



Software Defined Vehicles

The Next Generation
of Automobiles

January 2025

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Software Defined Vehicles and Their Evolution to a Feature Rich & Efficient Version

What is an SDV?

Software-Defined Vehicles (SDVs) are driven by digital technology, controlling everything from driving and entertainment to safety and comfort along with a customized experience.

Connected to the **cloud**, they get new features wirelessly, without hardware changes. By separating software from hardware, SDVs enable faster development, scalability, and seamless integration into digital ecosystems, paving the way for **smarter, more adaptable vehicles**.



2020s

Focuses on connectivity, autonomy, and electrification



2000s

Infotainment systems, voice control & advanced driver assistance systems (ADAS) were introduced



1977

First car to have embedded Software. Electronic Control Unit in GM Oldsmobile Toronado

Road to Software Defined Vehicles

- The automotive industry is shifting from Vehicle 3.0 to Vehicle 4.0—Software-Defined Vehicles (SDVs)
- Vehicle 3.0 introduced digitalization with sensors, infotainment, and telematics powered by multiple ECUs
- Now, Vehicle 4.0 focuses on centralized computing, faster development, and user-centric experiences with software driving innovation

Vehicle Generation	1.0 Functional	2.0 Digital	3.0 Updateable	4.0 SDV
E/E Patterns	Multi-CAN	Functional Bandwidth	Functional Domains	Zonal
User Experience	Static IVI	Smartphone Projection	Connected IVI	Personalized
Updatability	No Updates	Phone App Updates	Firmware Updates	Software Updates
Connectivity	None/eCall Only	4G	Multi-Channel	5G with Edge
Software Architecture	Tightly Coupled	Cockpit Software Apps	Service-oriented	Edge Container



Increased technological sophistication

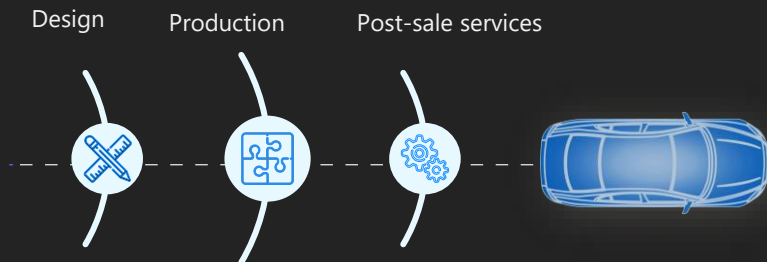
^ E/E - Electrical/Electronic; IVI - In-vehicle Infotainment

Source: 'Software-Defined Vehicle' report by SBD Automotive

SDV Transforming the Lifecycle of a Vehicle & CX

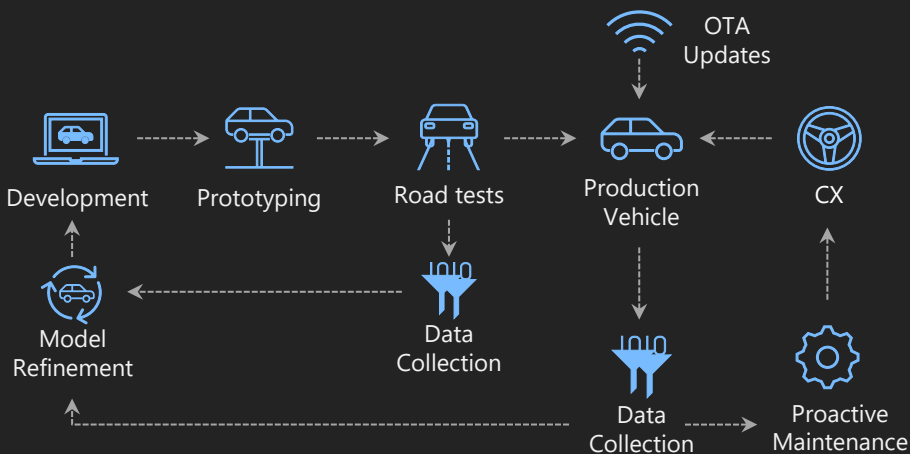
Traditional Vehicle Lifecycle

Traditionally, the automotive lifecycle was hardware-centric with design, production, and post-sale maintenance marking distinct phases. Once a car left the factory, its core features remained largely static.



SDV Lifecycle

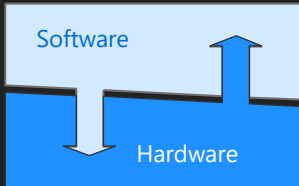
However, now SDV enable continuous updates and improvements long after the vehicle is sold. Over-the-air (OTA) updates allow manufacturers to enhance performance, introduce new features, and address issues remotely, much like smartphones and modern consumer electronics.



Source: 'Software-Defined Vehicle' report by LTTS

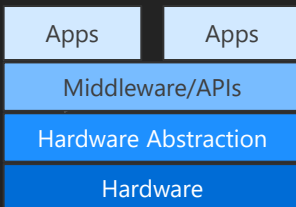
Separation of SW & HW Layers

Hardware Driven – *Software specific & unique to Hardware*

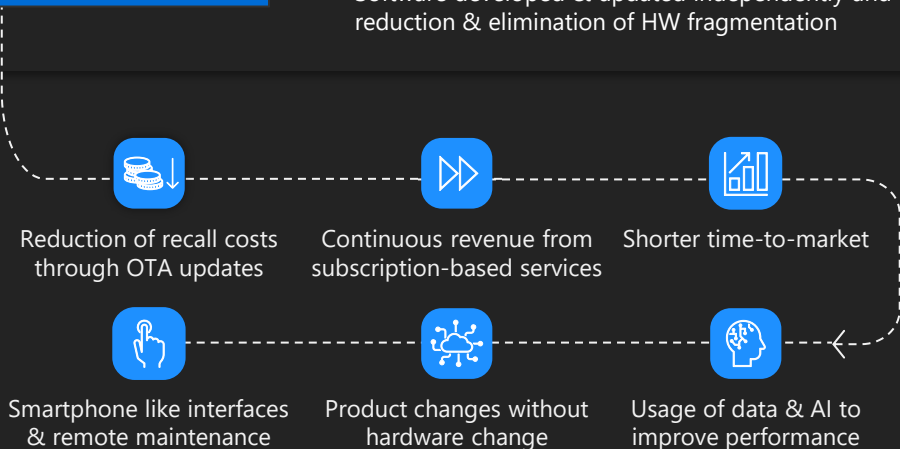


- Automakers source specialized hardware (HW) from a vendor. These HW have APIs which are unique to that component, hence software (SW) written on these becomes specific to that HW
- Updating is difficult due to HW & SW dependency

