this publication has been obtained from sources believed to be reliable. Gartner disclaims all warranties as to the accuracy, completeness or adequacy of such information and shall have no liability for errors, omissions or inadequacies in such information. This publication consists of the opinions of Gartner’s research organization and should not be construed as statements of fact. The opinions expressed herein are subject to change without notice. Although Gartner research may include a discussion of related legal issues, Gartner does not provide legal advice or services and its research should not be construed or used as such. Gartner is a public company, and its shareholders may include firms and funds that have financial interests in entities covered in Gartner research. Gartner’s Board of Directors may include senior managers of these firms or funds. Gartner research is produced independently by its research organization without input or influence from these firms, funds or their managers. For further information on the independence and integrity of Gartner research, see “Guiding Principles on Independence and Objectivity” on its website, http://www.gartner.com/technology/about/ombudsman/omb_guide2.jsp.