FROST & SULLIVAN

AMAZON WEB SERVICES RECEIVES THE 2023 COMPANY OF THE YEAR AWARD

Identified as best in class in the global automotive cloud computing platform industry

FROST & SULLIVAN

Best Practices Criteria for World-Class Performance

Frost & Sullivan applies a rigorous analytical process to evaluate multiple nominees for each award category before determining the final award recipient. The process involves a detailed evaluation of best practices criteria across two dimensions for each nominated company. Amazon Web Services excels in many of the criteria in the automotive cloud computing platform space.

AWARD CRITERIA

Visionary Innovation & Performance	Customer Impact
Addressing Unmet Needs	Price/Performance Value
Visionary Scenarios Through Mega Trends	Customer Purchase Experience
Implementation of Best Practices	Customer Ownership Experience
Leadership Focus	Customer Service Experience
Financial Performance	Brand Equity

Cloud Computing Solutions for Advanced Automotive Capabilities

AWS has been continually expanding its services to support virtually any workload, and it now has more than 240 fully featured services for computing, storage, databases, networking, analytics, machine learning and artificial intelligence (AI), Internet of Things (IoT), mobile, security, hybrid, virtual and augmented reality (VR and AR), media, and application development, deployment, and management from 102 Availability Zones within 32 geographic regions, with announced plans for 15 more Availability Zones and five more AWS Regions in Canada, Germany, Malaysia, New Zealand, and Thailand. Enterprises in various industries (including automotive, energy and utilities, financial services, healthcare, manufacturing, and telecommunications) leverage its solutions to achieve broad organizational objectives and facilitate technology adoption and integration.

The automotive industry is undergoing significant technological advancements as original equipment manufacturers (OEM) adopt and integrate software-defined vehicle capabilities, connected mobility, autonomous mobility, and digital customer experiences. AWS supports this transformation with a

> *"[AWS] connects deep-seated domain and operational knowledge with advanced AI, ML, IoT, high-performance computing, analytics, and database capabilities, elevating its cloud computing platform and creating value-driven solutions. With a focus on enhancing capabilities on behalf of its clients, AWS helps them throughout their cloud computing transformation, meeting with them wherever they are in the journey."*
>
> *- Ashwini Suvarna*
> *Research Analyst, Mobility*

comprehensive cloud computing solution suite while also improving manufacturing operations and effectiveness, providing end-to-end supply chain visibility, and enabling developers and engineers to address complex automotive problems. With its versatile portfolio, the company is driving the industry's next growth phase and ensures it solidifies its standing as a leading innovator in the space.

AWS: Delivering Transformative Automotive Cloud Computing

AWS' vision centers on purpose-built innovation with the goal of enabling clients with cloud-based solutions. It connects deep-seated domain and operational knowledge with advanced AI, ML, IoT, high-performance computing, analytics, and database capabilities, elevating its cloud computing platform and creating value-driven solutions. With a focus on enhancing capabilities on behalf of its clients, AWS helps them throughout their cloud computing transformation, meeting with them wherever they are in the journey.

The AWS IoT Core offering bridges the connection of billions of IoT devices to the cloud and their trillions of messages to other AWS services. With secure device connections through mutual authentication and end-to-end encryption, clients can connect, manage, and scale their fleets quickly and efficiently without having to manage and provision servers. The service enables a robust messaging broker compatible across message queuing telemetry transport (MQTT) 5 and 3, MQTT over WebSockets, hypertext transfer protocol secure, and long-range wide area networks. AWS IoT Core facilitates the development of connected, autonomous, shared, and electric vehicle (EV) solutions.