Software Driven - *Software are independently built & updated due to middle layer*



- Instead of coupling to HW directly, APIs & SW are built on a newly added HW abstraction layer. This layer supports & connects to HW specific system, functions & data
- Further APIs/ Middleware enable hardware-agnostic interaction with hardware & other apps
- Software developed & updated independently and reduction & elimination of HW fragmentation



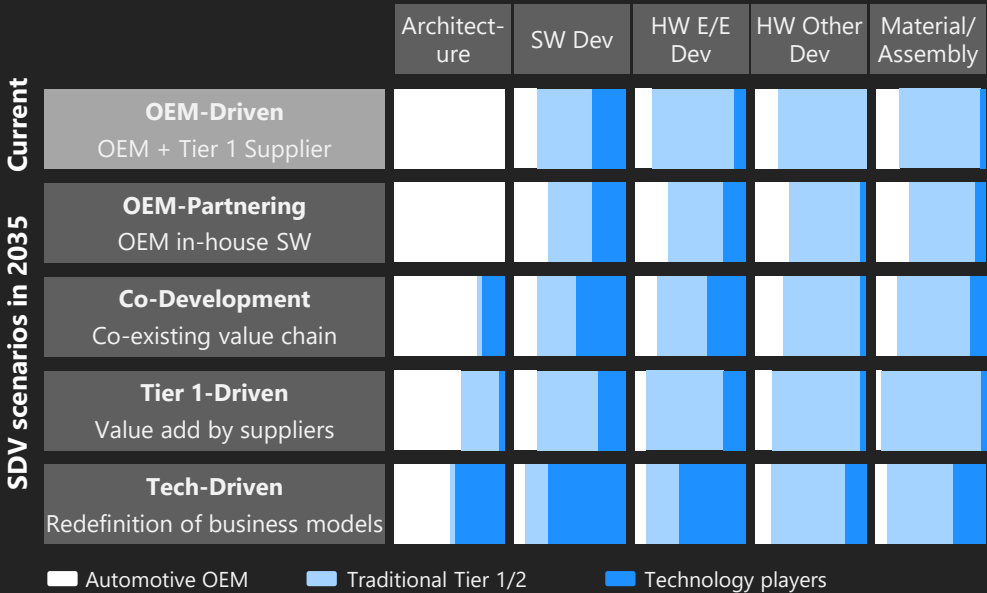
Source: 'Software-Defined Vehicle' report by SBD Automotive and 'Software-Defined Vehicles – Revolutionizing the Automotive Industry' report by Strategy&



Evolution of Participants in the Automotive Value Chain & Increasing Role of Technology Services Players

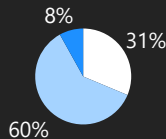
OEMs + Tech Cos. to Create SDVs

Contribution of OEM, Tier 1 Suppliers & Tech Players in SDV Value Chain



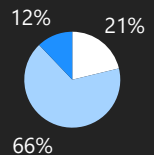
OEM Led Development

- OEM designed E/E and SW architecture
- Significant in-house SW capabilities partnering with tech



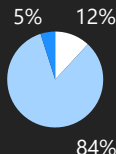
Co-Development

- E/E & SW stack sourced from & designed by tech players, as alternative to OEM/ Tier-1



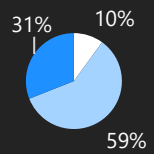
Tier-1 Driven

- Tier-1 scaling in SW & E/E architecture market
- Extend capabilities with tech
- Increased share from battery



Tech Driven

- Tech designed vehicle
- Vehicle integrated into ecosystem (e.g. mobile)
- Tech players evolving into electronics provider



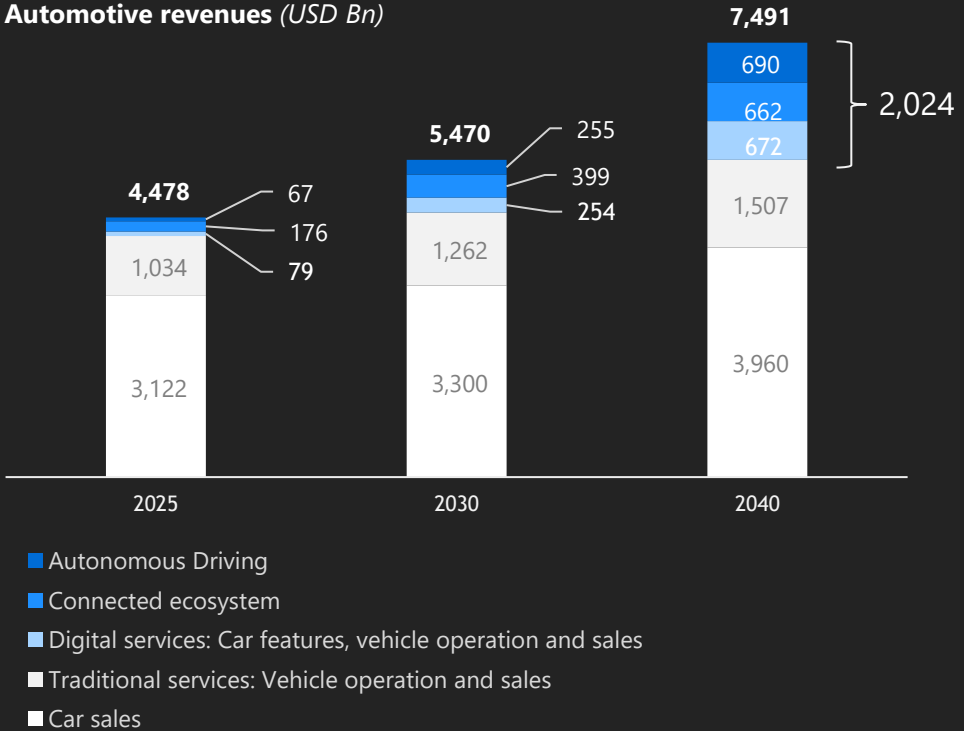
^ HW - Hardware; SW - Software; E/E - Electrical/Electronic; Dev - Development

