The Digital Vehicle Maturity Framework:

An update on the Eclipse SDV-LVL project

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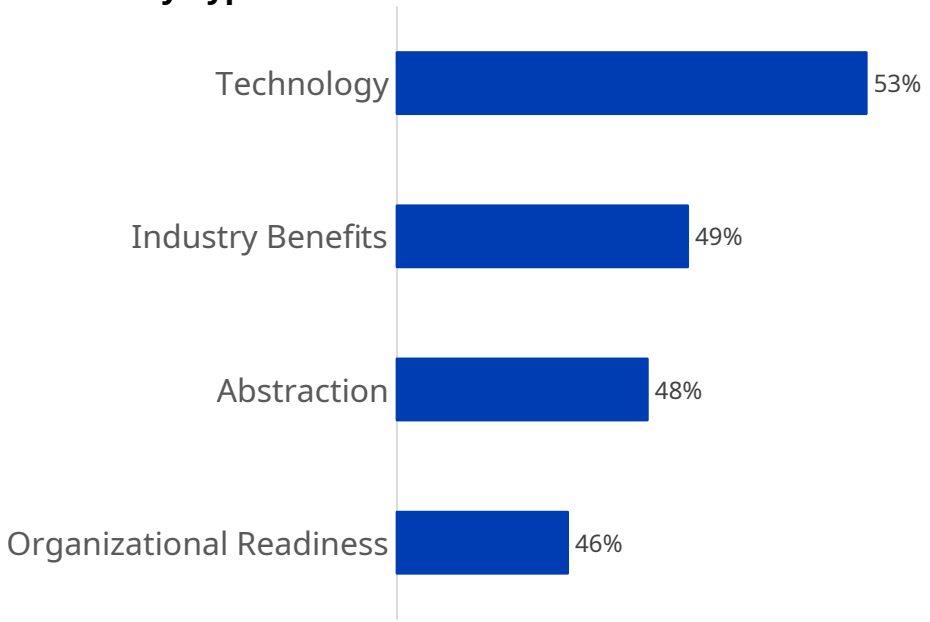
Technology Outpaces Other SDV Enablers Categories

SDV Enablers by Type of Enabler



Notes: n=559

Source: Omdia SDV Survey, 2026

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Abstraction

Physical to virtual, APIs, portable runtime, digital twins.

Technology

Networking, OS/middleware, cloud/OTA systems, AI models & tooling

Organizational Readiness

CI/CD/CT pipelines, MLOps, cross-functional collaboration, compliance.

Industry Benefits

Lifecycle monetization, BOM vs. lifecycle economics, new business

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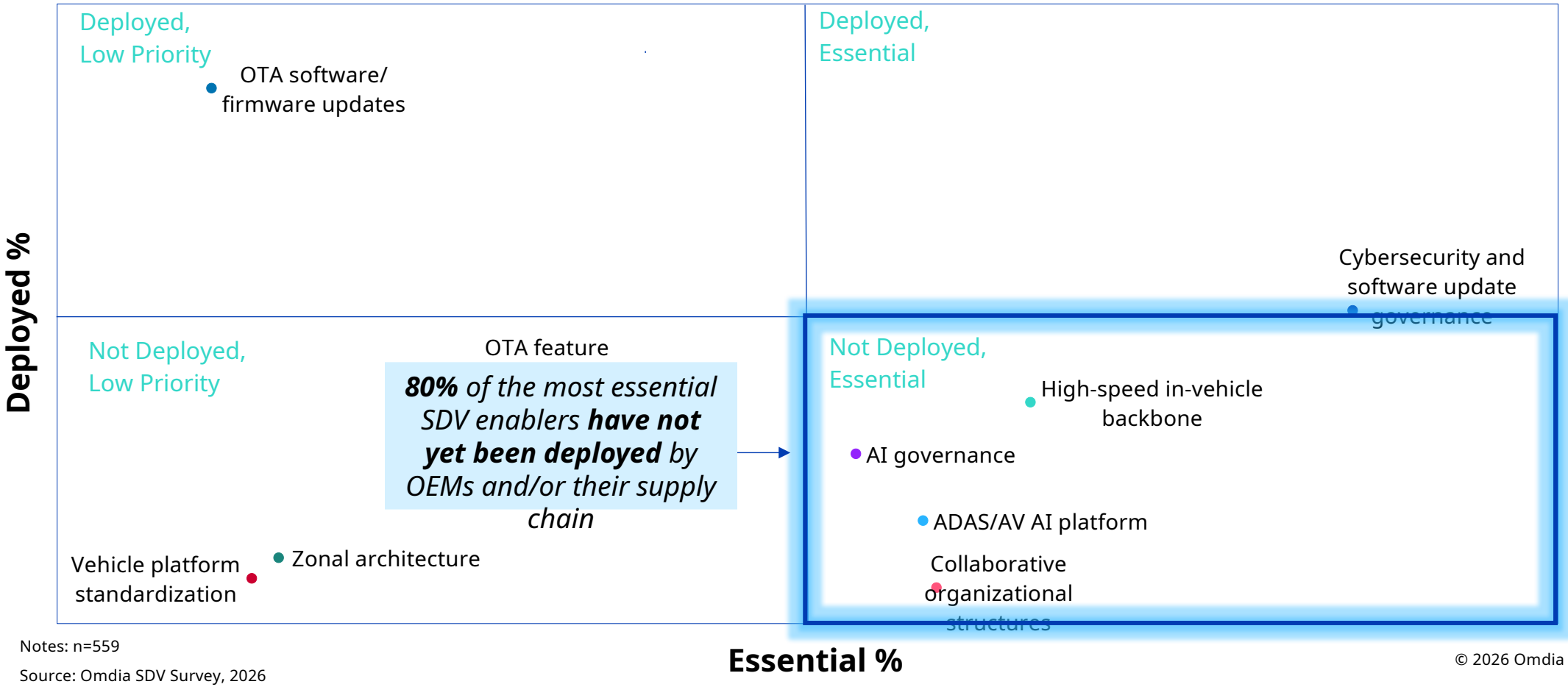
SDV Deployments Remain Limited to Basic OTA Updates



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Scaling barriers: Technical debt meets organizational inertia

