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Topic: Creating a software service offering to address the automotive Software Defined Vehicle (SDV) transition challenges

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Intro

The automobile industry is undergoing the most significant transformation of its 100-year history. This transformation is driven by consumers' desire for vehicles to integrate with their digital life. Digital native consumers are asking - why my $50,000 car cannot do what my $300 smartphone does. Such questions are traditional automakers to embark on a journey to re-engineer the vehicle as a platform defined by software while they are being challenged by new technology players, especially in EVs.

Software-defined vehicles represent the next frontier in transportation evolution, laying the groundwork for multiple advancements, such as autonomous vehicles and integration into intelligent transport networks leveraging cloud technology. The evolution of software-defined vehicles entails fundamental shifts in vehicle electrical and electronic architecture, enabling new functionalities such as autonomous driving, hyper-personalization, continuous communication with infrastructure, etc. This paradigm shift extends to constant updates and evolution of vehicle functions throughout the vehicle's life cycle. Consequently, vehicles are transitioning towards a software-defined paradigm, enabling robust interaction with their surroundings through sensor arrays, actuators, information processing, and communication systems, making vehicles a data center on wheels (modern vehicles can potentially create 1 TB of Data daily) [49].

Though software-defined vehicles unlock unprecedented possibilities for enhancing vehicle functionality and transforming transportation systems, OEMs (especially legacy players) face multiple challenges in adopting SDV and making this shift.

Original Equipment Manufacturers (OEMs) [1] encounter several challenges when adopting Software-Defined Vehicles (SDVs).

According to McKinsey's research, the software codes on each vehicle have exceeded 200 million lines, and the market scale of automotive software and related services has exceeded 24 billion US dollars, which will continue to increase at high speed in the next 5–10 years [2]

This transformation opens up new opportunities for Digital Service companies like GlobalLogic, which have robust and complex software product engineering expertise.
As a part of GlobalLogic, a leader in Digital Product engineering, we have worked within the Automotive domain for more than 20 years, gaining experience and observing the challenges of OEMs and Tier1s in transition.

As part of a 30,000+ people global solid organization with one of the biggest engineering centers in Ukraine (TOP3), we worked with prominent industry leaders and got access to multiple ecosystem partners.

Leveraging both company and personal experience, our team has worked to define an Offering that will help OEMs and Tier1s in their SDV journey, explicitly focusing on Cloud-Powered SDV Infrastructure that is an enabler for any OEM or Tier1 in a true SDV transformation. This infrastructure setup was possible with advances in the Cloud field, primarily driven by AWS [3] and new Automotive tools and frameworks that became available on the AWS platform and the availability of AWS ARM-based Graviton Machines and QNX Licenses through EC2 machines.

This offering also serves a role in differentiating GlobalLogic from other service players and opening up new business opportunities in the growing SDV market.

The biggest challenge was to create an offering in an early stage of technology development and to create needed proof points for our clients that would give us a competitive advantage in this niche and get first projects and revenue with a new offering. Besides that, as this has been driven entirely by the Ukrainian team, we had a practical challenge of selling our offering without any client visits and creating a pitch that would work in the remote setup.

This work will focus both on market study and specifically trends of SDV and Zonal E/E Architectures, which is tightly connected; challenges OEMs and Tier1s experience with growing software complexity, that results in quality issues, production delays and commercial losses and approach of Cloud-Powered SDV Infrastructure that can become an enabler to resolve given challenges.

This project aims to create an offering, validate the offering with the market, acquire clients through that offering, generate an additional revenue stream, and create differentiation for GlobalLogic in the Automotive market. During this project, we will explore existing market advancements and trends. We will focus on creating tangible artifacts that will allow us to have meaningful client discussions and will create a new service revenue stream.