Source: 'Software-Defined Vehicles – Revolutionizing the Automotive Industry' report by Strategy&

Increasing Share of SW Revenue

- OEMs set to diversify from traditional revenue sources (car sales & aftermarket services)
- Future revenues expected to increasingly come from digital services and software-enabled features like
 - Subscription models (e.g. OTA updates)
 - Pay-per-use offerings for advanced driver assistance systems (ADAS), and
 - Connected devices, real-time response, personalized features & services
- Tech giants and new automotive players to increasingly generate revenue from the new digitally-enabled services

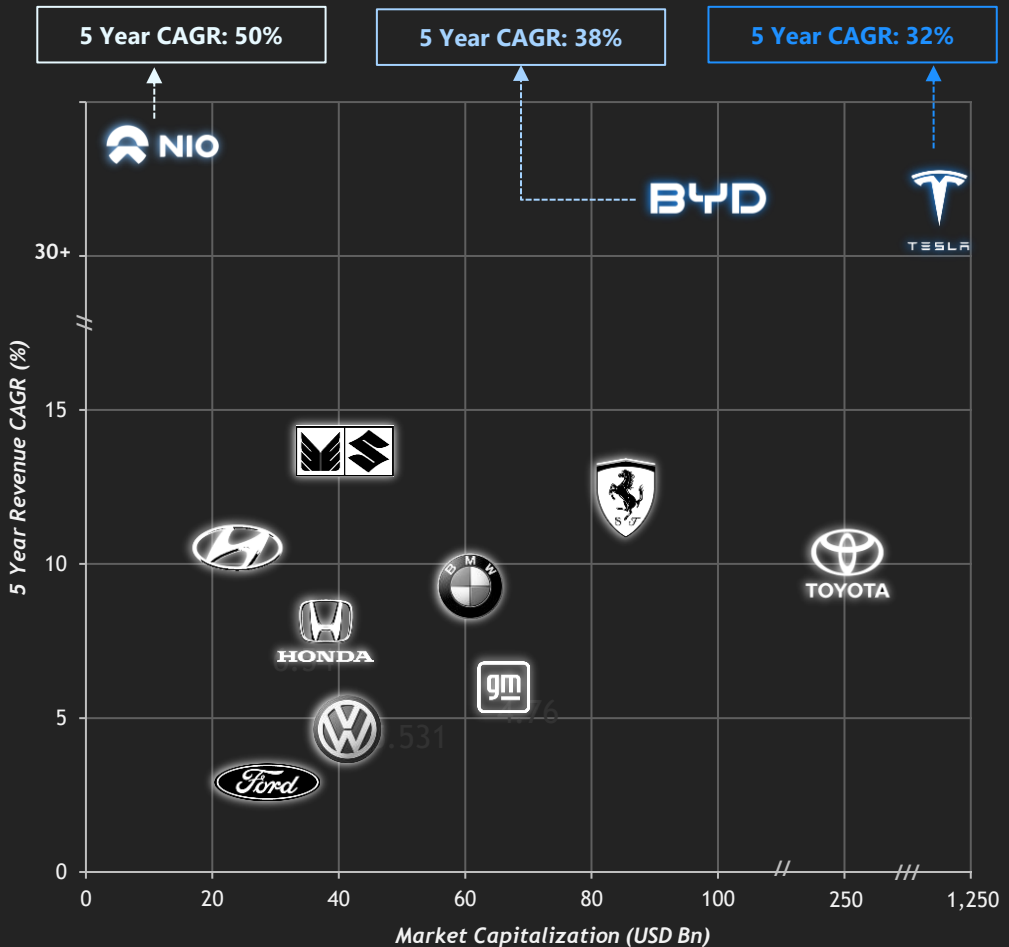
Automotive revenues (USD Bn)



Source: 'Moving into the Software-Defined Vehicle Fast Lane' report by Accenture

Domination by New-Age OEMs

Top OEMs by Market Cap and Revenue Growth



- Traditional OEMs are facing challenges in linking R&D decisions to value generation in software-defined vehicles
- On the other hand, newer OEMs with a strong focus on SW and new-age technologies like have sustained higher market cap and revenue growth

Source: Company financial statements and market data

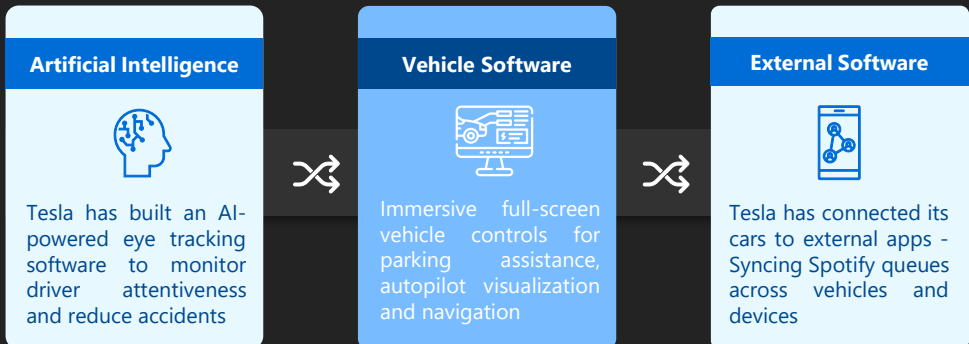
Tesla – Redefining Mobility

Headquartered out of Texas, Tesla is one of the world's fastest growing electric vehicle (EV) manufacturing companies.