Key insights

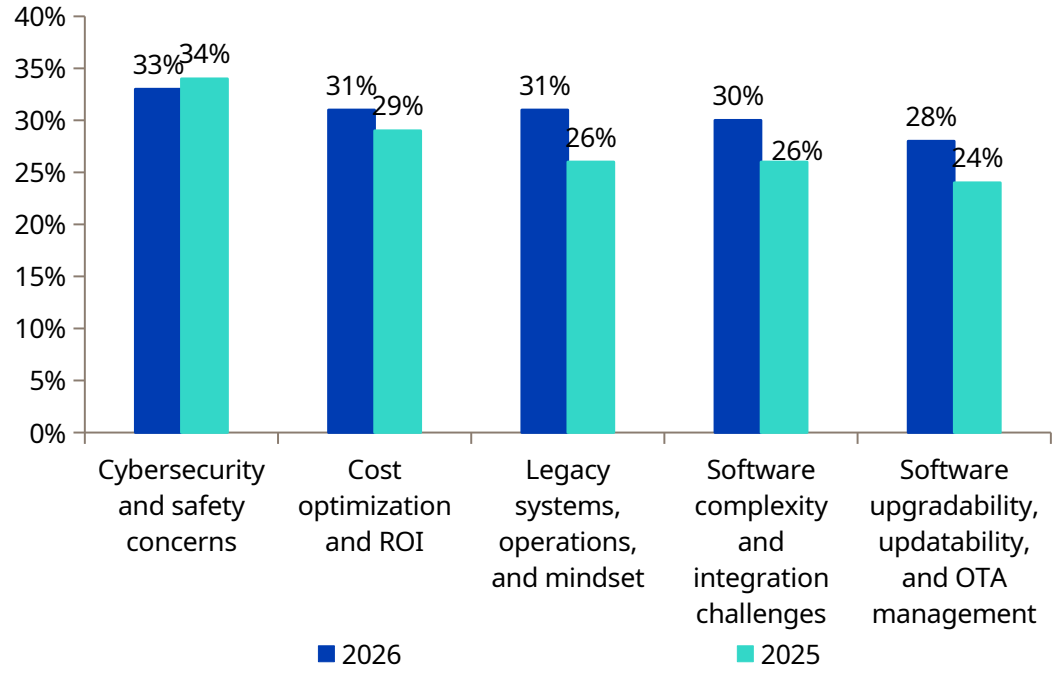
- **Legacy systems are the fastest-growing barrier (+5 pts YoY).**
- Cultural inertia and legacy processes outpace technical bottlenecks.

- **Execution complexity is compounding (+4 pts YoY).**
- Integration debt and cross-tier supplier coordination remain unresolved.

- **Cybersecurity is baseline table stakes (33%, -1% pt YoY).**
- Driven by regulatory pressure (UN R155/R156) rather than architectural debt.

What are the main challenges to scaling SDV implementations?

Top 5 challenges, 2026 vs. 2025



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Core takeaway: The scaling barrier has shifted from technical feasibility to organizational inertia and integration complexity

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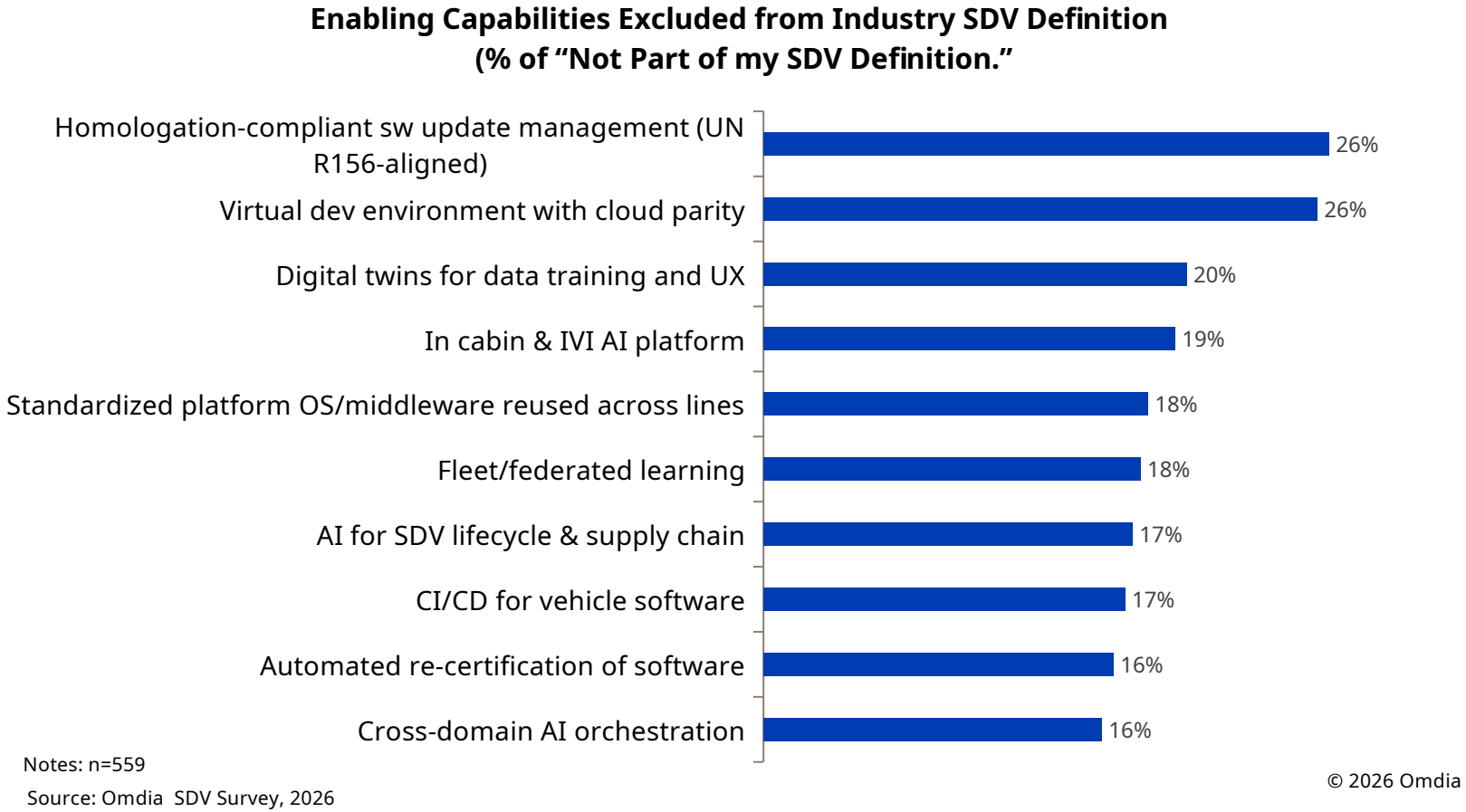
Industry Blind Spots: Core Capabilities Excluded from Current SDV Definitions



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UN R156 & Virtual Parity (26% excluded): Viewed as compliance overhead, but continuous OTA deployment cannot scale without automated validation and approval.

Digital Twins (20% excluded): Dismissed as isolated design tools, yet critical for closed-loop software validation and fleet intelligence (L6–L7).

Fleet Learning & In-Cabin AI (18–19% excluded): Often siloed into infotainment rather than recognized as unified platform software.