AWS IoT Core Message Brokering
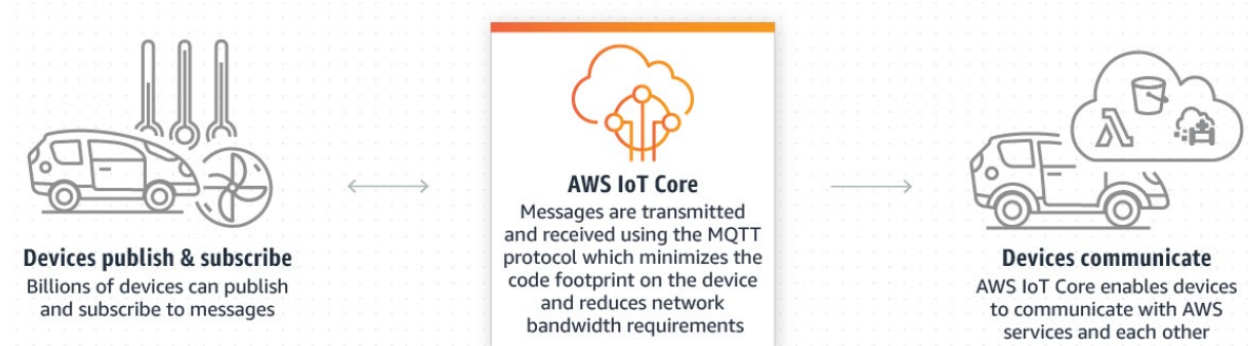
Source: AWS

Software-defined and connected vehicles generate abundant data, making it overwhelming to sift through and leaving significant insights on the table. AWS recognizes this opportunity and has introduced the AWS IoT FleetWise service to collect, transform, and transfer real-time on-vehicle data to the cloud. The service allows clients to dynamically collect preferred data at pre-specified frequencies, standardizing and contextualizing it for various purposes, including monitoring EV battery health, enhancing in-cabin infotainment systems, and improving fleet operations.
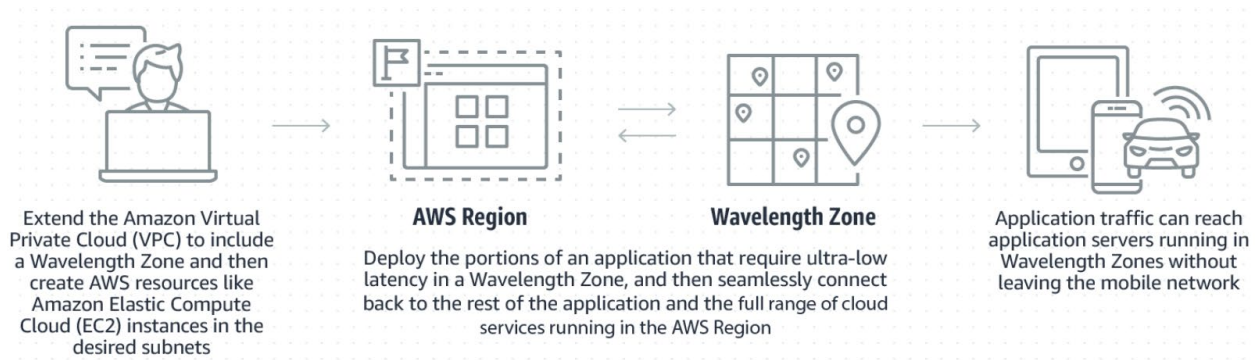
AWS IoT FleetWise
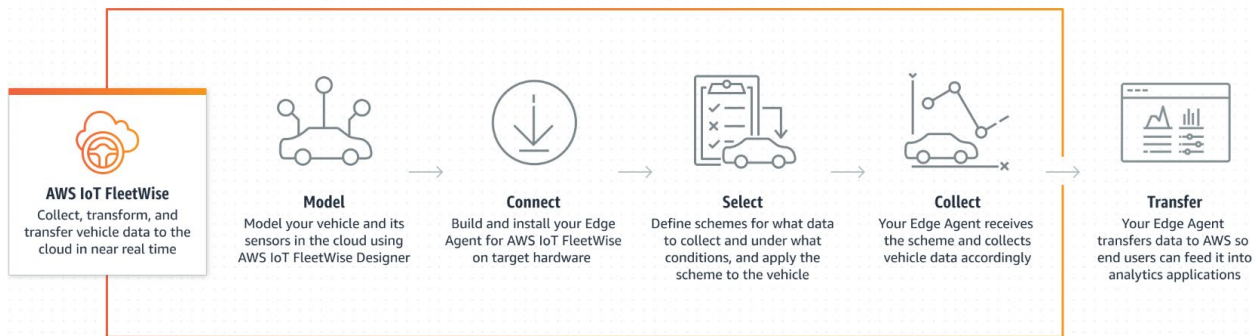
Source: AWS