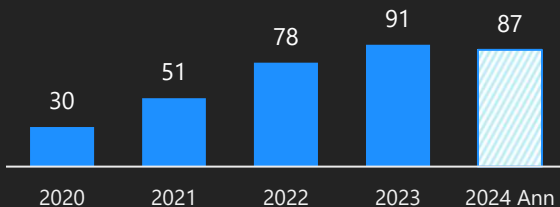
Owing to its focus on energy transition, R&D and software-integration in vehicles, Tesla is able to stand out from its peers in the automotive segment whilst commanding a USD 1+ Tn market capitalization



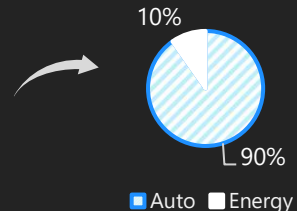
Foraying Into All Aspects of the Next-Gen Vehicle



Tesla's Automotive Revenue (USD Bn)



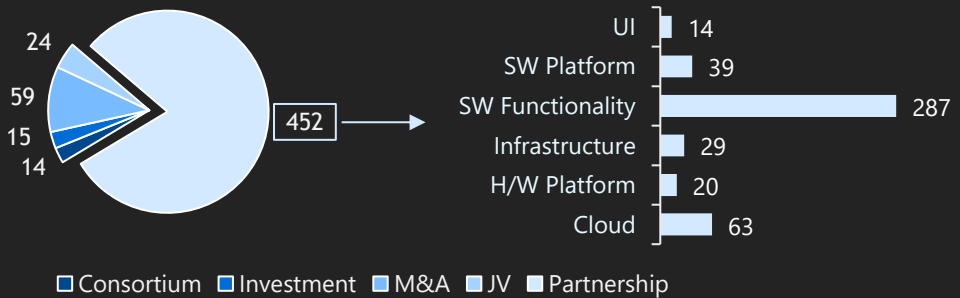
Tesla's Total Revenue



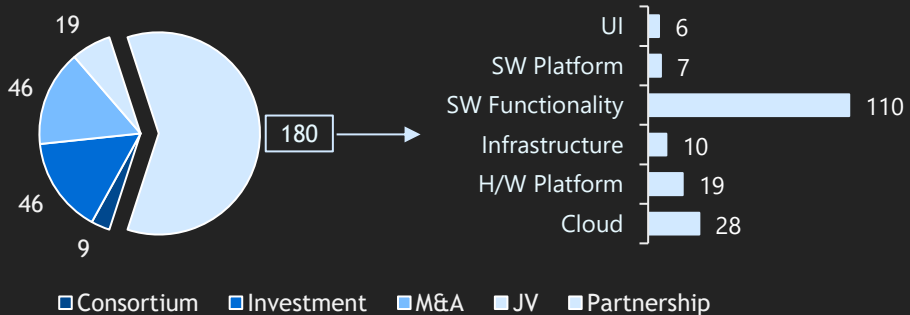
Source: Annual report and company website; Ann – 9m Annualized