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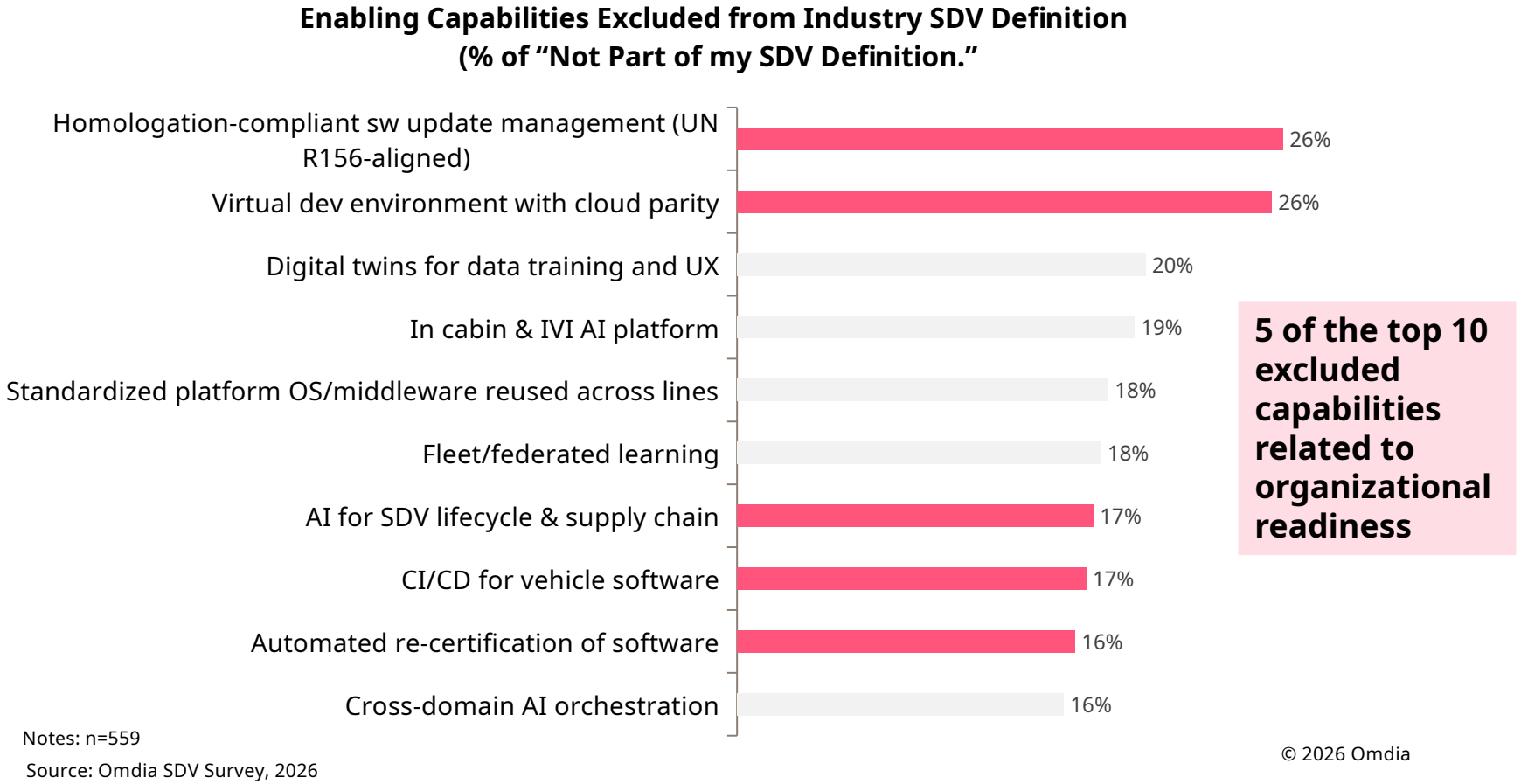

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5 of the top 10 excluded capabilities related to organizational readiness

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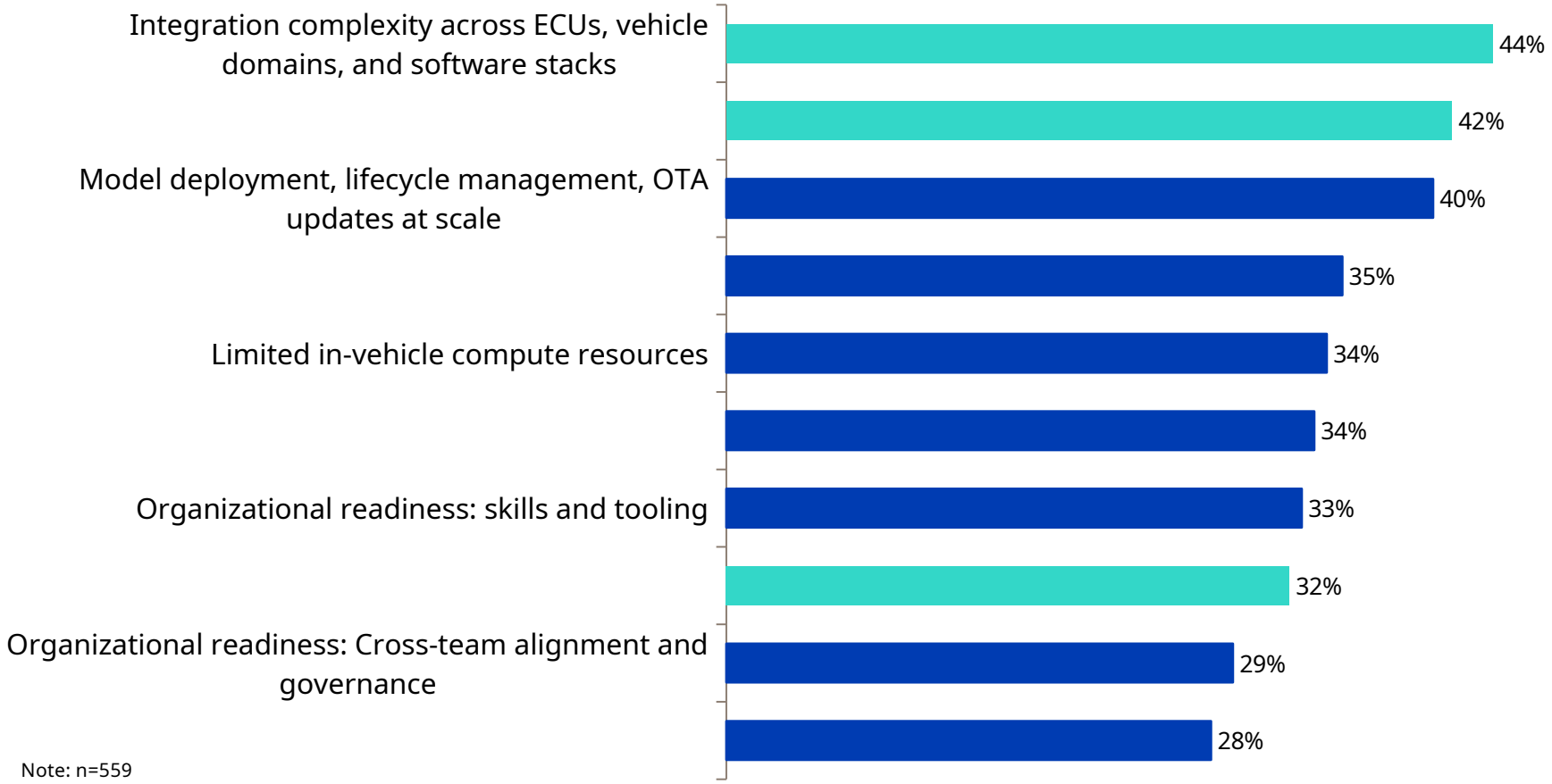
The Cost of No Common Language: Edge AI Deployment Stalls

