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RESEARCH SERVICES

Drivers Avoid Traffic Jams with Big Data and Analytics

With in-memory computing and big data behind it, Japan's popular Zenryoku Annai! application is helping drivers get to their destinations faster and more efficiently—both day and night.

BY JOE MULLICH

Tokyo's first taxicabs appeared a century ago. Now, about a quarter million of them service the metropolitan area and beyond. For Nomura Research Institute (NRI), Japan's largest consulting and IT consulting firm, all these vehicles crisscrossing the nation represent a huge wealth of information and clues about how to break gridlock in one of the world's most densely populated countries.

NRI is analyzing traffic jams in Japan using multiple sources, including traffic data from sensors around the country and location data from 12,000 taxicabs. What enables NRI to keep up with the massive data flow is the use of in-memory computing technology, which can process reams of different data types in real time for instant analysis.[1]

Not too long ago, NRI relied on more traditional technologies. But the database component, in particular, became a stumbling block for this application. According to Hiroshi Terada, NRI's general manager for ERP solutions, "An ordinary relational database took several minutes to analyze the 360 million traffic records and we had problems with real-time data processing."[2]

After NRI implemented in-memory computing technology, it was able to analyze the millions of records in just over one second. "The speed this enables is sudden and significant, and has the potential to transform entire business models," says Akihiko Nakamura, corporate senior vice president, Services and Industrial Solution Division, at NRI.[3]

New Business from Big Data

NRI is a leading example of how to find huge benefits from "big data," the term given to data that comes in large volumes, variety and velocity. Thanks to big data, NRI has leveraged its research and traffic analysis expertise to develop a widely used service called "Zenryoku Annai!." Using this service, subscribers all over Japan can plot out the shortest travel routes, avoid traffic snarls and estimate what time they will arrive at their destinations.[4]

Zenryoku Annai! combines information from satellite navigation systems linked to sensors at fixed locations along roads with traffic data determined through statistical analysis on position and speed information from subscribers, moving vehicles and even pedestrians.[5] Meanwhile, data from thousands of taxicabs is added to the mix. Using all this information, Zenryoku Annai! analyzes road conditions and helps drivers plan routes more accurately and over a wider range than is possible with conventional GPS systems.

"As the number of users of our Zenryoku Annai! service continues to grow, so too does the amount of position and speed data collected. Accordingly, we must now process this data faster than ever before," says Aritaka Masuda, general manager of NRI's Ubiqlink Department, which is responsible for gathering the traffic information.[6]

Masuda says in-memory computing tests have confirmed that 360 million data points can be processed in just over

Traffic Data Jam in Japan

- **Challenge:** 360 million data records of Japanese traffic information needed to be analyzed more quickly than the several minutes required by traditional relational database technology.
- **Solution:** In-memory computing, which can analyze large amounts of data quickly, was able to process the 360 million records in just over one second.

Nomura Research Institute at a Glance

- **Business activities:** Consulting, financial IT solutions, industrial IT solutions, IT platform services
- **Established:** April 1, 1965
- **Headquarters:** Tokyo, Japan
- **Capital:** 18.6 billion yen
- **Sales:** 363.8 billion yen (fiscal 2012, ending March 31, 2013)
- **Employees:** 5,823 (NRI Group 7,738)

www.nri.co.jp/

Source: Nomura Research Institute

1. SAP. "NRI: HANA." Customer Testimonial Video. http://goo.gl/gat2AC
2. SAP. "NongFu Spring: Accelerating performance with SAP HANA." Customer Testimonial. http://goo.gl/MAQgp1
3. Ashford, Warwick. "SAP highlights customer experiences of in-memory computing at Sapphire Now." *ComputerWeekly.com*, May 19, 2011. http://goo.gl/gsGp5e
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5., 6. Intel. "Not limited to ERP applications alone, the Intel® Xeon® processor E7 family also provides new business opportunities via in-memory technology." Case study, 2011. http://goo.gl/6nZC9m

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one second. The technology has improved search speed by a factor of more than 1,800 over the department's previous relational database management system.

Besides the big boost in speed, NRI found that in-memory computing helps simplify the programming needed to solve a complex analytical challenge and—somewhat counterintuitively—has even reduced the amount of processing power needed.

