



INDIA | MAY 25, 2023

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Developing a platform for software-defined vehicles

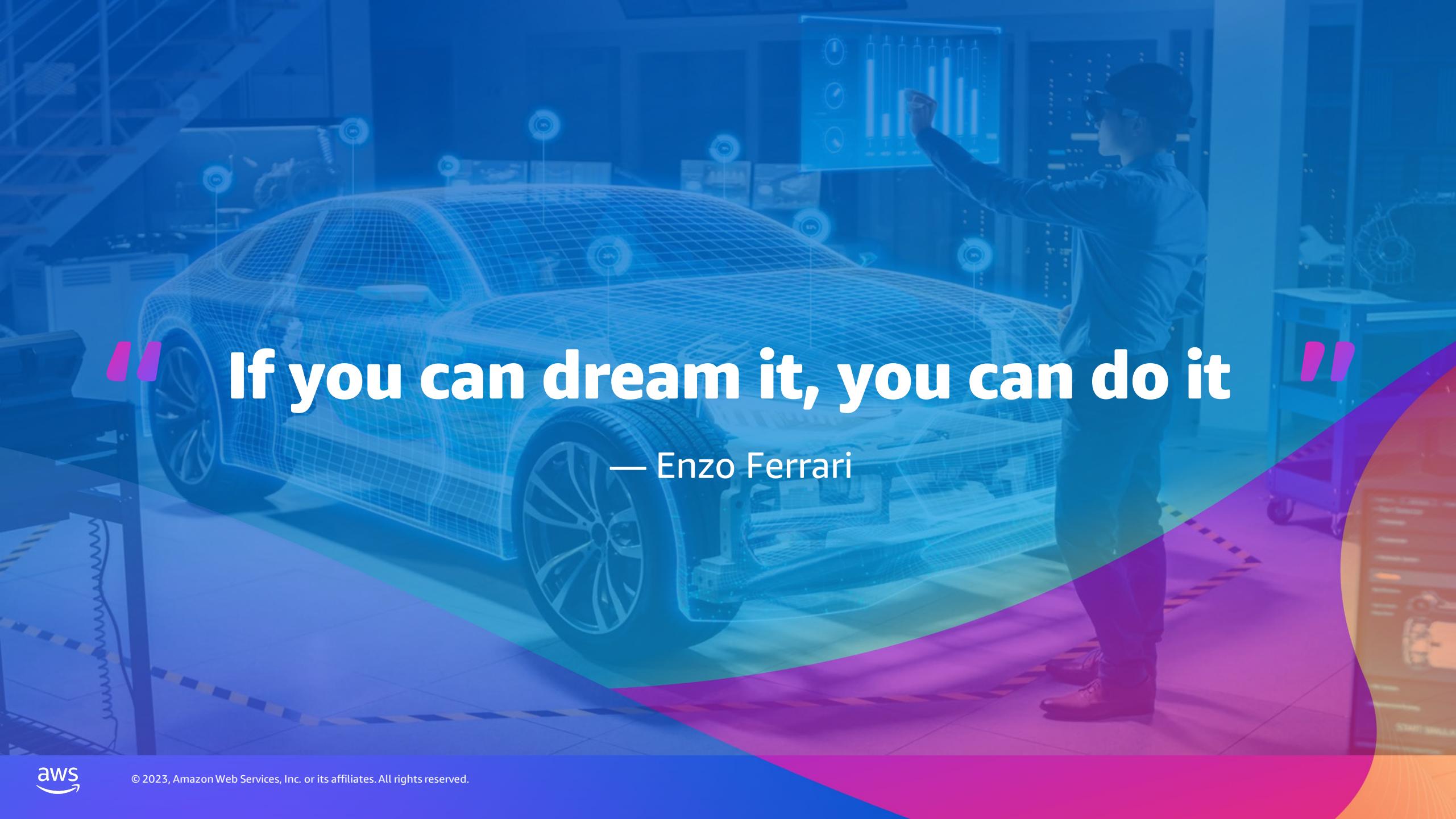
Ankit Kaushik (he/him)