What challenges does your organization face when deploying in-vehicle edge AI in a Software-Defined Vehicle (SDV) architecture?



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Edge AI cannot scale across ECUs when each vehicle domain uses a different data model and interface. A standardized maturity taxonomy is essential to establish common semantic APIs, unified data governance, and cross-domain orchestration.

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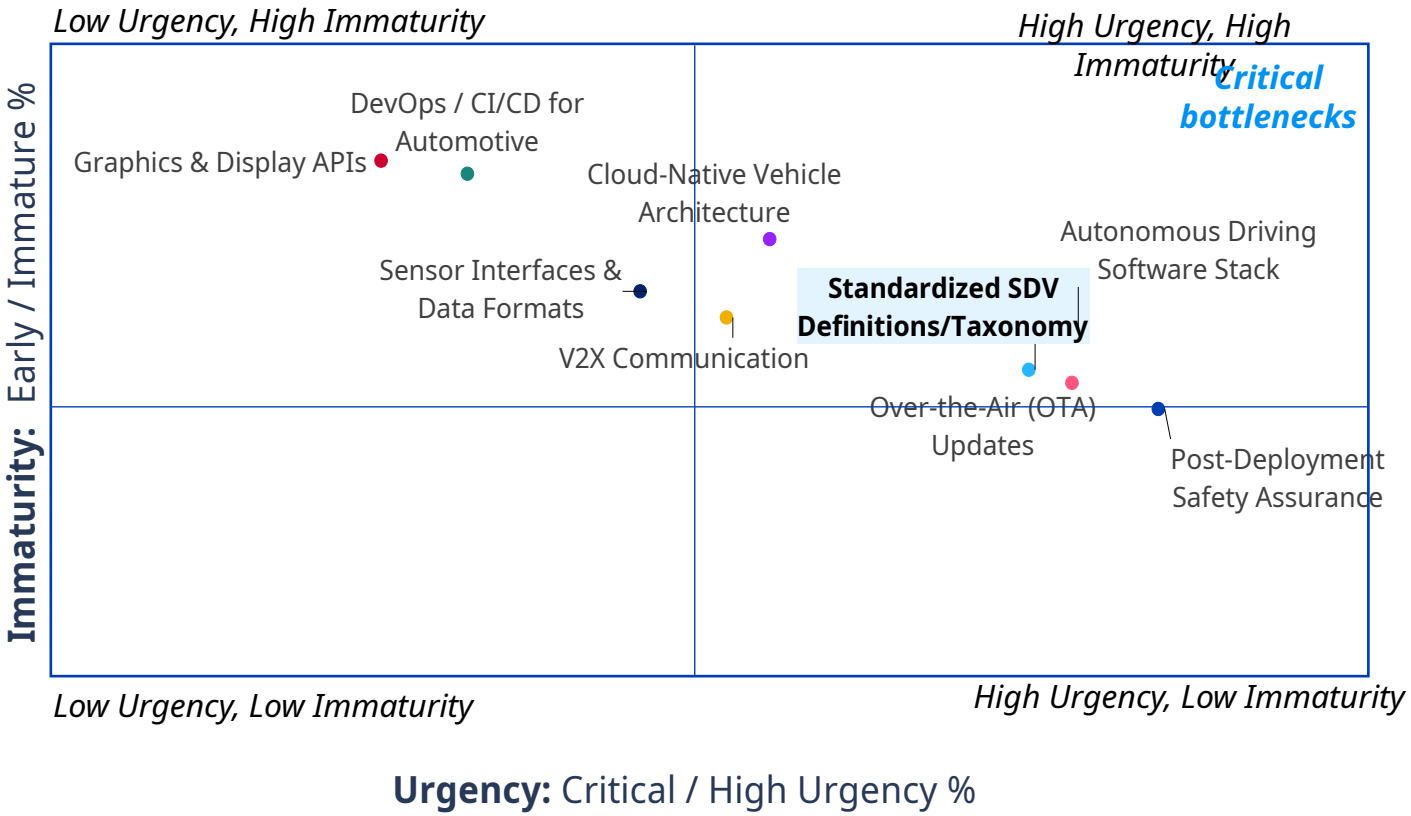
64% Urgently Require Standardized SDV Definitions



Universal Industry Priorities (>60% Urgency)

- **Standardized SDV Taxonomy (64%)**, Post-Deployment Safety (67%), AD Software (65%), and OTA Updates (65%) are the most urgent priorities.
- **High consensus on core enablers:** Confirms that standardized operational safety and lifecycle taxonomy are non-negotiable prerequisites before SDVs can scale across mainstream model lines.

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Source: Omdia SDV Organizations Survey 2026 sponsored by SAE ICT/

