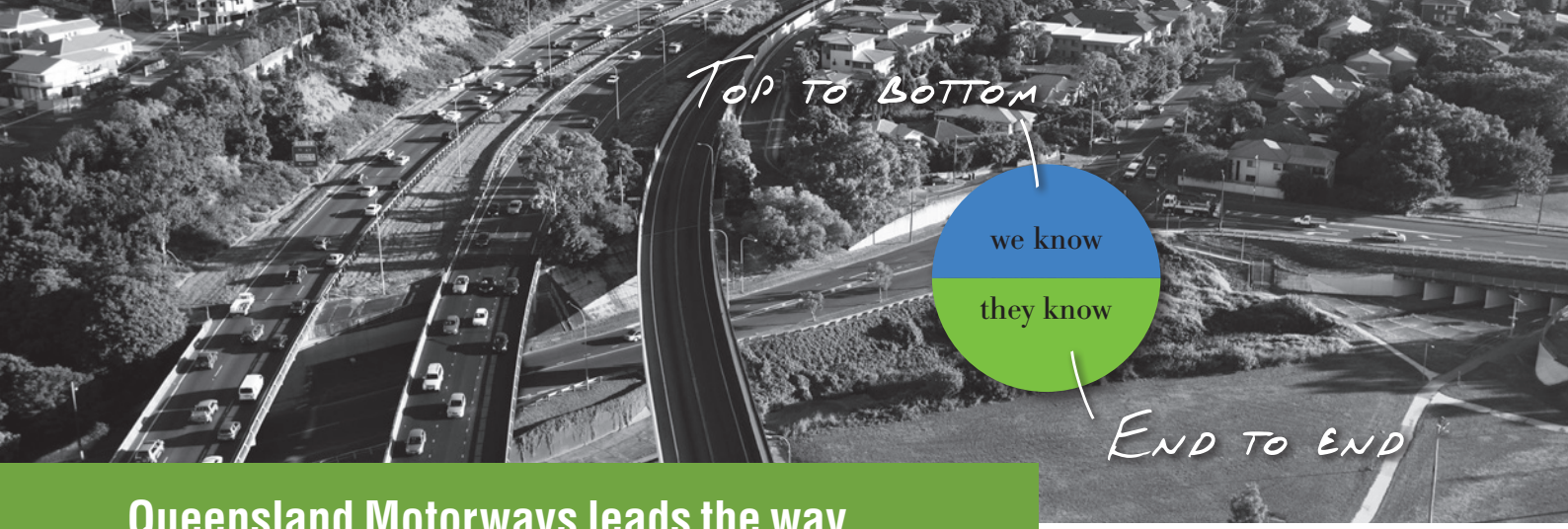

Queensland Motorways leads the way to intelligent traffic management with IBM and SAP

Overview

■ ***The Challenge***

Heavy traffic on Brisbane's motorways was creating congestion, lengthening journey times for motorists and reducing travel reliability for local businesses. Toll plazas added to the problem, creating a choke point for motorists slowing to pay tolls and also with vehicles required to merge near the toll booths. The Queensland Government, in conjunction with Queensland Motorways, which manages and operates the Gateway Bridge, Gateway Extension and Logan motorways decided to embark on a major upgrade project to enable traffic to flow more freely.

■ ***The Solution***

To support its delivery of the AU$1.88 billion Gateway Upgrade Project, Queensland Motorways was committed to delivering free-flow tolling on the Gateway Bridge. Queensland Motorways increased the scope of its free-flow tolling project to include the Gateway Extension and Logan motorways to provide a consistent user experience for motorists. IBM Global Business Services was contracted by Queensland Motorways to design, build, test, and deploy the intelligent free-flow tolling central system solution based on technology from IBM, SAP, and Dacolian. Thales was contracted separately to provide the roadside equipment solution. Collecting vehicle data from in-vehicle tags and road-side video cameras, the solution manages the entire tolling process from end to end without interrupting traffic flow.

■ ***The Benefits***

The solution allows Queensland Motorways to combine its knowledge of commuters' travel patterns with real-time data on traffic conditions to recommend fastest routes and avoid congestion. This helps to speed journeys, reduce congestion, and cut exhaust emissions. Drivers no longer have to stop to pay tolls, which reduces congestion, increases safety and enhances network reliability.