Head Solutions Architect

AWS India



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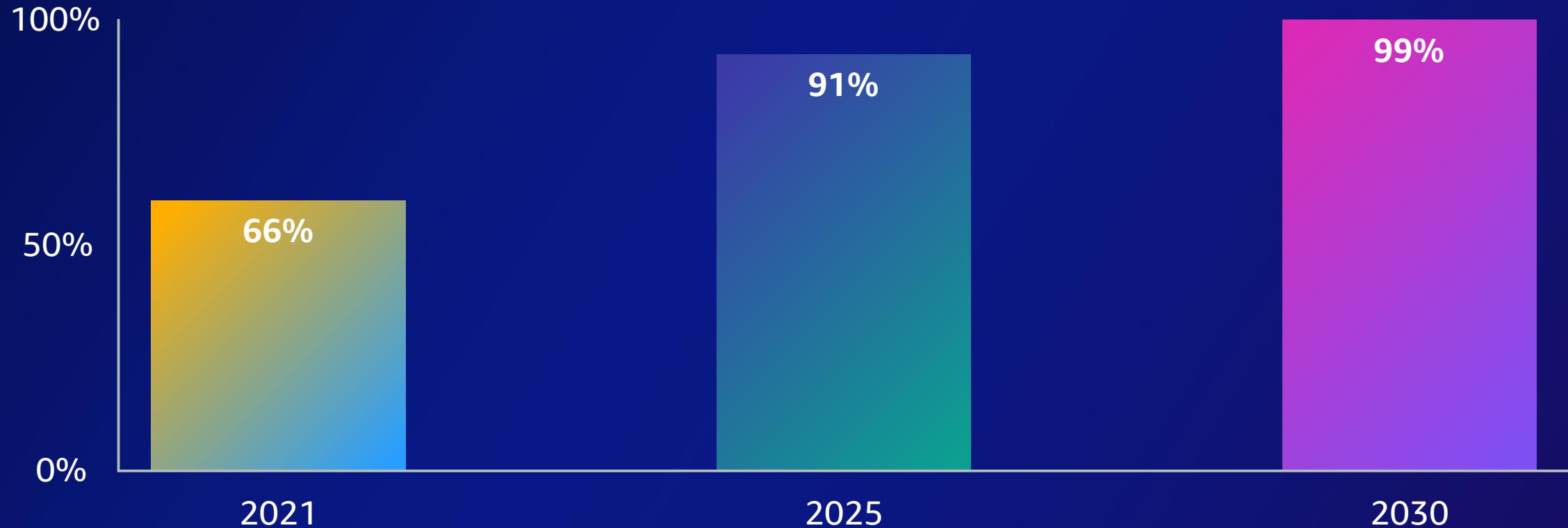
"If you can dream it, you can do it"

— Enzo Ferrari

We've come a long way...



