

Avis Budget Group and Slalom Further Digitize the Car Rental Process with Machine Learning on AWS



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- Christopher Cerruto, vice president of global architecture and analytics at Avis Budget Group

The Next Generation of Mobility

Avis Budget Group's mission is to make the car rental process easy and painless for its customers. The company's ambitions go beyond optimization: Through its embrace of connected devices, modern technology, data, and advanced analytics, Avis Budget Group is invested in cultivating a new world of mobility across business lines.

“Throughout its 73-year history, Avis Budget Group has consistently transformed and adopted new technology solutions as they made sense for the business and our customers,” says Christopher Cerruto, vice president of global architecture and analytics at Avis Budget Group.

With the development and launch of its mobile app and direct-to-consumer applications as well as its connected car initiatives, the company began to build its digital footprint. As Avis Budget Group grew and continued mapping its development to the rapidly-evolving customer journey, its leadership realized the importance of building a next-generation digital mobility platform.

Connected, Integrated, and On-Demand Transportation

For the Avis Budget Group team, providing a unique and personalized customer experience while optimizing its fleet management and pricing is core to driving success in a competitive market. Its current technology footprint includes a mainframe system at its base which is not a long-term solution for the company's objectives and ambitions. Therefore, Avis began evaluating new approaches to create a platform that would be able to support not only the company's near-term objectives, but also its long-term innovations.

“We have three main goals for innovation: reinventing the rental experience, digitizing our business, and developing new business models. We realized that our mainframe technology was not going to help us achieve these goals, so we chose to invest in becoming an API-driven company,” says Cerruto. “We began to look at how we could build a mobility platform to fulfill our vision and open up new business opportunities.”

About Avis Budget Group

[Avis Budget Group](#) is a global provider of transportation solutions. Its Avis and Budget brands have more than 11,000 rental locations in approximately 180 countries around the world. Its Zipcar brand, a leading car sharing network, has more than one million members in over 500 cities and towns.

Challenge

Avis Budget Group sought to become an API-driven company to reinvent the rental car experience, digitize its business, and develop new business models. The company needed help managing and using its data effectively while also scaling globally.

Solution

After deciding to build on AWS, Avis Budget Group chose to work with Slalom to complete a successful PoC on AWS and move forward with a pilot project at Newark airport. Using machine learning (ML), the pilot focused on building a practical on-site solution that could address the over- and under-utilization of cars in real-time using an optimization engine built in Amazon SageMaker.

Benefit

Avis Budget Group plans to roll out the optimization engine to all of its North American locations by December of 2020. The company's speed of development has improved substantially since building on AWS and working with Slalom. Through the PoC, Avis Budget Group found that moving the needle even a small amount on some of its objectives, such as optimizing car mileage, translates into big benefits for the business and for its customers.



All Signs Point to AWS

Avis Budget Group collects massive amounts of heterogeneous data from its car fleet and other internal and external data sources. The company's challenge was ingesting, normalizing, and analyzing its data to meet its objectives. "Key to sustained profitability is real-time fleet management and using the data we collect to make proactive, rather than reactive, decisions," says Cerruto.

"We've been working with OEM partners and building hardware to create an edge computing presence that collects data from cars for a long time. Connectivity wasn't the hard part for us," says Cerruto. "But we needed help figuring out how we could react to the massive amounts of data we collect, how we store the data, and our general environment for securely analyzing the data in real time, and at scale, to meet our objectives. We decided to build our new platform on the cloud because we felt the cloud would be an enabler."