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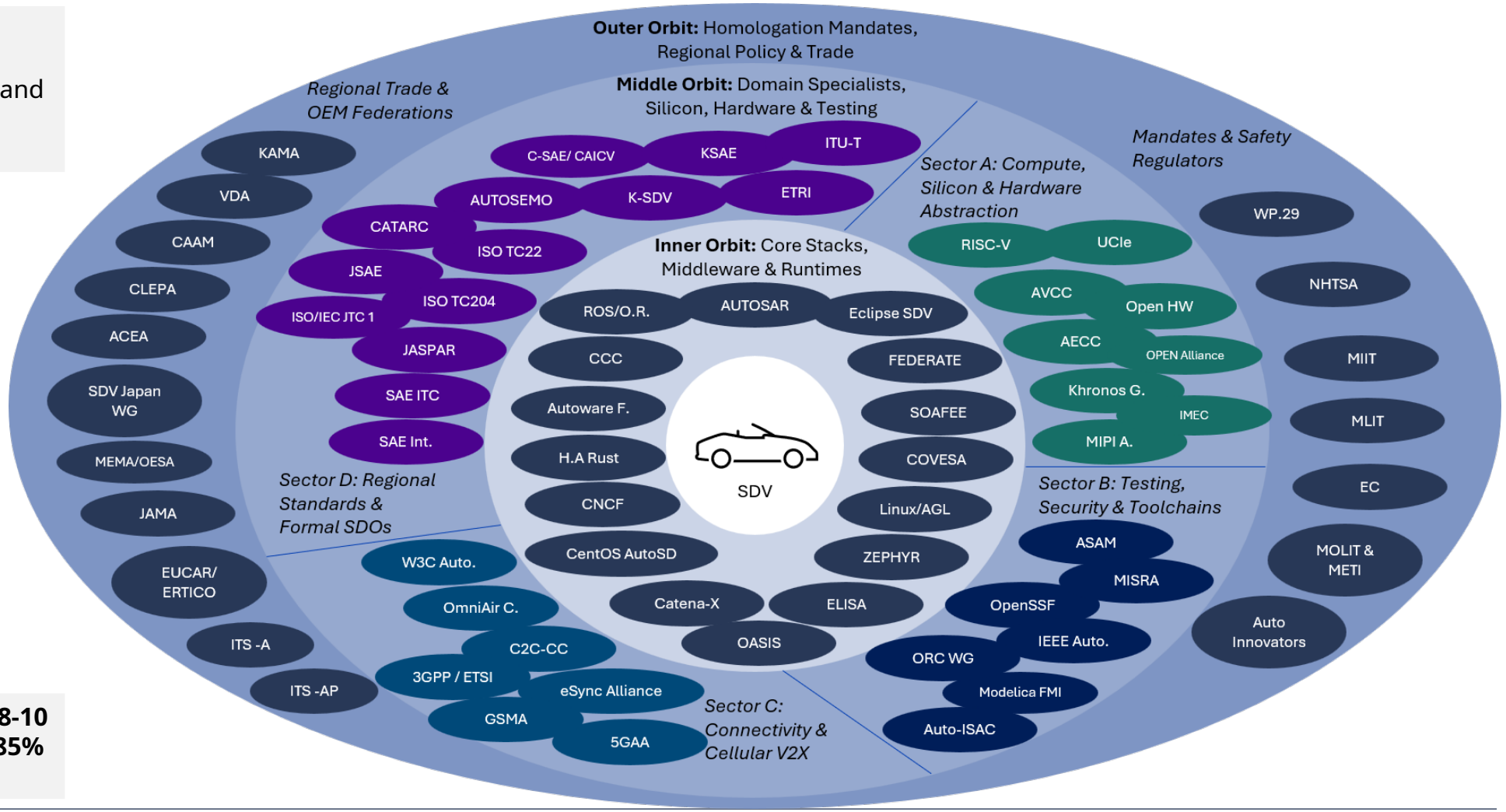
Acute Sprawl with Zero Gravitational Core

- **Uncoordinated Bodies:** The landscape suffers from severe sprawl across consortia, SDOs, and alliances operating with zero unified gravitational core.

- **Disconnected Orbits:** Fast-moving open-source stacks in the inner orbit lack structured translation layers into the middle orbit SDOs and Outer-Orbit homologation mandates, leaving OEMs to bridge the gap alone.

- **Concentrated Power:** Around **8-10** OEMs and Tier 1s control over **85%** of active board seats



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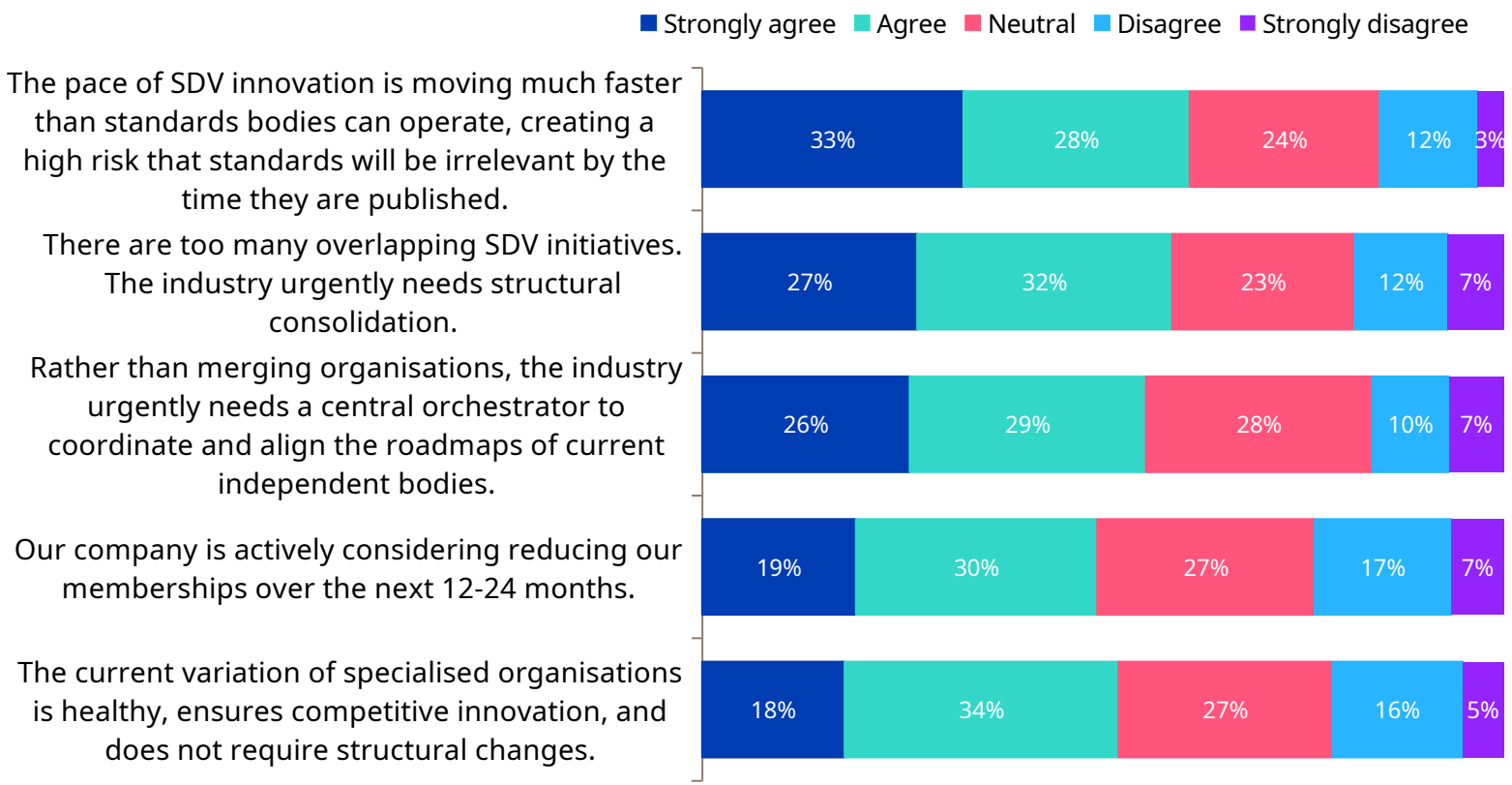
Why a Framework, Not a Standard

To what extent do you agree with the following statements regarding the overall landscape of the SDV ecosystem?