Reinventing automotive global % of connected vehicles are growing

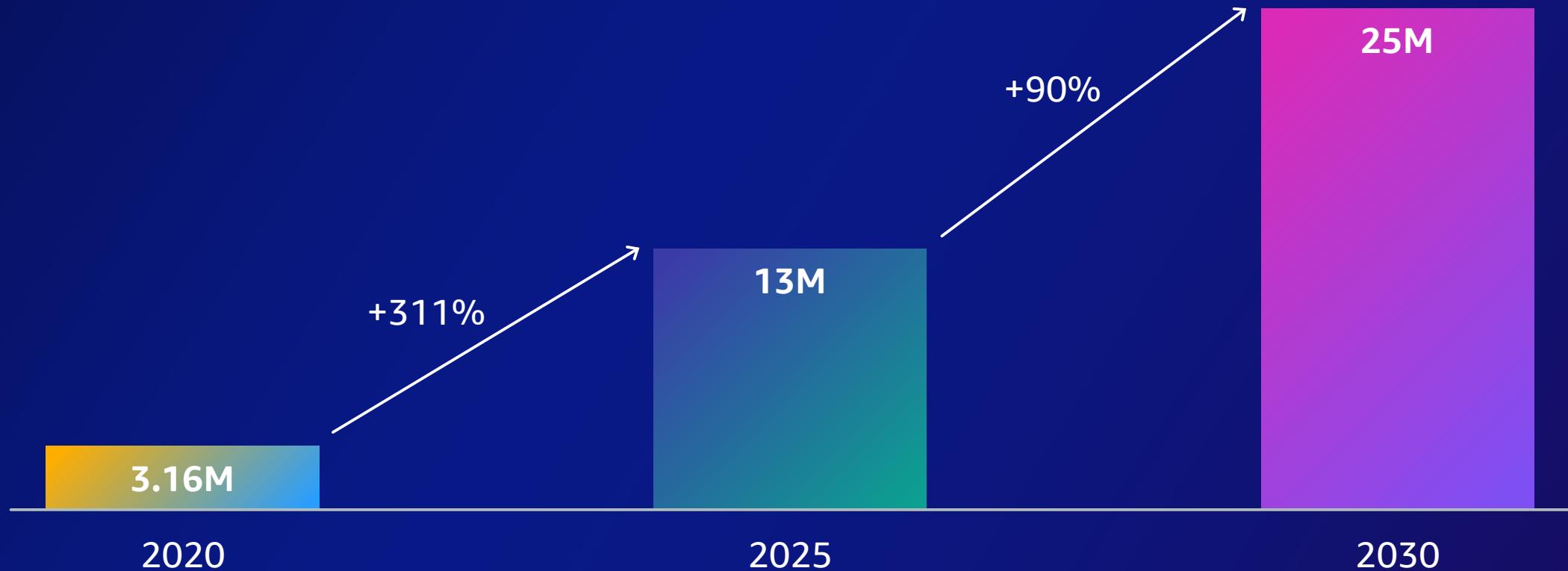


Source SBD Automotive



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Reinventing sustainable mobility global EV sales are growing



IEA 2022; Global EV sales by scenario, 2020-2030, [<https://www.iea.org/data-and-statistics/charts/global-ev-sales-by-scenario-2020-2030>], License: CC BY 4.0

Industry view



“Software will be what differentiates players in the automotive industry within a few years. Incumbents must make significant shifts in technology, competitive dynamics, and talent.

- McKinsey & Company



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Rewiring car electronics and software architecture for the ‘Roaring 2020s’

August 4, 2021 | Article

Software’s importance is increasing for the vast majority of industrial players.

Faulty software implementations can lead to severe financial and reputational challenges . . .

. . . but software also can open new valuation horizons

Millions of dollars at stake

64%

of large software programs face **cost overruns**

Risks to brand’s reputation

78%

of large software programs face **schedule overruns**

Risk of vehicle recalls

>2 million

vehicles recalled by an OEM to address **software bugs** in the powertrain domain

