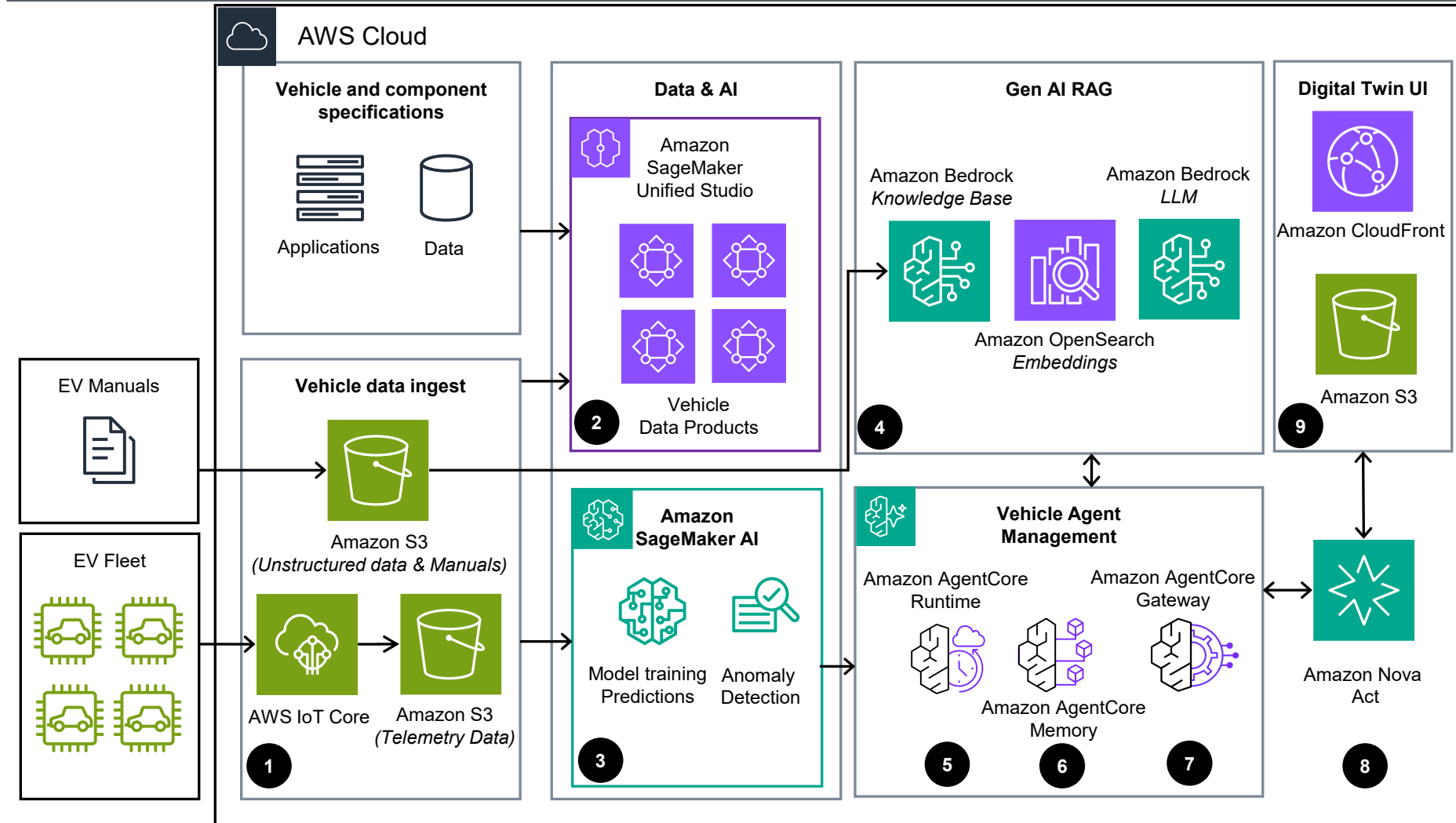


Guidance for EV Digital Twin AI Powered Operational Monitoring on AWS

EV Digital Twin Architecture

This architecture diagram helps you build an AI-powered predictive maintenance system for electric vehicle fleets using generative AI agents, retrieval-augmented generation, and browser automation on AWS.