Partnerships Across the SDV Stack

Activities of OEMs in the SDV Space



Activities of Tier1s in the SDV Space



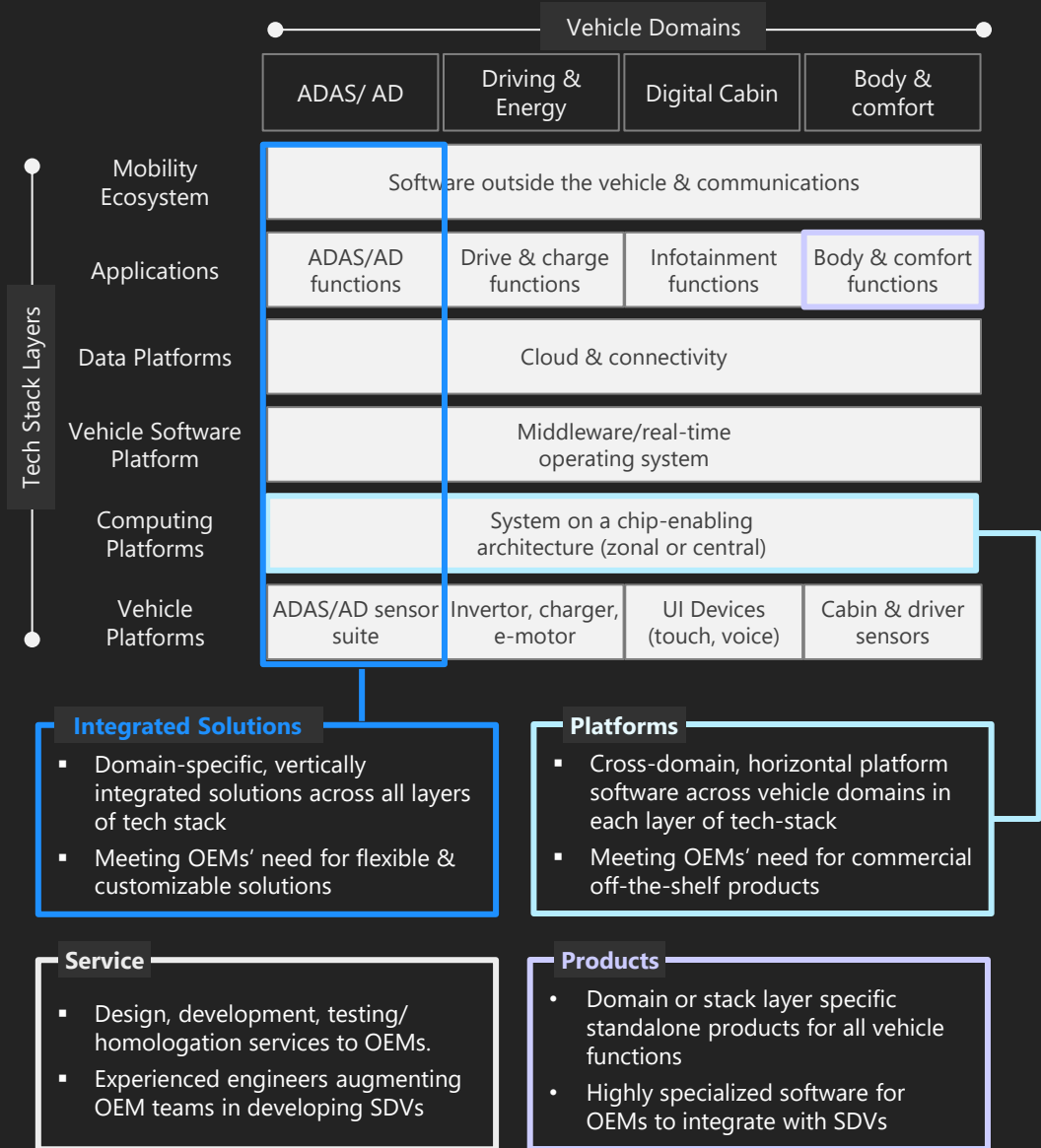
- In traditional mfg. models OEMs and Tier 1 suppliers operated in defined silos
- Advent of SDV has driven deeper collaboration with technology providers specializing in software platforms, operating systems, cloud infrastructure, and AI-based solutions
- These partnerships enable seamless integration of complex software stacks, centralized computing architectures, and connectivity frameworks into SDVs

^ Activities of Top 10 OEMs and Tier 1s in terms of revenue (over the last 10 years); H/W - Hardware; SW - Software
Source: 'At the Crossroads of Software-Defined Vehicles (SDV)' report by Ernst & Young



Automotive Software Landscape

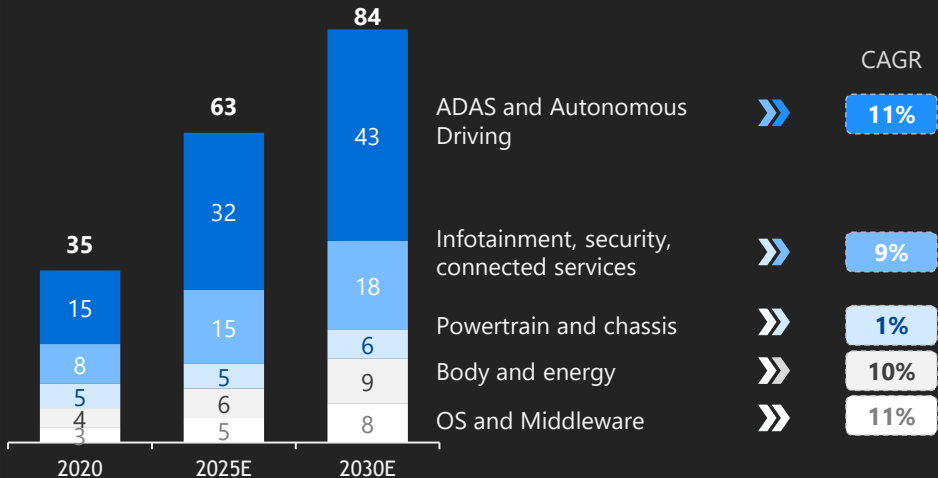
Emerging Business Models



^ ADAS = Advanced Driver Assistance Systems; AD = Autonomous Driving
Source: BCG research

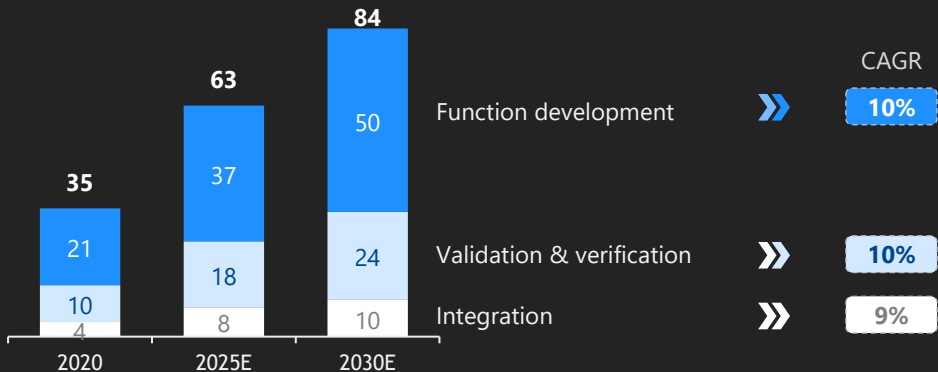
Expanding Automotive SW Market

Automotive Software Market (USD Bn)



As auto players look to strengthen tech capabilities, there is strong focus on operating systems, autonomous & assisted driving

Split by Offering (USD Bn)



Rising demand for advanced functionality & system validation in the evolving automotive software industry

Source: 'Automotive Software and Electronics 2030' report by McKinsey & Company

Tech Services Cos. in the Ecosystem

Large IT Service Providers

accenture

Capgemini

tcs

Tech Mahindra



Infosys

HCLTech

Cognizant

Coforge

Well established, legacy corporations that were set up as IT shops. However, now these companies are ramping up their R&D spend – signaling confidence in the ER&D market

Domestic ER&D Experts



KPIT

CYIENT



India based, pure-play ER&D/ engg. focused companies with dedicated BD teams

Foreign ER&D Experts

AKKODIS



bertrandt

(expleo)



Visteon



Engineering companies focused on asset-heavy verticals such as automotive and A&D

High Growth Service Providers

<epam>

Globant



GlobalLogic



IT companies with focus on digital engineering services, now adding capabilities in the automotive segment

^ ER&D – Engineering, Research & Development; Engg. - Engineering

Trajectory of Indian Enterprises

Indian companies' expertise in software development for global OEMs, coupled with shifting geopolitical dynamics and supply chain realignments, positions them to gain a strategic advantage and drive innovation in the evolving SDV landscape.