Cybersecurity risks

>1 million

vehicles recalled by an OEM to address **vulnerability to hackers**

4–6x

6–9

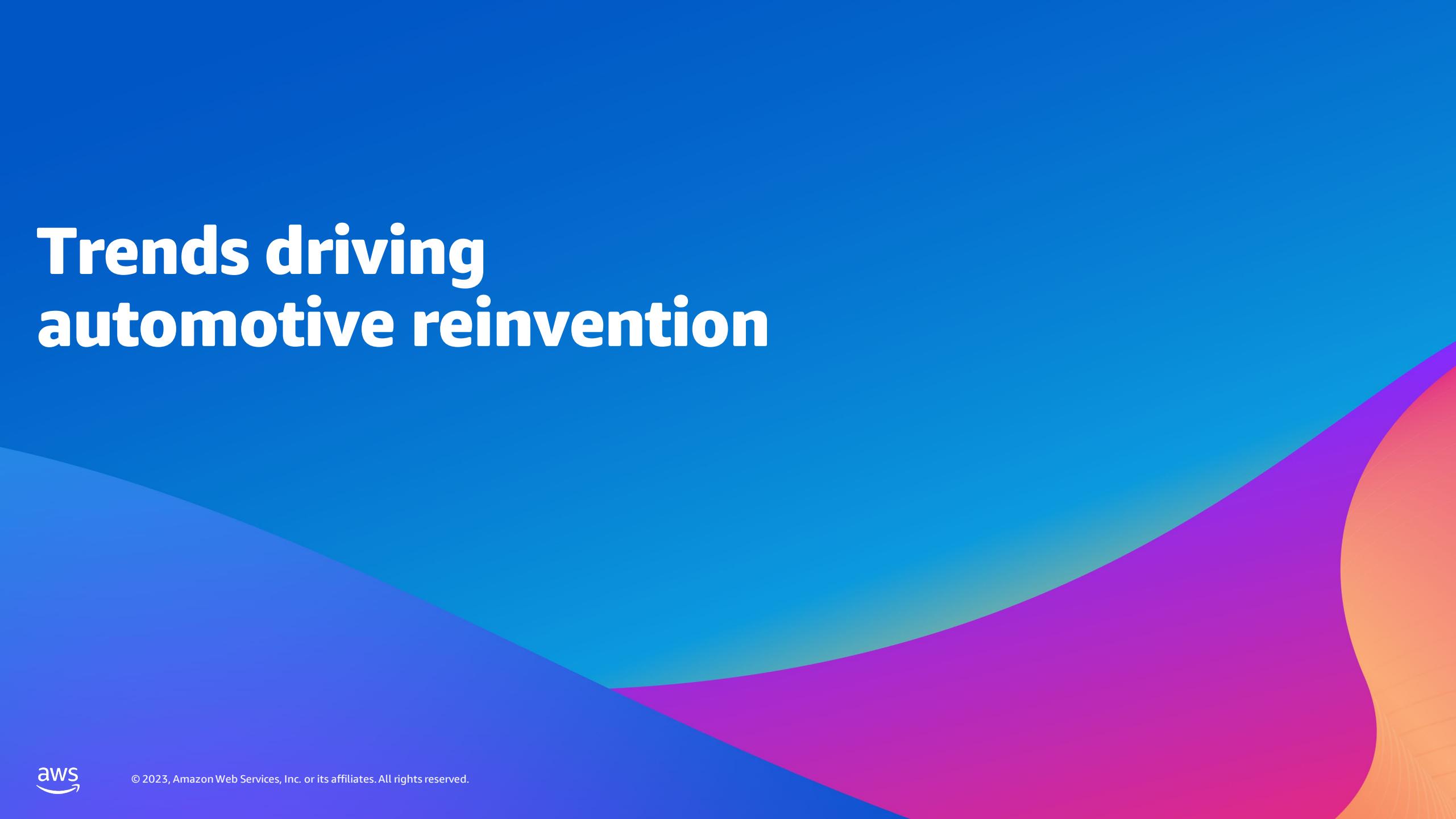


Typical valuation, revenue multiple

Source: Robert N. Charette, “This car runs on code,” IEEE Spectrum, February 2009, spectrum.ieee.org; McKinsey analysis

McKinsey
& Company

Trends driving automotive reinvention



Sustainability



A close-up photograph of a car's front wheel and headlight at night. The car has a dark, reflective body with a prominent blue light strip along the side. The headlight is illuminated, showing a futuristic multi-lens design. The wheel features a multi-spoke alloy design with a blue glow. The background is dark, suggesting a nighttime setting.