■ ***Key Solution Components***

Industry: Travel and transportation
Applications: SAP® ERP 6.0, SAP Customer Relationship Management 7.0, SAP NetWeaver® Business Warehouse 7.0, SAP NetWeaver Process Integration 7.1, SAP Solution Manager 4.0
Hardware: IBM® Power® 570, IBM BladeCenter® with IBM HS21 blades, IBM System Storage® DS8000, Thales roadside tolling gantries
Software: IBM Tivoli® Access Manager for Enterprise Single Sign-On, IBM WebSphere® Application Server 6.1, IBM WebSphere Message Broker 6.1, IBM WebSphere MQ 6.0, Dacolian OCR, Oracle, Red Hat Enterprise Linux
Services: IBM Global Business Services, IBM Global Technology Services, Thales Australia, Vitronic Machine Vision Australia Pty Ltd

IBM | SAP®

"IBM Global Business Services is one of the few companies in the world that has proven expertise in delivering successful free-flow tolling projects… IBM focused on aligning the business and IT resources during the project, which led to its success. What you get is a more efficient process."

Phil Mumford
CEO
Queensland Motorways

Snaking its way from the southern approaches to Brisbane city to the north of the city, the multi-lane Gateway Motorway, the most significant part of Queensland Motorways' network and the city's road infrastructure, bypasses the central business district to provide easy access to Brisbane's sea- and airports and the cities of north-eastern Australia. Half-way along the route, it crosses the Brisbane River at the iconic Gateway Bridge.

"Improving traffic flow on the Gateway Motorway, and particularly on the Gateway Bridge, is key to ensuring effective network management in Brisbane," says Phil Mumford, CEO of Queensland Motorways, the company responsible for managing and operating this road infrastructure. "Any congestion or issues on the bridge ultimately affect the whole network: people start to divert to other roads which are already carrying high traffic volumes and soon enough, everyone's journey is negatively impacted.

"The physical upgrade is vitally necessary, but we can't keep building multi-billion dollar infrastructure. The pattern we see is that every time a new road is built, utilization increases and congestion comes back again. We realized that to have a long-term impact on the problem, we needed to be smarter about how we manage our traffic flow."

To tackle this problem, in early 2007 Queensland Motorways embarked on the largest bridge and road upgrade in Queensland's history. The Gateway Upgrade Project, which will cost AU$1.88 billion (US$1.45 billion), will see the creation of a second Gateway Bridge, doubling capacity to twelve lanes, a new 7km section of motorway north of the bridges, and upgrades to 12km of motorway south of the bridges.

Improving traffic flow

While investigating ways to transform traffic management processes, the Queensland Government, together with Queensland Motorways, identified the toll plazas on the Gateway and Logan motorways as a major pinch point. The need to have vehicles either slow as they passed through the toll plazas using electronic tolling or to stop and pay with cash at a toll booth was significantly slowing the speed of traffic.

"Free-flow tolling was seen as beneficial for two reasons," explains Phil Mumford. "First, if we could automate the tolling process and eliminate the need for drivers to stop, it would immediately increase the average speed of traffic flow, improve safety and the traveling experience of motorists. Secondly, the solution would allow us to digitally capture and analyze information about the vehicles that use our roads, which would help us make dramatic improvements to traffic management in the future."

Leveraging IBM industry expertise

Queensland Motorways began looking for a partner that could help to design and implement such a solution, and after a series of site visits and a tender

process, drew up a shortlist of three business and IT consulting companies for the delivery of the central system.

"IBM Global Business Services is one of the few companies in the world that has proven expertise in delivering successful free-flow tolling projects, and we were very impressed with their work on congestion charging in Stockholm," says Phil Mumford. "The ability to provide an end-to-end solution including hardware, software and services – and to work effectively with other key partners such as SAP and Thales – was a key factor in our favoring the IBM proposal.

"IBM focused on aligning the business and IT resources during the project, which led to its success. What you get is a more efficient process. The business knows what they want to achieve – it just needs help to define what is required and to come up with some innovative solutions along the way. A common understanding of requirements is critical, because it means that processes that would normally consume a lot of resources become streamlined, simple and easy to understand."