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1. Speed to Value (61%)

- **Formal standards take 3-5 years;** innovation moves faster.
- An open framework enables immediate benchmarking.

2. Initiative Fatigue (59%)

- 49% plan to trim consortium memberships.
- A common framework clarifies where specific initiatives fit without creating yet another body.

3. Alignment Over Replacement (55%)

- **Orchestrates existing roadmaps** (e.g., Eclipse).
- Harmonizes definitions without disrupting existing work.

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The Core Drivers for Shared SDV Taxonomy and Framework

01 Capability Blind Spots

The current SDV definition remains narrow and inconsistent, routinely excluding foundational lifecycle, edge, and operational capabilities needed at scale.

02 Cost of no Common Language

Semantic misalignment across OEMs, Tier 1s, and silicon vendors stalls deployment, forcing teams to burn budget on custom glue code and integration.

Convergin g Industry Need

03 Bottlenecked Enablers

Top priorities are trapped in high immaturity:

- 67% post-deployment safety
- 65% AD software and OTA updates
- 64% standardized SDV taxonomy

04 Demand for Orchestration

Siloed execution has hit a ceiling:

- 59% demand urgent consolidation of bodies
- 55% seek a neutral central orchestrator

> *"Nobody owns the end-to-end stack, and nobody wants their competitor to own it. AUTOSAR owns legacy base software, Eclipse has developer velocity, and SOAFEE has silicon backing, but there is no neutral arbiter stitching them together."* – **Chief Software Architect, European OEM**

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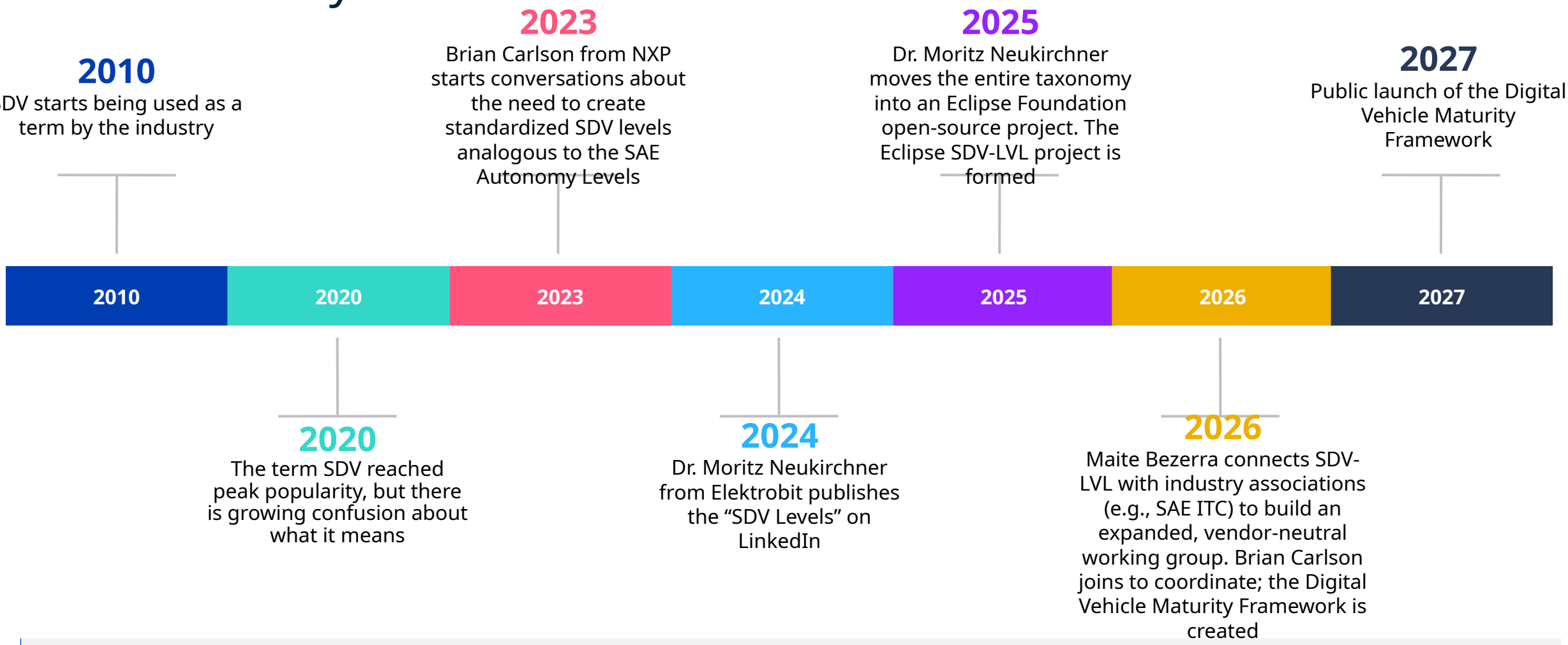
SDV Taxonomy Timeline



In response to industry demand, with **64% requiring specifications within 6–18 months**, the framework will operate on an annual revision cycle rather than multi-year standards freezes.

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Why "Digital Vehicle" Rather Than "SDV"?

Beyond "Software-Defined"



An intermediate architectural milestone

- Software is fundamental, but a lasting standard must account for the physical hardware foundation and connectivity enabling it.
- Decoupling software from hardware is a necessary bridge, not the final state of mobility transformation.

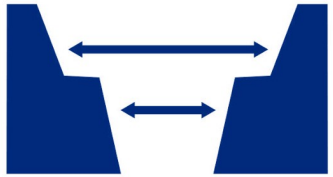
Vehicle-Level Outcomes



Encompassing the entire technological continuum

- Frames progression as a holistic vehicle-level outcome rather than the adoption of isolated tools or compute stacks.
- Accommodates diverse starting points, architectures, and business strategies without requiring every phase to qualify as "software-defined."

Enduring Future-Proofing



Bridging SDVs to AI-Defined Vehicles (AIDV)

- Programs are already advancing into predictive, self-orchestrating, and multi-agent platforms powered by edge AI.
- Avoids framework obsolescence as market buzzwords shift from software-centric to autonomous and federated ecosystems.