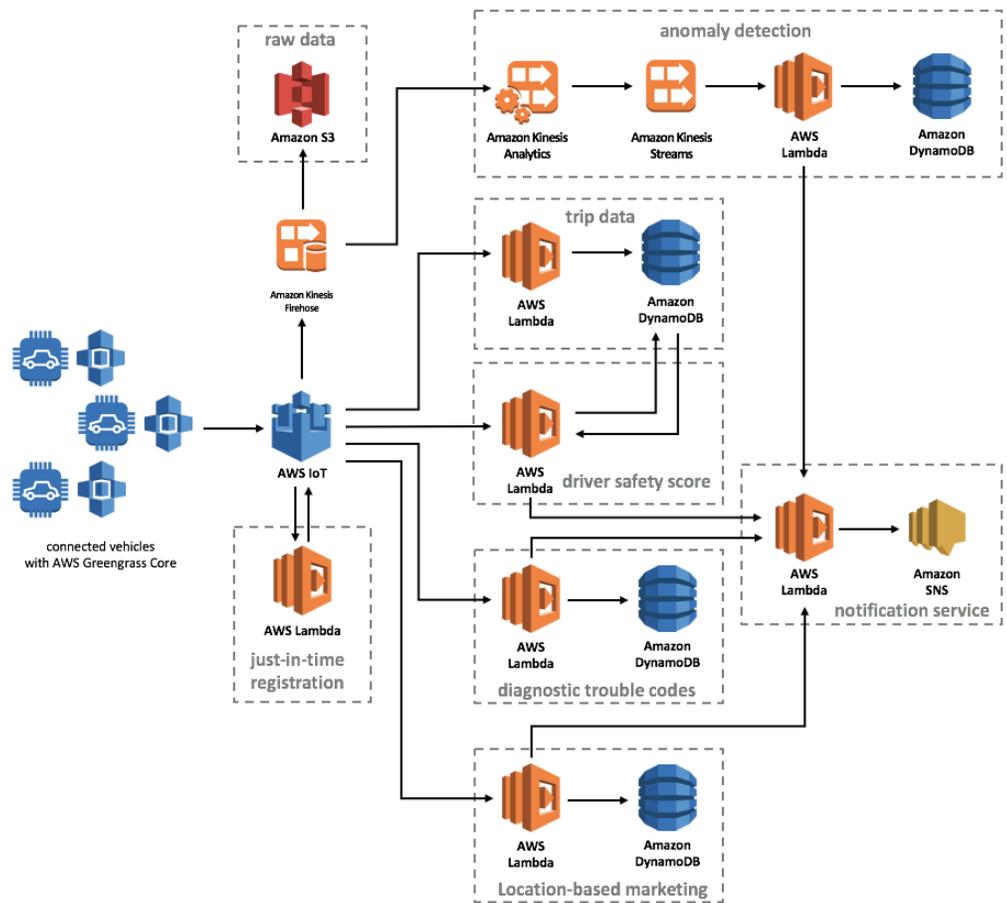
After the company evaluated its options, including hosting its own cloud environment, it chose to build on Amazon Web Services (AWS).

"Through an exhaustive evaluation of our criteria, all of the signs pointed to AWS," says Cerruto. "We found that many limitations of the existing infrastructure would be eradicated by building on AWS. We would no longer need to worry about storage limitations or infrastructure performance. We could benefit from the strong security posture of AWS and its continuous investment in security best practices. We also found we could take advantage of many database and compute options that would provide new opportunities for us to analyze and expose our data sets while also discovering it would be cheaper to build and run the platform on AWS. The prospects for future-state development in AWS—given the AWS cloud-native services and up-the-stack capabilities—proved thrilling to us."

A significant highlight for the Avis Budget Group team was the introduction of the [AWS Connected Vehicle Solution Framework](#), with capabilities of local computing within vehicles, sophisticated event rules, and data processing and storage. The solution is designed to provide a framework for connected vehicle services, allowing companies like Avis Budget group to focus on extending the solution's functionality rather than managing the underlying infrastructure operations.

"After the introduction of the AWS Connected Vehicle Solution Framework, and many demos showing us how quickly we could get a solution, it became a question of, 'Why wouldn't we build on AWS?'" says Cerruto.

The AWS team recommended that Avis evaluate [Slalom](#), an AWS Partner Network (APN) Premier consulting partner with proven expertise in DevOps, data and analytics, and migration work on AWS, to help build the company's platform on AWS.



The AWS Connected Vehicle Solution Framework Architecture Diagram

Identifying Use Cases to Drive Business and Customer Value

Slalom helps companies bring their visions to life. The company specializes in complex and ambitious projects, with a focus on projects involving machine learning (ML).

“We see ML moving away from the back office and becoming much more of a strategic imperative across business units,” says Saken Kulkarni, practice area lead of advanced analytics at Slalom. “Taking advantage of ML to put data to better use is becoming more of a staple in how companies understand and solve business problems.”