The roadside solution replaces the traditional toll booths with a Thales/Vitronic road-side gantry that utilizes video cameras and dedicated short-range communication technologies to capture information on passing vehicles. Vehicles are identified either by an in-vehicle tag or by analyzing footage of their number plates using two optical character recognition (OCR) engines, one at the roadside and a Dacolian engine at the central system.

The vehicle data is then matched to the appropriate customer account, and an IBM-developed rating engine assesses how much money is owed. The billing information is passed to back-end SAP ERP Financials and SAP Customer Relationship Management (CRM) applications, which either deduct the total from a prepaid customer account, or generate an invoice. Business reporting is handled by SAP NetWeaver Business Warehouse, and integration by SAP NetWeaver Process Integration.

"The whole process is automated and instantaneous, and there is no need for drivers to stop to pay their toll," explains Phil Mumford. "Moreover, except in certain cases where a vehicle cannot be identified by OCR, there is no need for manual intervention by our staff. This not only improves traffic flow – it also cuts down the cost per transaction, which will help us offer better value to our customers."

Transforming customer service

More importantly, the introduction of the SAP CRM application is leading to a fundamental change in the way Queensland Motorways interacts with its customers. Now it can see what vehicles are using the roads and how often and at what times they use the roads. In the future, Queensland Motorways will be able to tailor its services to individual drivers – with a profound effect on both customer experience and traffic management.

"With SAP CRM, we have achieved a better understanding of who our customers are," says Phil Mumford. "In the future we'll be able to offer customers useful information about the transport network. For example, a customer making regular trips to the airport on a Monday morning may want to receive congestion reports direct to their phones. The whole experience has the potential to be much more personalized.

"The idea is to have 'a motorway that thinks' – a more intelligent solution that will give our customers a better range of options for their journeys."

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> Queensland Motorways

TECHNICAL LANDSCAPE

Servers: IBM® Power® 570 server with 16 IBM POWER6 4.7GHz processors, 25 Intel Xeon® processor-based IBM® HS21 blade servers in two IBM BladeCenter® chassis, IBM System Storage® DS8000

Software: SAP® ERP 6.0, SAP Customer Relationship Management 7.0, SAP NetWeaver® Business Warehouse 7.0, SAP NetWeaver Process Integration 7.1, SAP Solution Manager 4.0, IBM Tivoli® Access Manager for Enterprise Single Sign-On, IBM WebSphere® Application Server 6.1, IBM WebSphere Message Broker 6.1, IBM WebSphere MQ 6.0, Dacolian OCR, Oracle, Red Hat Enterprise Linux

"We know that our needs will change tomorrow. The beauty of the SOA solution is that we can change our components as needed, seamlessly. It might be about introducing a new piece of technology; it might be a business process or a whole new business model. It changes the way we think about our technology lifecycles."

Phil Mumford
CEO
Queensland Motorways

Some of these ideas are still on the drawing board, but with the launch of the free-flow tolling system, motorists, the paying customers, now have access to a wide range of information and features via a Web portal and SMS.

This enables them to review usage information, pay bills and top up credit online. Similarly, business users are able to obtain information on all the vehicles in their fleet, and pay for the total road usage from a single account.

Exploring the technical architecture

The infrastructure of the solution is split across three locations: the road-side systems, the primary data center, and a disaster recovery site.

At the road-side, all sensor equipment with integrated pre-processing systems – vehicle classification, vehicle imaging, DSRC beacons and the detection and tracking unit – are installed on a single accessible gantry with no in-road installation.

Data from each of the roadside subsystems is passed to a Toll Management Unit housed in a roadside shelter where it is combined to form individual passage reports which are then passed via IBM WebSphere MQ to an enterprise service bus (ESB) based on WebSphere Message Broker and SAP NetWeaver Process Integration.

The passage report is then passed to the identification and rating engine, which uses OCR technology from Dacolian to identify the vehicle and to verify the OCR result achieved by the roadside system.