KPIT

In 2018, KPIT restructured its operations: demerging its Business IT segment into Birlasoft Limited to become a dedicated automotive software company

15K+

Employees

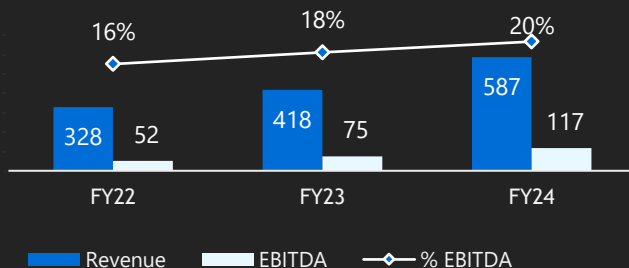
7x

EV/Revenue

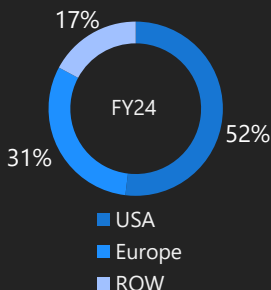
36x

EV/EBITDA

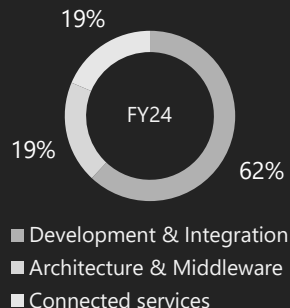
The company specializes in the passenger car segment and has achieved a CAGR of 33.8% over the past three years.



Revenue by Geography



Revenue by Service offering



OEM Partnerships



[^] All values in USD Mn (wherever applicable)
Source: Annual reports and company filings

KPIT's Inorganic Growth Initiatives

Historically, KPIT has pursued strategic partnerships to drive inorganic growth and enhance its technological capabilities especially its SDV offerings

KPIT

25+

Years of experience in the space

20 Mn+

Vehicles with KPIT SW

25+

OEMs/Tier 1 Partnerships along with 6 SDV programs

80+

Ready Platforms



October 2024

- **Board approved proposed QIP of USD 339 Mn** for likely tuck-in acquisitions



December 2023

- Made **Strategic investment in AirConsole**, a Switzerland-based in-car gaming platform



May 2023

- **Sold 50% stake in Qorix**, previously a wholly-owned subsidiary, to ZF Group
- KPIT and ZF Group aim to **jointly develop** automotive middleware platforms and solutions for the mobility ecosystem



September 2022

- **Acquired Technica Engineering for USD 114 Mn**, a Munich-based company specializing in electric and electronic vehicle architecture.
- This enabled KPIT to create across-the-stack expertise offering a one-stop shop for transformation towards SDV

Source: Annual reports and company filings

Tata Elxsi – SW Provider for OEMs

Tata Elxsi is strengthening its focus on SDV-related engagements with OEMs across the globe. Currently, the company has on-boarded 5 Global OEMs and has signed multi-year contract with a major American Tier 1 supplier



Tata Elxsi offers a range of SDV services including its Connected Vehicle Platform – TETHER (cloud based and powered by IoT and AI/ML) & automotive core software

16k+

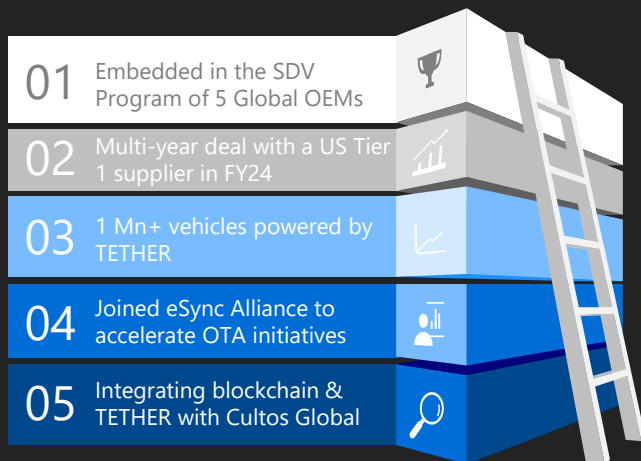
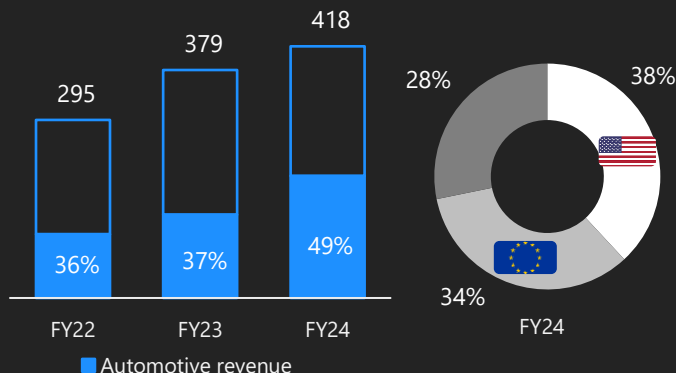
Employees