AWS' partnership network across industry verticals (e.g., telecommunications) enables it to purposefully innovate and develop new use cases. Clients that leverage AWS Wavelength, a mobile edge computing cloud continuum infrastructure, can develop, deploy, and scale ultra-low-latency applications for fifth-generation (5G) devices. For example, its collaboration with telecommunications provider Vodafone enabled the development of an AI collision avoidance decision tool using a feedback control mechanism for Reply Autonomous. With AWS Wavelength, clients can deliver media and entertainment experiences (e.g., live video streaming and augmented and virtual reality) and run AI and ML at the edge to accelerate 5G and develop advanced driver assistance systems (ADAS).

By leveraging Wavelength's functionalities, AWS can offer vehicle-to-everything (V2X) and Cellular-V2X (C-V2X) solutions, enabling communication between vehicles, multiple devices, and surrounding infrastructure (e.g., traffic lights). These solutions are ideal for transportation and law enforcement agencies and situations with real-time criticality that require high throughput and low latency. Additionally, the company's partnership with LG Electronics (LG) aims to improve the security and privacy requirements of the C-V2X platform. LG's pilot program uses the Verizon 5G network to move data in real-time and ensure the shared data between vehicles, devices, and infrastructure remains secure. The next generation C-V2X solution is more responsive, reliable, faster, and has higher bandwidth, improving driver safety and enhancing mobility services.

AWS Wavelength

Source: AWS

In addition to AWS IoT Core, AWS IoT FleetWise, and AWS Wavelength, the rest of the company's solution suite integrates easily to broaden and complement software-defined and connected vehicle capabilities. Solutions include:

- **AWS Snowball Edge**: A physical container that allows enterprises to move terabytes of offline and remote data to the cloud.

- **AWS Snowcone**: An edge computing, data storage, and on-the-go data transfer solution that facilitates private network connectivity for remote and ruggedized areas (e.g., agriculture and military) and fleet data.

- **AWS Outposts**: A hybrid, edge, and on-premises solution with full infrastructure management and services that extends native AWS services for low-latency and local data processing and residency.

- **Amazon SageMaker Ground Truth**: Provides high-quality labeled data to quickly train ML datasets, develop custom generative AI applications, enable computer vision, and three-dimensional light detection and ranging navigation.

Through a combination of its solutions, AWS enables various use cases that propel the automotive industry into its next growth phase.

Use Cases

Autonomous Mobility: The development and deployment of ADAS and autonomous vehicles (AV) solutions require a scalable computing, storage, and networking platform with extensive deep learning, AI, and ML frameworks. AWS' powerful technologies and robust services support autonomous mobility development, providing data management, labeling, processing analytics, simulation, model, and software development for the quick time to market and cost efficiency of innovative ADAS and AV solutions.

Connected Mobility: IoT and other software-driven technologies are ubiquitous in everyday life. By leveraging these solutions, automotive OEMs are creating new engaging services requiring high-performance computing of telemetry data from vehicles and the cloud. AWS' portfolio provides comprehensive vehicle data collection, analytics and insights, fleet management, and connected edge and infrastructure to support connected vehicle solutions.

Software-defined Vehicle: The automotive industry is adopting and embedding software into more vehicles, requiring robust capabilities. The company's solutions enable vehicle data collection to add and improve the end-user experience, cybersecurity, safety, and over-the-air updates.