Images which cannot be analyzed automatically with the required confidence level are manually processed in a manual image review application. From there, billing information is passed via the ESB into the SAP CRM and SAP ERP systems. The free-flow tolling system adheres to the latest Australian interoperability standards, and data is automatically exchanged with other operators.

The solution also includes an intranet portal built on SAP NetWeaver Portal, which is accessed by internal users. IBM Tivoli Access Manager for Enterprise Single Sign-On provides secure, convenient access to the portal and to other resources: a single password is used to access all services, and users only need to sign in once. This helps Queensland Motorways safeguard sensitive customer and business data, without introducing a complex security infrastructure and reducing usability.

A self-service Web portal has been developed to provide access for Queensland Motorways' customers to payment options, account status and other important information. IBM WebSphere Application Server provides the platform for the delivery of this portal.

Service-oriented architecture

IBM Global Business Services has designed and built the solution in accordance with the principles of service-oriented architecture (SOA). Individual systems communicate via the ESB rather than specialized point-to-point interfaces. As a result, any component can be replaced or upgraded without affecting other systems, and components can be orchestrated in different ways to provide new services without the need for significant custom development effort.

"We know that our needs will change over time," says Phil Mumford. "The beauty of the SOA solution is that we can change our components as needed, seamlessly. It might be about introducing a new piece of technology; it might be a business process or a whole new business model. It changes the way we think about our technology lifecycles."

Central system servers and storage

The Dacolian servers, Web servers, and various other systems such as IBM Tivoli Access Manager for Enterprise Single Sign-On, run on 25 Intel Xeon processor-based IBM HS21 blade servers in two IBM BladeCenter chassis.

Meanwhile, the SAP applications, identification, rating and interoperability applications, Internet Web portal and Oracle databases run on an IBM Power 570 server with 16 IBM POWER6 4.7GHz processors. Red Hat Enterprise Linux is used as the operating system for the entire environment.

A storage area network, based on IBM System Storage DS8000 hardware, provides high-speed access to data. By using a combination of Fibre Channel and FATA disks, the company can obtain the most effective balance between high-performance and cost-effective storage.

The complete production infrastructure is mirrored with identical hardware at the disaster recovery site, which is used to run development, test and staging environments during normal operations. IBM Global Technology Services was responsible for designing, implementing and testing the entire infrastructure at both the primary and disaster recovery sites.

PowerVM and BladeCenter

The Power 570 servers leverage IBM PowerVM technologies to provide an autonomic, virtualized server environment. The SAP applications and databases run in separate logical partitions (LPARs) that dynamically allocate available processor resources to maximize overall system throughput and enable load balancing and peak load compensation.

As a result, Queensland Motorways has enough flexibility in its infrastructure to ensure its tolling service runs 24x7x365. Even when server maintenance is necessary at the main data center, workload can be moved to a standby server at the disaster recovery site until the production machine is back online.

This flexibility is complemented by the highly scalable IBM BladeCenter platform, which allows Queensland Motorways to upgrade its processing capabilities simply by plugging additional blade servers into the chassis. For example, if the company decides to extend the free-flow tolling solution, and this requires more Dacolian OCR servers to be installed, the BladeCenter infrastructure will enable rapid expansion at minimal cost.

This dynamic infrastructure gives Queensland Motorways the flexibility to extend and grow the solution to meet the changing demands of the business.

Looking to the future

The free-flow tolling solution is on course to deliver rapid benefits for both Queensland Motorways and the motorists of south-east Queensland – increasing the reliability and safety of travel on its motorways, and significantly improving operational efficiency, which should help the company to deliver improved services and better value.

Looking at the big picture, Phil Mumford believes that the best is still to come: "Under our old systems, we didn't have the flexibility to obtain some of the data that will greatly assist us make better business decisions. We now also have a system that will enable us to offer tailor-made solutions to our customers – total flexibility, total mobility."

"Moving forward our customers will have access to information such as projected travel times, and our systems will help them to make informed travel decisions."

> *"Total mobility is about giving customers the ultimate choice as to how they travel… Moving forward, our customers will have access to information such as projected travel times, and our systems will help them to make informed travel decisions."*
>
> Phil Mumford
> CEO
> Queensland Motorways

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