11x

EV/Revenue

39x

EV/EBITDA



^ All values in USD Mn; OTA= Over-the-air
Source: Annual reports and company filings

Global Expansion of Tata Tech

Tata Motors has been the largest customer of Tata Technologies over the years. However, the entity now derives a growing share of revenue from global OEMs (64% of revenue from foreign customers in FY24)



Offerings span outsourced engineering, digital transformation and educational services, focusing on the EV and SDV segments

15k+

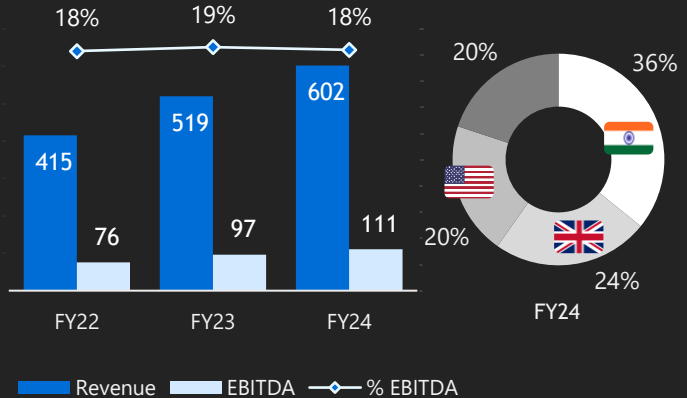
Employees

7x

EV/Revenue

38x

EV/EBITDA



Joint Venture



Each entity will hold 50% stake in the JV – BMW TechWorks India



JV will innovate automotive software including SDV and digital transformation solutions



Tata Technologies will drive key software projects for BMW's future mobility solutions

[^] All values in USD Mn; USD
Source: Annual reports and company filings

Other Notable Players

- Legacy tech service players are increasingly positioning themselves as strategic technology partners for SDV OEMs and Tier 1 suppliers
- Focus is on enhancing capabilities in high-growth areas like autonomous systems, investments in R&D and targeted acquisitions of niche technology players



USD 1.2 Bn
FY24 Revenue



32.8%
Transportation



Global OEMs
Partnerships

Transportation - Automotive dominant segment with a strong focus on SDVs, AI and vehicle cybersecurity

CYIENT



USD 714 Mn
FY24 Revenue



USD 160 Mn
FY24 EBITDA



16k+
Employees

Specializing in product engineering with focus on SDV, connected cockpits and zonal architecture

Key Private Players



^ All values in USD Mn; USD

Quest Global

Strategically Positioned to Capitalize on the SDV Opportunity

To leverage the future growth potential of the automotive sector, Quest has pursued inorganic expansion to strengthen its SDV capabilities and offer these services to its existing automotive clients through cross-selling

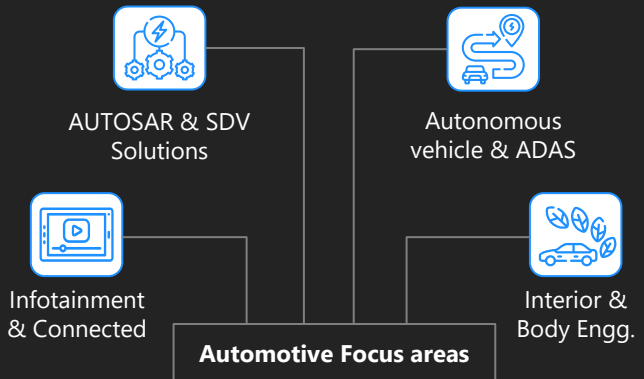
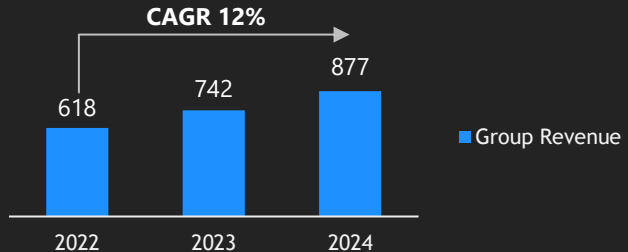


End-to-end ER&D company with deep expertise across SW & mechanical engg., testing & automation in the automotive segment, especially SDVs

20K+
Employees

17
Acquisitions in last 10 years

60+
Global locations



Preferred Partner of Major PE Firms over the years


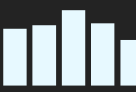
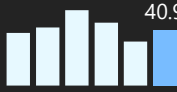


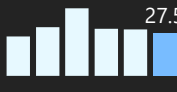









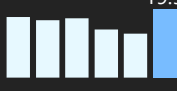

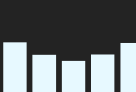



THE CARLYLE GROUP

[^] All values in USD Mn; Engg. - Engineering
Source: Annual reports and company filings

Market Multiples

Automotive ER&D Companies in India

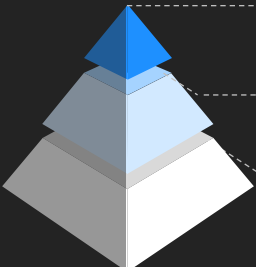
Company	Revenue LTM	3 Yr CAGR	QoQ Growth*	EBITDA LTM	EV/LTM Revenue 6-Month Trend	EV/LTM EBITDA 6-Month Trend
 TATA ELXSI	443	↑ 25%	↑ 3%	121	 11.6x	 40.9x
 L&T Technology Services	1,193	↑ 21%	↑ 5%	212	 5.2x	 27.5x
KPIT	646	↑ 34%	↑ 8%	119	 7.3x	 37.2x
CYIENT	860	↑ 20%	↑ 3%	132	 2.9x	 17.7x
 TATA TECHNOLOGIES	615	↑ 29%	↑ 2%	106	 7.1x	 39.7x
 AXISCADDES <small>Industrial Solutions. By Design.</small>	117	↑ 22%	↑ 18%	13	 2.6x	 19.9x
 SASKEN	55	↑ 0%	↑ 9%	2	 6.8x	 NM
					Mean	30.5x
					Median	32.3x