Core Takeaway: While "SDV" focuses on code, compute, and decoupling, "Digital Vehicle" captures the holistic, lifecycle-spanning transformation of the entire automotive system, from physical hardware baselines to federated intelligence.

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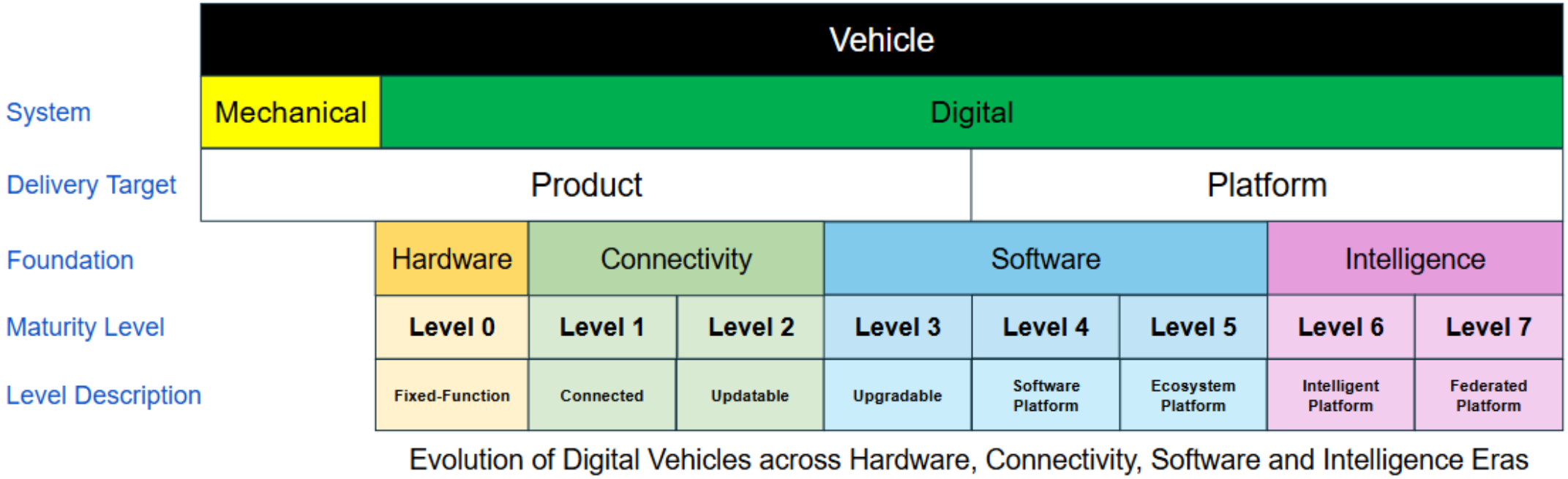
Digital Vehicle Maturity Continuum



Evolution of Digital Vehicles across Hardware, Connectivity, Software and Intelligence Eras

Source: SDV-LVL

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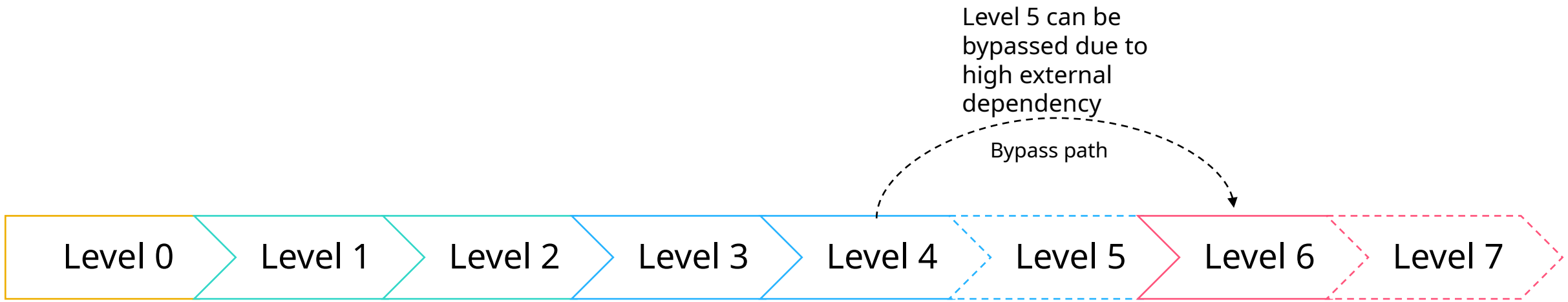
Digital Vehicle Maturity Framework Progression



Fixed-Function	Connected	Updatable	Upgradable	Software Platform	Ecosystem Platform	Intelligent Platform	Federated Platform
Function-specific hardware with embedded firmware that remains fixed after production	Wireless connectivity enables remote data, services and basic interactions	Remote software updates enable improvements in select vehicle domains	Cross-vehicle software upgrades enable enhancements and new functions	OEM service platform decouples cross-vehicle applications and capabilities from vehicle-specific hardware	Third-party ecosystem under OEM governance enables new vehicle services to deliver personalized value	Vehicle anticipates needs and orchestrates functionality and experiences for desired outcomes	Vehicle autonomously cooperates with independent external ecosystems to optimize outcomes

Source: Eclipse SDV-LVL project

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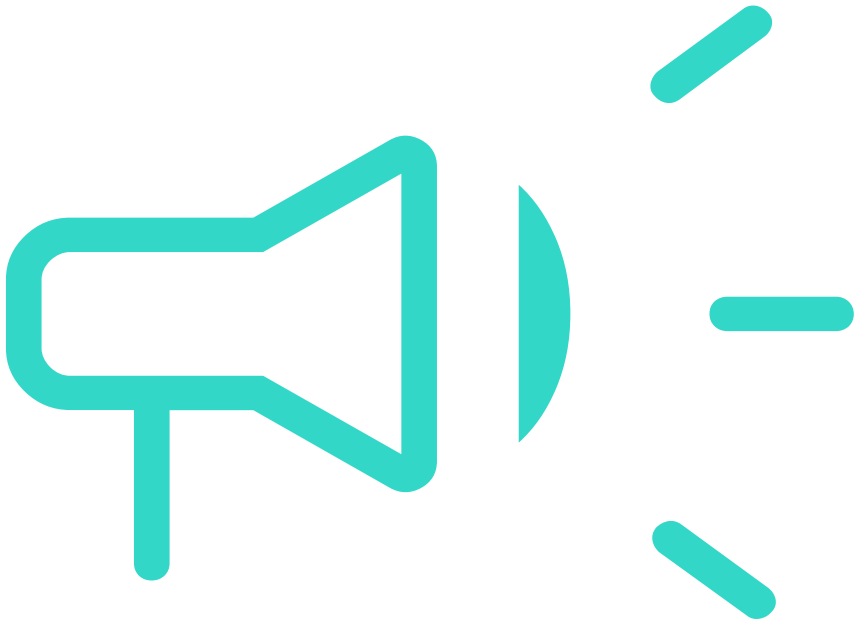
Call to Action