"In addition to making real-time processing possible, this approach simplifies traffic-data generation logic," says Kenji Honda, an NRI senior systems analyst in the Ubiqlink Business Planning Group. He says the higher speed of data extraction processing achievable with in-memory computing means that historical data can be processed on a continuous basis. This, in turn, reduces the amount of computer resources required to perform calculations.[7]

A Better Quality of Life

The ability to analyze traffic jams more quickly—and thus to potentially alleviate issues faster—is crucial in nation's like Japan, which can be crippled by traffic congestion. During the country's largest spring break, traffic jams can stretch 37 miles or more.[8]

Traffic congestion also can and does have a significant impact on quality of life and the economy in many major cities around the world. For example, a 2013 report from the Texas A&M Transportation Institute found that the financial cost of congestion in the United States in 2011 was $121 billion, translating to $818 per U.S. commuter.[9]

The likely negative impact that traffic jams have on public health is an even greater concern. As roadways choke on traffic, researchers suspect that the tailpipe exhaust from cars and trucks—already implicated in heart disease and cancer—may also injure brains cells and synapses key to memory.[10] According to one analysis, drivers traveling the 10-worst U.S. traffic corridors annually spend an average of 140 hours, or about the time spent in the office in a month. Meanwhile, a 2013 survey by workplace solutions provider Regus suggests that traffic congestion and crowded public transportation systems are the top causes of stress and declining productivity among Hong Kong employees.[11]

Tokyo at a Glance

- **Population:** 13.2 million (metropolitan area)
- **Number of taxicabs:** Approximately 250,000 (metropolitan area)
- **Number of cars:** Approximately 3.33 million
- **Total land area:** 2,700 square miles

The Price of Traffic Congestion in the United States in 2012

- **Total Cost:** $121 billion
- **Wasted Fuel:** 2.9 billion gallons
- **CO_2 Emissions:** 56 billion pounds

Source: Texas A&M Transportation Institute[15]

The NRI findings come at a time when many government agencies and companies in Japan are exploring new ways to leverage traffic data and other sources in an effort to improve quality of life issues. Toyota, which is the largest provider of taxis in Japan, recently announced it is using real-time traffic information from 700,000 Toyota vehicles on the country's roads to offer what it calls a "big data" service to local governments and businesses. The service is aimed at helping drivers during disasters and emergencies. Drivers will be encouraged to share their own observations on road conditions, including blocked paths and strong winds, with other drivers around the country.[12]

A recent report in *The Japan Times* notes the Japanese Government also wants to use car navigation data to better monitor traffic after disasters.[13] The Transport Ministry found it was able to check conditions on only 79 percent of the nation's roadways on the night after the earthquake and tsunami ravaged the Tohoku region in 2011. Following the disaster, the ministry discovered that traffic data collected from car navigation systems clearly showed roads on which no vehicles were running. Being able to understand traffic conditions immediately, both day and night, is a crucial aid in responding to a disaster.

All this demonstrates the growing need for—and benefits of—using big data in the public sector. "In the past, it could easily have taken several hours to process large volumes of data, and for this reason, I suspect many of our clients ultimately abandoned the process of data analysis" in the public sector, says NRI's Masashi. "But in-memory computing may well provide a way to offer faster, tailored solutions to them."[14] •

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Innovation Bridges Public Sector Goals vs. Performance Gap

The new survey, qualitative interviews and report from Bloomberg Businessweek Research Services clearly shows that most public sector agencies are struggling to deliver better service to their citizens while contending with severe financial constraints. But a host of technology innovations can help ensure safety, further improve quality of life and increase confidence in government. SAP's public sector industry team presents some ideas on how public sector leaders can bridge the gap between what they want to deliver and what their budgets will enable them to do.

What are some leading-edge innovations that can help public sector agencies harness the power of big data?
The public sector is emerging as the single largest producer and consumer of big data and will benefit greatly from the innovations we deliver. We think the SAP HANA platform should play a key role in helping public sector agencies rapidly and easily crunch very large volumes of granular data and take immediate action—which is where traditional relational databases fail.

Modern analytical tools powered by the SAP HANA platform can help agencies exploit the opportunity of big data by empowering users to access information anywhere, adapt to changing conditions, more accurately predict outcomes and, ultimately, make better decisions. Analytics tools are now much more intuitive and powerful, and they are no longer the domain of a select few data analysts and scientists. Instead, real-time analytics presented in easy-to-digest visual form are now available for all stakeholders.

How does a public sector agency get started, given budget constraints?
Agencies should identify and prioritize use cases that could provide value to the public and that big data can address. They should also take into consideration the technical and organizational feasibility, along with the potential value of the identified use cases.

Target the highest value use case(s) first and then consider taking a phased approach to deploying a big data framework that is optimized across devices and delivery options—cloud, on-premises or hybrid. Next, implement an integrated real-time reporting and analytics solution and make it available.

For more information, please visit the SAP public sector technology Web site:
www.sap.com/publicsector

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- **SAP HANA** platform to handle your big data challenges
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