^ NM – Not Meaningful; Multiples as on 31st December 2024; *Quarter ended 30th September 2024; All values in USD Mn
Source: CapitalIQ

Key M&A Deals in the SDV Space

Acquirer	Target	Target Description	EV	Rev	EV/ Rev
	 tttech auto	Austria based company developing safety-critical systems & middleware for SDVs	» 625		
		US based provider of engineering solutions to A&D, automotive and industrial clients	» 1,300	800	1.6x
		Germany based automotive application lifecycle management company	» -	-	-
		Germany based automotive software developer	» 480	187	2.6x
		Germany based automotive engineering services company	» 268	172	1.6x

Valuation Drivers in the ER&D Space

	EV/ EBITDA	Financial		Business	Delivery
		Revenue	Growth	EBITDA	Cust Conc. Model
	High	>100 Mn	>25%	>20%	Medium Annuity-led FP
	Medium	50-100 Mn	10-25%	10-20%	Concentrated T&M + FP
	Low	<50 Mn	<10%+	<10%	Diversified T&M

Other Key Factors Driving High Valuation Multiples



An optimal mix of onshore and offshore delivery



High %age of US & Europe based clients



Industry veterans at the helm of the management

^ All transactions mentioned above are from 2023 and 2024; Rev – Revenue; All values in USD Mn (wherever applicable)
Source: Company filings and announcements

o3 Capital Advised PTG on its Acquisition by Quest Global



Deal-Making in the SDV Space


Deal Rationale



Singapore based engineering and R&D company



US based product engineering company



Operational

Enhances vehicle connected system capabilities of Quest

Capitalizes on growing Digital Cockpit Solutions market led by SDV

Exclusive partnership with Global OEMs



Financial

Increase in revenue of Quest by 10% with this acquisition

Margin Accretive Acquisition

Positions Quest strategically on the path to IPO

o3 Capital has been an indispensable partner throughout the transaction journey. Their unwavering persistence, strategic insights, and expertise played a pivotal role in identification of a world class partner and their innovative thinking & expertise in structuring deals were instrumental in achieving the desired outcomes

Vishwa Prasad, CEO at People Tech Group

o3 Capital acted as the exclusive financial advisor to People Tech Group

o3 Capital Transactions

219

Transactions
closed

\$11B

Total
Transaction value

15

Transactions Closed in
Last 12 Months

Select Technology Transactions



L&T Technology Services

intelliswift
love the new

Intelliswift acquired by
LTTS for USD 110 Mn



TAO DIGITAL™
Transformation Made Simple

VESPER

TAO Digital raised
growth funding from
Vesper Company



SYNAPSE
design

Synapse Design
acquired by Quest
Global

cā dence®

invecas

Invecas acquired by
Cadence Design
Systems



TESSOLVE
A Hero Electronics Venture

Novo Tellus invested
in Tessolve

ACCORDION

merilytics

Merilytics acquired by
Accordion Partners

Orion Innovation

SRYAS™
Your Business. Your Way.

Sryas acquired by
Orion Innovation
(backed by One
Equity Partners)



ADEPT

Quest Global
acquired
Adept Chips



AXISCADES
Imagined Solutions. By Design

AxisCADES raised debt
for closing the
acquisition of Mistral
Solutions

ESW | CAPITAL

MBI Digital

ESW Capital exits its
portfolio company
MBI Solutions



truenorth
CHRYSCAPITAL

ChrysCapital &
TrueNorth acquired
minority stake in
Quest Global

infostretch

EVERSTONE **Goldman Sachs**

Everstone & GS
acquired majority
stake in Infostretch

Expertise Across Healthcare, Life Sciences, Consumer, Digital & Financial Services

Blackstone

evercare

Blackstone acquired a
majority stake in Care
Hospitals



Baring Private
Equity Asia

AIG
HOSPITALS

BPEA invested in
AIG hospitals

La Renon

CHRYSCAPITAL

Chrys Capital's
acquisition of
minority stake in La
Renon



BOMBAY SHAVING COMPANY

MALABAR INVESTMENTS

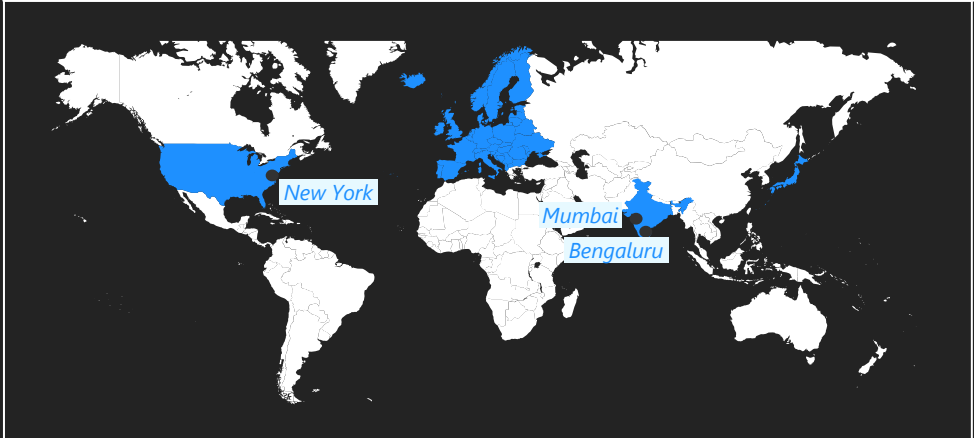
الخليج للاستثمار الإسلامي
Gulf Islamic Investments
(YOUR PARTNER FOR GROWTH)

Bombay Shaving
Company raised funds
from Malabar, GII and
others

• Color denotes o3 Capital's client

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