Slalom began working with Avis Budget Group by completing a Proof of Concept (PoC) on AWS. [Intel Xeon-based Skylake Amazon SageMaker instances](#) were used for training the dataset, and then also as an inference platform for the connected car PoC. The Slalom team used the Intel-based instances as they offered the best total cost of ownership (TCO) for deploying ML on AWS.

Avis identified many different business-impacting use cases. Slalom used AWS and business intelligence (BI) and data visualization tooling from [Tableau](#) and [deck.gl](#) to help Avis visualize its data at scale and in real time. “Slalom did a great job with the PoC,” says Cerruto. “When we looked to the larger project, we felt that working with Slalom and taking advantage of the company’s expertise and local presence will enable us to do this faster than we could on our own.”



“The success of the PoC demonstrated that moving the needle even a small amount on some of our objectives, such as optimizing car mileage, translates into big benefits for the business and for our customers,” says Cerruto. The company found, for example, that optimally managing the miles put on its fleet at even a smaller scale could result in saving tens of millions of dollars.

Following the PoC, the team chose to conduct an in-depth pilot project focused on addressing two business use cases its fleet operations team believed would have the most immediate impact on revenue and customer satisfaction: its rent-out (re-purchase/lease) car program and load balancing mileage across cars.

Optimizing Car Mileage and Improving Rental Processes

With Newark Airport chosen as its pilot location, Slalom spent weeks on the Avis parking lot working with field agents. The team sought to identify how they could build a practical on-site solution that could address the over- and under-utilization of cars in real-time using an optimization engine built on AWS.

“We completed an initial regression analysis on rental car usage at Newark and found that vehicles were not being utilized as effectively as they could be,” says Kulkarni. “So, we asked, ‘How can we begin with the AWS Connected Vehicle Framework and then develop a mileage optimization machine learning architecture and model that will enable us to line up cars in real-time for rental based on their optimized mileage?’”

The optimization engine model is built in Amazon SageMaker. The solution uses Amazon API Gateway and AWS Lambda to invoke a model endpoint deployed by SageMaker. The engine is running on Amazon Elastic Compute Cloud (Amazon EC2) C5 instances, which are ideal for running advanced compute-intensive workloads. The Amazon EC2 C5 instances are powered by the Intel Xeon Platinum 8000 series (Skylake-SP) processor.

“We first identified data fields and data attributes to build the model, such as the brand of car, reservation status, booking data, check-out and check-in time, rental length, class of vehicle, and purchase dates,” says Kulkarni.

“The engine then gathers the data from the on-premises operational services and databases being used at this time,” says Kulkarni. “The data fields trigger an API within AWS. The data is then streamed, processed, and transformed with Amazon Kinesis Firehouse and Lambda. Lambda invokes SageMaker. The modeling is performed in SageMaker.” The model results are then integrated into a newly-launched rental application and device mobile app; the app obtains feedback and sends feedback to AWS. Changes are then implemented in subsequent model iterations in SageMaker.

Using Technology to Empower New Business Innovations

With the initial pilot rollout underway, the Avis Budget Group team is confident that its vision of a next-generation transportation platform is not only possible to realize on AWS but can exceed its initial expectations.



“We’ve had great experiences working across AWS teams since the beginning. By building on AWS, we’re able to begin realizing our vision of building a full transportation platform at a pace that’s 10x faster than what we had imagined,” says Cerruto.

The company plans to roll out the optimization engine to all of its North American locations by December of 2020. “Through the pilot launched at one location, we challenged Slalom and ourselves to build a simple machine learning model on AWS that we know will grow and evolve,” says Cerruto. As they continue to address new use cases on AWS, a key focus for the team is building an ecosystem of collaborators in the transportation space to stretch the bounds of what is possible.

“When we began this journey, we knew we were not going to do it alone,” says Cerruto. “We envision ourselves as playing the role of connecting a system and providing a platform for managing a vehicle and providing a service for anyone who needs to get from point A to point Z. We’re building this API-driven, API-first platform in AWS with integration at its heart so that we can work with developers and partners across the industry to bring together disruptive services and products in a seamless fashion for the benefit of end users.”

“Once you get both feet into this kind of a platform, you feel, for the first time, like you are limitless,” says Cerruto. “Business is driving the decisions and technology is helping us get there quickly. And none of this would have been possible for us without building on AWS.”



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