The Open Repository

- **Explore and Contribute:** Access the taxonomy documentation, track ongoing developments, and submit additions directly to the Eclipse SDV-LVL repository
- **The complete, row-by-row specification** across all levels is available in the appendix and the Eclipse SDV repository
- **Website:**
  - https://projects.eclipse.org/projects/automotive.sdv-lvl
  - https://drive.google.com/drive/u/0/folders/1SUqjQgQa7yrtbN0Z3_ELY_R71UWYrxPc

White Paper and Executive Quotes at CES

- **Launching at CES:** Official publication of the Digital Vehicle Framework white paper
- **Get Featured:** Contact Brian Carlson or Maite Bezerra to provide an executive quote or partner endorsement before the publication freeze.
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Thank You!

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Digital Maturity Framework – Product

Foundation		Hardware	Connectivity		Software
Dimension		**Level 0: Fixed-Function**	**Level 1: Connected**	**Level 2: Updatable**	**Level 3: Upgradable**
Summary	**Level Description**	Function-specific hardware with embedded firmware that remains fixed after production	Wireless connectivity enables remote data, services and basic interactions	Remote software updates enable improvements in select vehicle domains	Cross-vehicle software upgrades enable enhancements and new functions
Attributes	**User Experience**	*Vehicle capabilities established at delivery* • Fixed vehicle features • Physical updates only	*Vehicle is accessible and informative* • Connected convenience • Connected real-time data	*Vehicle stays current with less effort* • Remote updates • Proactive diagnostics	*Vehicle continually evolves after delivery* • Evolving vehicle capabilities • Personalized experiences
	Customer Benefits	Known features, performance and controls at purchase	Remote access, vehicle status, live navigation and emergency support	Remote fixes, security patches and select improvements without dealer visits	Keep vehicle fresh with new features and personalized experiences during ownership
	Industry Benefits	Established manufacturing and retail economics with well-defined processes	Customer engagement, access to fleet data, and connected services opportunities	Increased customer satisfaction with improved reliability and reduced warranty costs	Operational efficiencies, customer engagement and post-sale monetization
Key Enablers	**Abstraction**	Physical functions, Electronic Control Unit (ECU)	Connectivity, vehicle identity, APIs and data	Over-the-air (OTA) software package deployment	Vehicle hardware, features, data and configuration
	Technology	Microcontrollers, embedded real-time firmware, in-vehicle networking and calibration/configuration management	Telematics and secure wireless cloud connectivity, vehicle and mobile identity, remote command APIs	Secure vehicle OTA update support and fleet software update management system	Vehicle-wide compute, high-speed networking, hardware/software decoupling, middleware, application lifecycle management and configuration management
	Organizational Readiness	Firmware development, software processes and in-vehicle networking	Vehicle connectivity and services. Involving new organizations, external providers and post-production support	Remote cloud operations and vehicle software DevOps	Scalable E/E architecture and continuous software delivery process (CI/CD/CT pipeline)

The Digital Vehicle maturity journey transforms automotive economics from optimizing a fixed vehicle at sale to continuously improving, monetizing, and orchestrating a connected vehicle fleet across its lifecycle.

OTA = Over-the-Air | **CI/CD/CT** = Continuous Integration/Continuous Deployment/Continuous Test | **ECU** = Electronic Control Unit | **API** = Application Programming Interface

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Digital Maturity Framework – Platform

Foundation		Software		Intelligence	
Dimension		**Level 4: Software Platform**	**Level 5: Ecosystem Platform**	**Level 6: Intelligent Platform**	**Level 7: Federated Platform**
Summary	**Level Description**	OEM service platform decouples cross-vehicle applications and capabilities from vehicle-specific hardware	Third-party cross-vehicle ecosystem under OEM governance enables new services to deliver personalized value	Vehicle anticipates needs and orchestrates functionality and experiences for desired outcomes	Vehicle autonomously cooperates with independent external ecosystems to optimize outcomes
Attributes	**User Experience**	*Vehicle becomes a unified service platform providing consistent experiences* • Consistent vehicle experiences • Faster, continuous improvements	*Vehicle becomes an extensible service platform delivering personalized value* • Discoverable third-party services • Digital life integration	*Vehicle understands me and orchestrates context-aware experiences* • Personalized and context-aware • Predictive and proactive digital life platform	*Vehicle connects my world and optimizes outcomes* • Optimizes time, cost, energy and convenience • Cooperative digital life platform
	Customer Benefits	Access to the latest OEM features. Supports rapid innovations, improved user experiences and higher retained value.	Extends vehicle capabilities with preferred apps, services, devices and partners	Provides predictive, personalized and proactive vehicle experiences	Delivers a frictionless, personalized experience across vehicle, home, work, and connected world
	Industry Benefits	Faster and more consistent delivery of vehicle capabilities across fleets delivering operational efficiencies and cost reduction	Total cost of ownership efficiencies and ecosystem to scale services and revenue	Vehicle data is valuable to power services, operational intelligence and partnerships	Transforms vehicle into a trusted participant in broader mobility, energy, service, and infrastructure ecosystems. Extends business opportunities.
Key Enablers	**Abstraction**	Capability framework, versioned vehicle service APIs, portable software runtime, and fleet lifecycle/compatibility management.	Trusted identity and partner integration	Intent, context, policy, data, and AI models	Federated identity, trusted, policy-governed ecosystem, cross-domain intent/outcome and federated data model
	Technology	Unified software platform, governed service and vehicle data integration using standardized APIs, and fleet-scale lifecycle	Software Development Kit (SDK) and policy management	Unified encapsulation of compute, data and models for multi-agent development, fleet feedback data loops. Governed intelligence, context, orchestration, AI safety, authority and trust services	Cross-industry interface standards, decentralized identity, automated transaction and settlement rails, policy-enforced orchestration, real-time digital twin federation
	Organizational Readiness	Unified vehicle software platform focus with platform ownership and enterprise architecture governance with common platform pipeline and fleet operations capabilities	Platform operating model with governed APIs and data standards, partner onboarding and certification, ecosystem governance, developer enablement, marketplace, billing, and cloud-service operations.	AI/ML engineering and MLOps, AI tooling, data governance and privacy functions, defined accountability for AI-driven decisions and agent platforms for planning, post-sales and operations	Cross-industry governance and standards participation, ecosystem revenue sharing models, legal and liability frameworks for autonomous machine transactions and dedicated ecosystem partner management organizations

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