AWS believes in the importance of its clients implementing cloud computing capabilities for their unique use cases. In working with clients, the company introduces best practices strategies to ensure its solutions help them overcome challenges and achieve their goals. For example, the company opened a demonstration lab in San Jose, California, to showcase various solutions' capabilities, use, and value. AWS also provides customer-specific proof-of-concepts and prototypes. Over a two-to-three-week period, the company lets clients use real data in their actual environments to develop a proof-of-concept and assure

them of the solutions' validity. Prototyping is a six-week engagement and the final phase before total production. During this stage, the prototype is built and deployed, and if the solutions meet the client's requirements, it goes to full production and rollout. This approach ensures AWS meets clients' specific requirements and receives value-driven solutions. With a legacy of cloud computing leadership, the company's compelling value proposition underpins its sustained success.

Roadmap to Success: Customer-centric, Continuous, Proactive

Throughout the purchasing process, AWS works with clients to identify areas across their organization that cloud can be adopted to solve customers' biggest issues. The company helps smaller clients understand where and how to leverage cloud solutions that will provide the most benefit. Additionally, as enterprise-level companies adopt new solutions that utilize cloud capabilities, it helps them leverage cloud technologies to realize the advantages fully. For example, its automotive client, BMW Group (BMW), is undergoing an enterprise-wide cloud transition, that started with AWS' cloud data hubs. As technologies continue to mature, AWS is helping BMW to develop its ADAS platform and is providing ongoing support as the client expands its cloud solutions.

Throughout the implementation process, AWS' line of business experts works with its clients' business unit heads (e.g., head of manufacturing, head of ADAS, and head of sales and marketing). The company's

> *"Throughout the implementation process, AWS' line of business experts works with its clients' business unit heads (e.g., head of manufacturing, head of ADAS, and head of digital customer experience). The company's experts have an extensive background in their line of business, ensuring it understands clients' unique industries from the beginning and can find the solution to overcome their most pressing challenges."*
>
> *- Elizabeth Whynott*
> *Best Practices Research Analyst*

experts have an extensive background in their line of business, ensuring it understands clients' unique industries from the beginning and can find the solution to overcome their most pressing challenges. This foundational approach establishes ongoing customer trust for long-lasting relationships throughout the service lifecycle.

AWS' approach goes beyond its extensive expertise and best-in-class capabilities, with customer value as a strategic imperative. The company has earned a sterling reputation over the years, supporting clients' paths toward adopting and scaling cloud solutions. Its customer success team forms close relationships with clients, delivering and executing solutions on time and within clients' requirements. These partnerships continue throughout the service lifecycle to ensure AWS' solutions deliver on clients' key performance indicators. AWS' focused implementation approach and close relationships position it as a partner of choice across automotive OEMs.

A Promising Outlook for 2023 and Beyond

Since its inception, AWS' sterling reputation and customer-centric framework have led to its coveted preferred partner status. Over the years, it added a range of new automotive OEMs to its established base, including BMW, Stellantis, Honda, Rivian, Volkswagen Group, and Toyota. With over 100,000 specialist partners across 150 countries, the company helps clients innovate, modernize, and scale for various industries and applications.

Use Cases

BMW: The automotive OEM is an innovative leader in the industry's digital transformation. The company is continually creating new digital and connected driving experiences. To this end, BMW created centralized and on-premises data lakes to collect and combine data from its vehicles' sensors, operational systems, and data warehouses. However, this data was siloed and difficult to access, slowing product development. To overcome these roadblocks, BMW turned to AWS Cloud and its managed services, including Amazon Athena, Amazon Simple Storage Service, Amazon Kinesis Data Firehose, and AWS Glue. These services provide BMW agility, transparency, and efficiency, processing 10 terabytes of data from 1.2 million vehicles daily.[1]