1 Electric Vehicle (EV) fleet vehicles generate telemetry data (tire pressure, motor temperature, inverter thermals). **AWS IoT Core** ingests this data into **Amazon Simple Storage Service** (Amazon S3) for storage and processing. Amazon S3 also stores EV manuals as unstructured data.

2 Combining vehicle and enterprise data using **Amazon SageMaker Unified Studio** to create vehicle data products that provide component-level information like tire (tread depth) and motor (vibration).

3 **Amazon SageMaker AI** trains vehicle component predictive maintenance models and anomaly detection analytics using fleet telemetry data.

4 **Amazon S3** stores unstructured vehicle maintenance manuals. **Amazon Bedrock Knowledge Bases** indexes them using **Amazon OpenSearch Serverless** for vector search. The agent uses retrieval-augmented generation (RAG) with authoritative manual citations from the Knowledge Base before generating recommendations.

5 **AgentCore Runtime** hosts the AI agents and uses **Amazon Bedrock** large language model (LLM) (Claude), to orchestrate 17 specialized tools for vehicle analysis, machine learning (ML) predictions, and maintenance guidance.

6 **AgentCore Memory** stores short-term and long-term conversation history, enabling recurring issue detection and cross-vehicle fleet pattern analysis across sessions.

7 **AgentCore Gateway** exposes vehicle history and report generation as Model Context Protocol (MCP) tool endpoints, enabling integration with enterprise applications and external fleet management systems.

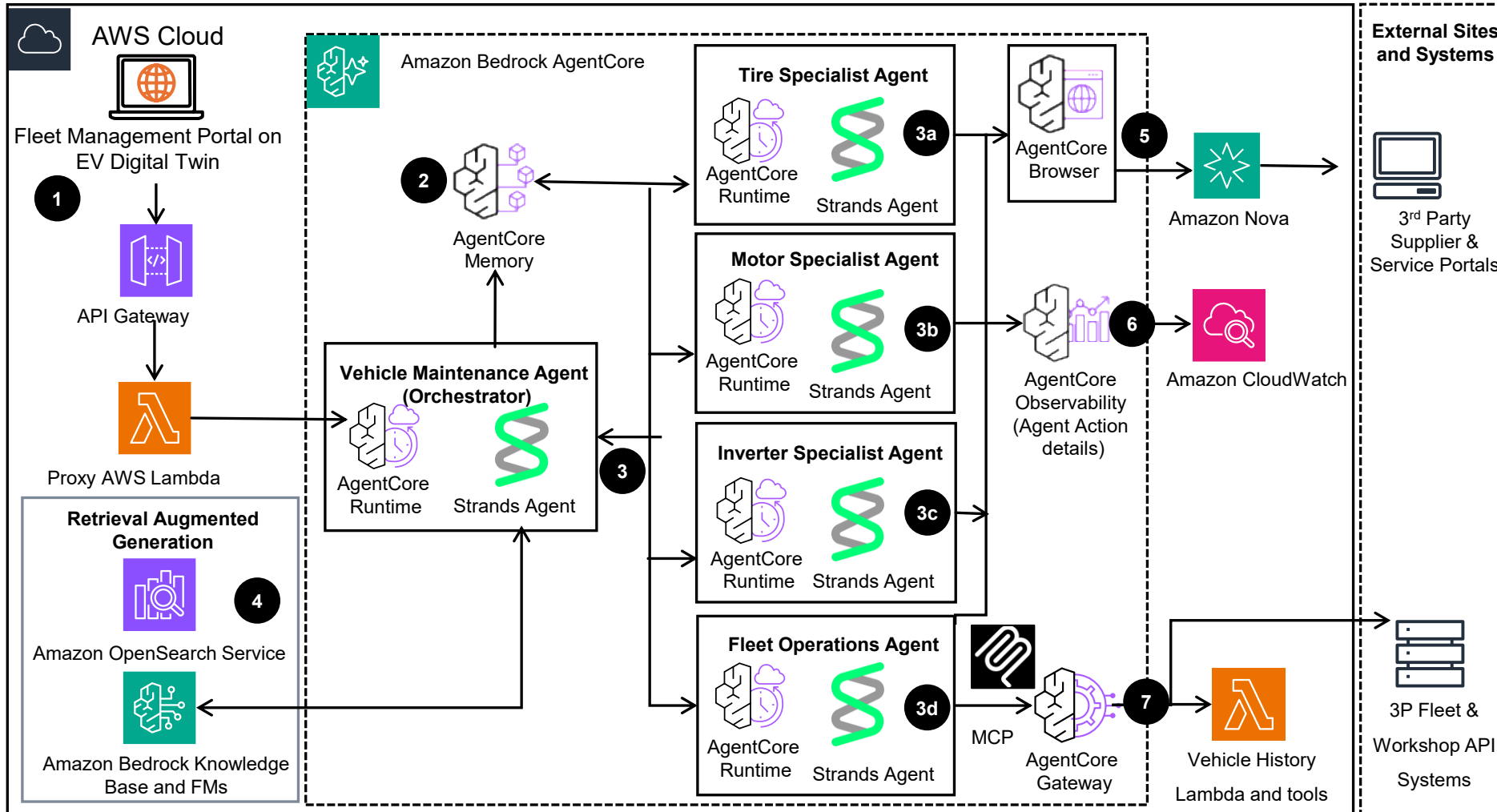
8 **Amazon Nova Act** drives browser automation for example automated tire ordering with live session viewing, streaming results back to the user interface (UI) for fleet operator oversight.