Technology

Connected
Autonomous
Shared
Electrification

A photograph of a family of three in a car. A woman with long brown hair, wearing a brown jacket over a white top, is seated in the passenger seat, smiling and looking out the window. A young boy in a denim jacket with a white fur-trimmed collar sits in the middle seat, also looking out. A man with a beard, wearing a brown jacket, is driving the car and looking towards the camera. The car's interior is visible, including the steering wheel and dashboard.

Customer experience
and personalization

Our customers

TOYOTA

VOLVO



DENSO



SCANIA



BMW
GROUP



VOLKSWAGEN
AKTIENGESELLSCHAFT

Continental

HONDA
The Power of Dreams



BlackBerry®



The journey to software defined vehicles

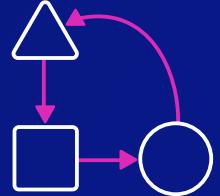
The promise of software defined vehicles



Better customer experiences



Vehicles that get better with time



New services and business models



Data-driven discipline



Intelligent decision making



Increased performance

Pressure points: Why act now?



Customer Demand



Continuous feature updates leading to business model upgrades



Talent and Competencies



Increasing challenges to hire and maintain SW Dev

Build consistent in-house sw competencies



Compliance & Safety



Privacy, Safety, Maintenance, Regional Variations



System Complexity



Hundreds of computers, sensors and SW versions

Hundreds of teams & partners

Enabling technologies for the software defined era

IoT

Scale to millions of vehicles & smart city infrastructure with managed IoT services



Data Lakes

Combine silos of data (CV, ADAS, manufacturing, enterprise) with data lake architectures



AI/ML

A comprehensive data strategy to uncover hidden value with AI/ML and deploy perception & path planning modules



Edge to Cloud

Holistic capabilities including 5G/MEC for next generation connected mobility services



HW Consolidation & Virtualization

By virtualizing the sensors, networking, and hardware interfaces, customers can achieve parity between cloud and vehicle



Vehicle Data Microservices

Provide a normalized, consistent, secure data access layer that allows developers to create new insights & microservices



Application Encapsulation

Containers provide self contained, isolated, easily distributable packages for development of virtual ECUs deployed to vehicles



Cloud Native Devops

As automotive companies are expanding their use of cloud native devops and CI/CD technologies to the embedded edge



Accelerating automotive software development



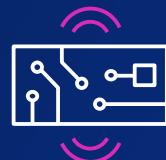
What is “Software Defined”?



- Functions enabled by *software are abstracted from hardware*
- Function enabled using ubiquitous cloud native *Service-Oriented Architecture (SOA)* software development model:
 - Functions delivered as services that are self-contained unit of software (**Virtual ECU packaged in Containers**)
 - Mechanism for publishing available services and their characteristics
 - Control of the use of these services

Vehicle code complexity is growing

Today's vehicles



Number of ECUs

>100



Lines of code

100–150M

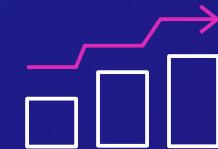
Fully software-defined vehicles



Number of ECUs

Decreasing

with centralized compute
architectures in new
vehicle platforms



Lines of code

Increasing

due to new functionality,
highly automated and
autonomous driving

Software-defined vehicles journey

Breaking down SDV



Hardware abstraction

Enabling a seamless experience between a developer's local environment, the cloud, and the vehicle



SW lifecycle management

Auto DevOps Platform to increase SW quality, developer productivity, and provide better security and governance



Vehicle data management

Enabling automotive customers to unlock enterprise-wide value from connected car data



AWS Automotive Solutions Areas

SOFTWARE-DEFINED VEHICLE

The vehicle is evolving into a software-defined digital platform and empowering the design and development teams to deliver on changing consumer value expectations



CONNECTED MOBILITY

In a software driven era, technology unlocks the power of your data to build intelligent, personalized features and revenue-generating mobility services



DIGITAL CUSTOMER ENGAGEMENT

Increase customer engagement with relevant marketing content, personalized digital experiences, and real-time data analysis