Lyft Level 5: In 2017, the ridesharing service Lyft launched its Level 5 AV division. The company collects petabytes of data from its AV fleet to run simulations, requiring considerable computing power. Lyft Level 5 leverages Amazon EC2 Spot Instances to improve the efficiency of simulations while storing and having access to massive amounts of data on Amazon Simple Storage Service. Using Amazon EC2 Spot Instances, Lyft maintains 77% of its computing fleet across Level 5 workloads and over 90% of its AV workload simulation for a two-thirds cost savings.[2] Furthermore, with AWS Direct Connect, Lyft reduces its data gathering, storage, and transferring expenses through the dedicated network connection between the engineering center and its cloud systems.

AWS invests heavily in go-to-market collaboration, partnering with specialists across the value chain that address specific automotive industry needs. For example, it partners with industry leaders in autonomous mobility (e.g., Capgemini), connected mobility (e.g., DXC Technology), digital customer experience (e.g., Deloitte, BCG, etc.), software-defined vehicles (e.g., Elektrobit, KPIT, Global Logic, etc.), manufacturing (e.g., HCLTech), supply chain (e.g., Accenture), product engineering (e.g., Siemens), and sustainability (e.g., Tech Mahindra). These collaborations help to connect vertical specialization, leveraging their expertise to help partners with cross-vertical skill sets, from software developers to system integrators to manufacturing. The company's strong partner network enables AWS to extend its research, explore new technologies, grow its use cases, and solidify its reputation as a leading innovator in the industry.

Frost & Sullivan believes the company is well-positioned to drive the automotive cloud computing platform space into its next growth phase, capturing market share and sustaining its leadership in the coming years.

Purpose-filled Mission and Vision

Across the automotive unit, AWS has dedicated teams across key industry areas that are accountable for strategy, technology, partnerships, and solutions. These teams continuously assess and identify broader market trends and innovations to develop strategies, accelerating the industry's growth. The company understands that trends are dynamic, thus its strategies are adaptable and evolve as changes and new opportunities emerge. Similarly, AWS' product development process is agile, and the company and its clients work together in sprints, iterating continuously to ensure solutions align with client requirements.

---

[1] https://aws.amazon.com/solutions/case-studies/bmw-group-case-study/
[2] https://aws.amazon.com/solutions/case-studies/Lyft-level-5-spot/

AWS identified a fundamental knowledge gap in what can be done with cloud solutions and how to do it as significant roadblocks for adopting cloud technologies. Additionally, while new entrants can focus on building their cloud capabilities from the ground up, established industry players must undergo a digital transformation. Legacy enterprises must incorporate new developers and procedures into the organization. This transformative process takes time and can be costly, pushing enterprises towards outsourcing their cloud solutions to stay competitive by fully leveraging new technologies.

With these considerations in mind, AWS guides clients through the cloud adoption process and provides them opportunities to develop their own capabilities independently or on top of its cloud computing platforms. Whether clients want to build their cloud solutions, outsource development, or simply want technologies that will enable their capabilities, AWS aims to enhance customer value and satisfaction.

In addition to supporting its clients' cloud computing journey, AWS focuses on helping them move quickly and collaboratively with purpose-built capabilities. The company's solutions aim to accelerate cloud capabilities wherever clients are in their journey, shortening development cycles, improving scaling, reducing churn, and elevating revenue with unmatched expertise and comprehensive solutions.

Conclusion

The automotive industry is undergoing apid technological advancements as original equipment manufacturers (OEM) adopt and integrate software-defined vehicle capabilities, connected mobility, autonomous mobility, and digital customer experiences. These new capabilities generate significant data, making it overwhelming to sift through and limiting the ability to leverage it for valuable insights. A means to collect, manage, store, transfer, and transform this data is necessary if OEMs want to continue to deliver innovative automotive solutions. Overall, Amazon Web Services (AWS) addresses these evolving needs with a strong leadership focus that incorporates client-centric strategies and exemplifies best practice implementation.