9 Fleet operators access the Digital Twin UI through **Amazon CloudFront**, which delivers it globally from **Amazon S3**, with natural language chat for vehicle diagnostics.

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Agent Orchestration Architecture of EV Digital Twin

This architecture shows how a Vehicle Maintenance Orchestrator on Amazon Bedrock AgentCore delegates diagnostics to specialist agents, supported by RAG, memory, and browser automation.



- 1** Fleet operators send requests from the **EV Digital Twin** portal through **Amazon API Gateway** and a proxy **AWS Lambda** to the orchestrator agent.
- 2** The **Vehicle Maintenance Orchestrator** on **AgentCore Runtime** (Strands Agent) analyzes each request and routes it to the appropriate specialist agent — tire, motor, inverter, or fleet operations.
- 3** **AgentCore Memory** maintains short-term and long-term conversation history across all agents, enabling recurring issue detection and cross-vehicle fleet pattern analysis.
- 3a** The **Tire Specialist Agent** on **AgentCore Runtime** handles tire analysis, wear prediction, anomaly detection, and tire-specific KB guidance.
- 3b** The **Motor Specialist Agent** handles motor performance analysis, failure prediction, and anomaly detection with motor-specific KB guidance.
- 3c** The **Inverter Specialist Agent** handles inverter condition analysis, degradation prediction, and inverter-specific guidance.
- 3d** The **Fleet Operations Agent** handles fleet-wide health monitoring, cross-vehicle pattern analysis, appointment scheduling
- 4** Specialist agents retrieve authoritative maintenance guidance via RAG — **Amazon Bedrock Knowledge Base** queries the EV manual through **Amazon OpenSearch Serverless** vector search
- 5** **AgentCore Browser** with **Amazon Nova Act** automates tasks on 3rd-party external or internal web portals with live DCV browser session streaming for operator oversight.
- 6** **AgentCore Observability** captures agent action traces, tool invocations, and memory operations via **Amazon CloudWatch** for monitoring.
- 7** **AgentCore Gateway** exposes vehicle history and report generation as MCP tool endpoints via a **Vehicle History Lambda**, or enabling integration with 3rd-party APIs and tools