AUTONOMOUS VEHICLE DEVELOPMENT

Amazon's 20 years of experience with autonomous systems, robotics, and machine learning taught us how to accelerate our customers AV development with purpose-built AWS solutions



PRODUCT ENGINEERING

Customers can use AWS and partner enabled solutions to develop new and innovative products at a faster pace by collaborating with multiple suppliers and OEMs across a single platform



SUSTAINABILITY & EV

Enable customers to create and manage sustainable mobility and transform their enterprise to positively impact climate change



MANUFACTURING

Realize improved manufacturing operations and overall equipment effectiveness by enabling data driven real time decisions leveraging existing shop floor data and innovative technologies.

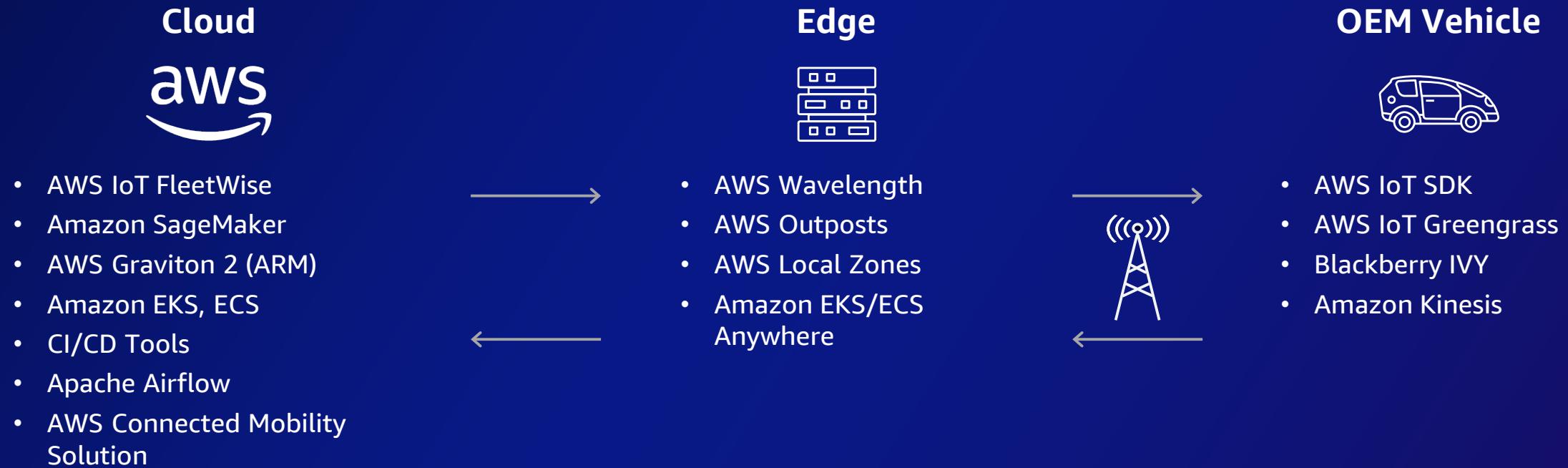


SUPPLY CHAIN

Gain end-to-end real-time visibility and insights beyond immediate suppliers to build a resilient, intelligent and cost-effective supply chain with unprecedented efficiency



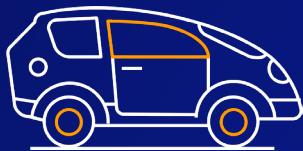
AWS offers holistic edge to cloud capabilities



But we are not doing it alone

Modernizing connected
vehicle backend and services

Data ingestion, storage, and analytics



Seamless Dev and Deploy, new
passenger experiences, and ML



Software defined vehicle



The road ahead



skillbuilder.aws



Your time is now

Build in-demand cloud skills your way



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Thank you!

Ankit Kaushik

Head Solutions Architect

AWS India



Please complete the
session survey