AWS' vision centers on purpose-built innovation, connecting deep-seated domain and operational knowledge with advanced artificial intelligence, machine learning, Internet of Things (IoT), high-performance computing, analytics, and database capabilities to elevate its cloud computing platform and create value-driven solutions. The company's cloud computing portfolio suite includes the AWS IoT Core that connects billions of IoT devices to the cloud and their messages to other AWS services; AWS IoT FleetWise to collect, transform, and transfer real-time on-vehicle data to the cloud; and AWS Wavelength for mobile edge computing and cloud continuum infrastructure, enabling the development, deployment, and scaling of ultra-low-latency applications for fifth-generation devices. The company remains a trusted partner, earning a reputation for offering the overall best in the automotive cloud computing platform industry. AWS aims to enhance customer value and satisfaction, accelerating clients' cloud computing capabilities by shortening development cycles, improving scaling, reducing churn, and elevating revenue with unmatched expertise and comprehensive solutions.

AWS earns Frost & Sullivan's 2023 Global Company of the Year Award for its strong overall performance in the automotive cloud computing platform market.

What You Need to Know about the Company of the Year Recognition

Frost & Sullivan's Company of the Year Award is its top honor and recognizes the market participant that exemplifies visionary innovation, market-leading performance, and unmatched customer care.

Best Practices Award Analysis

For the Company of the Year Award, Frost & Sullivan analysts independently evaluated the criteria listed below.

Visionary Innovation & Performance

Addressing Unmet Needs: Customers' unmet or under-served needs are unearthed and addressed by a robust solution development process

Visionary Scenarios Through Mega Trends: Long-range, macro-level scenarios are incorporated into the innovation strategy through the use of Mega Trends, thereby enabling first-to-market solutions and new growth opportunities

Leadership Focus: Company focuses on building a leadership position in core markets and on creating stiff barriers to entry for new competitors

Best Practices Implementation: Best-in-class implementation is characterized by processes, tools, or activities that generate a consistent and repeatable level of success

Financial Performance: Strong overall business performance is achieved in terms of revenue, revenue growth, operating margin, and other key financial metrics

Customer Impact

Price/Performance Value: Products or services provide the best value for the price compared to similar market offerings

Customer Purchase Experience: Quality of the purchase experience assures customers that they are buying the optimal solution for addressing their unique needs and constraints

Customer Ownership Experience: Customers proudly own the company's product or service and have a positive experience throughout the life of the product or service

Customer Service Experience: Customer service is accessible, fast, stress-free, and high quality

Brand Equity: Customers perceive the brand positively and exhibit high brand loyalty

About Frost & Sullivan

Frost & Sullivan is the Growth Pipeline Company™. We power our clients to a future shaped by growth. Our Growth Pipeline as a Service™ provides the CEO and the CEO's growth team with a continuous and rigorous platform of growth opportunities, ensuring long-term success. To achieve positive outcomes, our team leverages over 60 years of experience, coaching organizations of all types and sizes across 6 continents with our proven best practices. To power your Growth Pipeline future, visit Frost & Sullivan at http://www.frost.com.

The Growth Pipeline Engine™

Frost & Sullivan's proprietary model to systematically create ongoing growth opportunities and strategies for our clients is fuelled by the Innovation Generator™.

Learn more.

Key Impacts:

- **Growth Pipeline:** *Continuous Flow of Growth Opportunities*
- **Growth Strategies:** *Proven Best Practices*
- **Innovation Culture:** *Optimized Customer Experience*
- **ROI & Margin:** *Implementation Excellence*
- **Transformational Growth:** *Industry Leadership*

The Innovation Generator™

Our 6 analytical perspectives are crucial in capturing the broadest range of innovative growth opportunities, most of which occur at the points of these perspectives.

Analytical Perspectives:

- **Mega Trend (MT)**
- **Business Model (BM)**
- **Technology (TE)**
- **Industries (IN)**
- **Customer (CU)**
- **Geographies (GE)**