A Lesson Learned of Cloud Computing for Fleet Management in Taiwan

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Outlines

• Fleet Management System (FMS)
• Problem Statements
• Cloud Architecture
• Results & Conclusion
# Features of FMS

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
<th>Source</th>
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<tbody>
<tr>
<td>Enterprise Dashboard</td>
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<td>API Integration</td>
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<td>Find Closest Capable Driver</td>
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<td>Search!</td>
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<td>Landmarks and GeoFences</td>
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<td>GIS Overlays</td>
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<td>Advanced Large Fleet Reporting</td>
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<td>Satellite Imagery</td>
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<td>Fuel Efficiency Module</td>
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<td>Fleet, Driver &amp; Team Management</td>
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<td>International Language and Time Zone Support</td>
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<td>Animated Vehicle History Trails</td>
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<td>2-way Messaging</td>
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<td>Route Optimization</td>
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<td>Reports</td>
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<td>Speeding Alert Against Posted Speed</td>
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<td>Role Based Hierarchy</td>
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<td>InSight Real-Time Alerts</td>
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<td>Maintenance Reporting</td>
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Source: [http://www.telogis.com/](http://www.telogis.com/)
Vehicle Tracking

Source: http://skyeyes.tw/
Individual Monitoring

Source: http://skyeyes.tw/
Vehicle History Trails

Source: http://skyeyes.tw/

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011-02-24 12:01:00</td>
<td>0</td>
<td>台南市中華路</td>
<td>台南市中華路20號</td>
</tr>
</tbody>
</table>
Enterprise Dashboard

Source: http://skyeyes.tw/
Problem Statements

✅ Storage concerns
- 2 driving records per minute for 1300+ vehicles; 1.9 million a day
- Currently, only 2 months of historic records are stored in RDBMS

✅ Query concerns
- Customers query on vehicle history trails in many cases

• Tracking concerns
- Spatial analysis is performed within RDBMS

✅ Budget concerns
- Buy more RDBMS
- Buy Servers

![GIS FCU](https://example.com/gisfcu.png)

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Solution of Cloud Computing

• Apache Hadoop
  – Open Source Apache Project
  – Written in Java
  – Runs on Linux, Mac OS/X, Windows, and Solaris
  – Hadoop Core includes
    • Distributed File System: manage data
    • Map/Reduce: manage applications
Subprojects of Hadoop

- **Hadoop Common**: The common utilities that support the other Hadoop subprojects.
- **HDFS**: A distributed file system that provides high throughput access to application data.
- **HBase**: A scalable, distributed database that supports structured data storage for large tables.
- **Hive**: A data warehouse infrastructure that provides data summarization and ad hoc querying.
- **MapReduce**: A software framework for distributed processing of large data sets on compute clusters.
Cloud Architecture

Vehicle

Client

Socket 3G/GPRS

SocketServer

HBase API

HRegion

HRegion

WWW Server

HBase Thrift

WebServices

Hadoop 0.20.1 + HBase 0.20.3

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Query on Vehicle History Trails

![Diagram showing the process of querying vehicle history trails using Hadoop and HBase.]

The diagram illustrates the flow of data from sensors to HDFS, replication, and storage in HBase. The process involves querying vehicle history trails using SkyEye, with data logs such as:

- `<Log>OG697373,2010-08-01 00:00:20,181073.93371723476,2593861.9459652021,0,0</Log>`
- `<Log>OG697373,2010-08-01 00:02:19,181074.27517360024,2593862.129943765,0,0</Log>`
- `<Log>OG697373,2010-08-01 00:04:19,181074.78951989027,2593862.8648501704,0,0</Log>`
- `<Log>OG697373,2010-08-01 00:06:20,181074.78951989027,2593862.8648501704,0,0</Log>`
- `<Log>OG697373,2010-08-01 00:08:19,181073.42888279574,2593863.2403823179,0,0</Log>`
- `<Log>OG697373,2010-08-01 00:10:19,181073.42282975157,2593861.9483586662,0,0</Log>`

These logs are stored and processed using Hadoop and HBase, with web services and clients accessing the data.
Conclusion & Future Work

• Conclusion
  – Hadoop can accommodate large amount of data
  – Hadoop can greatly reduce the query time on giga data

• Future Work
  – To build 1mX1m map grid and look-up table
  – To adopt Map/Reduce in spatial analysis
THANK YOU