Market Research

The Change and the Market

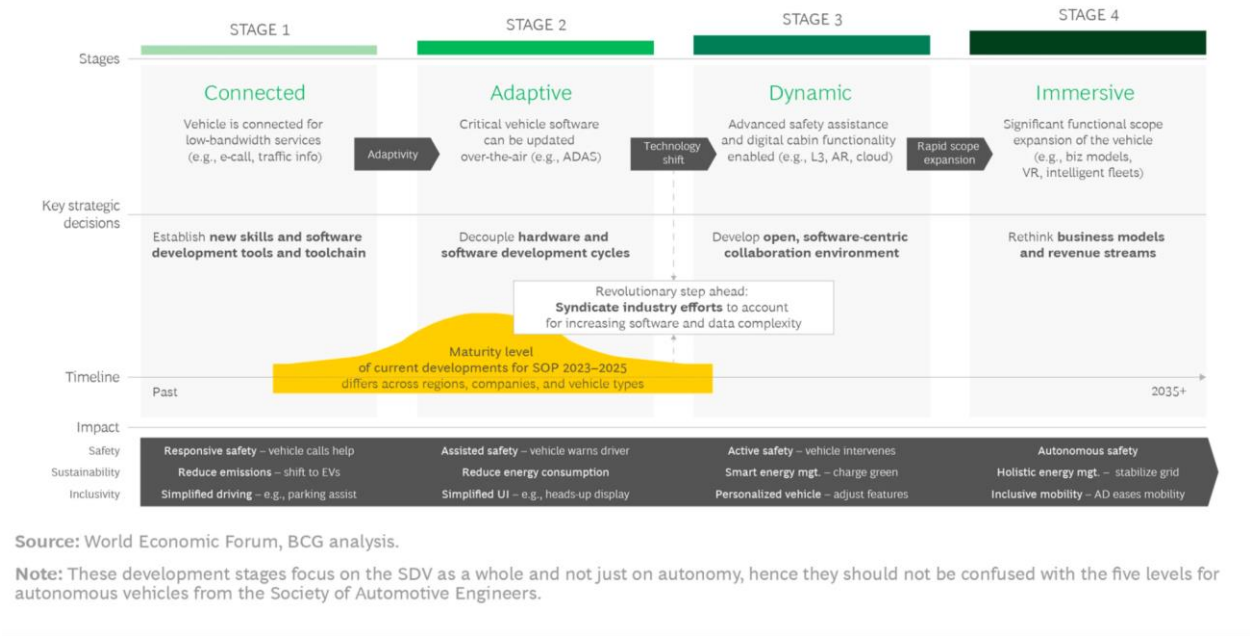
The next round of reform fueled by energy, connectivity, and intelligence advancements is taking place in the automotive industry. The connectivity revolution facilitates seamless data interaction, while the intelligence revolution enhances data utilization. These revolutions give rise to new automotive technologies, infrastructures, research and development (R&D) methodologies, manufacturing processes, and service models. Ultimately, this transformation reshapes the industrial ecosystem, paving the way for innovation and progress. [4]

Redefining traditional norms, cars are moving from combustion-powered, mechanical means of transportation to EV/new energy-focused software-defined vehicles (SDVs) [5].

Software-defined vehicles garner more attention due to their profound effects on the automotive industry ecosystem, spanning technologies, products, services, and enterprise competition. [6].

By 2030, the introduction of software-defined vehicles is projected to generate over $650 billion in value for the automotive industry. According to an analysis conducted by BCG on the growth of software-defined vehicles (SDVs), revenues for Original Equipment Manufacturers (OEMs) from automotive software and electronics are anticipated to increase nearly three-fold from $87 billion to $248 billion. Additionally, the supplier market for automotive software and electronics is expected to nearly double, rising from $236 billion to $411 billion. [7]

Based on BCG View, we are on the verge of a technology shift, creating an additional opportunity of $2,600 per vehicle for the value market and $7,500 for the premium market vehicle segment. [8]



Source: World Economic Forum, BCG analysis.

Note: These development stages focus on the SDV as a whole and not just on autonomy, hence they should not be confused with the five levels for autonomous vehicles from the Society of Automotive Engineers.

Image 1. Development Stages of SDV [8]

What is SDV and Why Now

In 2018, "Software-defined vehicles" became a hot industry topic; in 2019, Volkswagen CEO Herbert Diess said that Volkswagen would become a software-driven car company [9] (Ironically, we would lose his CEO position later, as VW had issues with their software on ID vehicle models) [50].

Software-Defined Vehicle (SDV) is when the car relies on computer software to do various tasks, such as driving, safety, comfort, etc. Instead of just using mechanical parts, SDVs rely on software for most of its functionality.

In the past, cars were all about powerful engines and showing off fancy exhaust pipes. Consumers would talk about what transmission is installed in the vehicle, how many cylinders the engine has, etc.

Today, four significant advancements - electric power, self-driving features, ride-sharing, and internet connectivity - are simultaneously shaking up the car world. On top of that, new companies are focusing on tech-savvy customers by creating "smartphones on wheels" - vehicles with big screens, easy internet access, and frequent software updates. [10]

At the same time, people are getting frustrated because their cars, in many cases, are far from the cool features and user-friendliness their smartphones have. They wonder why a $50,000 car can't do the same things as a $300 phone.

This frustration and new market players like Tesla pushed the idea of an SDV - a car like a fully programmable computer. New features can be added in months instead of years, and the car can get better over time with regular updates. But the car industry faces challenges in making this happen fast. Software is getting more complex, with hundreds of millions of lines of code needed for advanced features like self-driving. Plus, old-fashioned ways of developing automotive products and software slow things down.

Like how old phone brands like Nokia and BlackBerry were left behind by smartphones, traditional car companies could face a similar fate.

Now, the automotive industry must figure out how to succeed in the digital age. This means putting software first and designing cars around what customers want digitally. It also means a significant paradigm shift, potentially transforming the vehicle from a one-off device to a “platform” that can enable continuous addition of new services, refreshing it over the ownership cycle and finding the "killer

apps"—the must-have features and experiences that will drive the success of future vehicles.

To meet the customer-centric development and continuous improvement needed to achieve the usability goals mentioned earlier, the development process of SDVs must accelerate significantly. This means reducing the time it takes to introduce new features to the market.

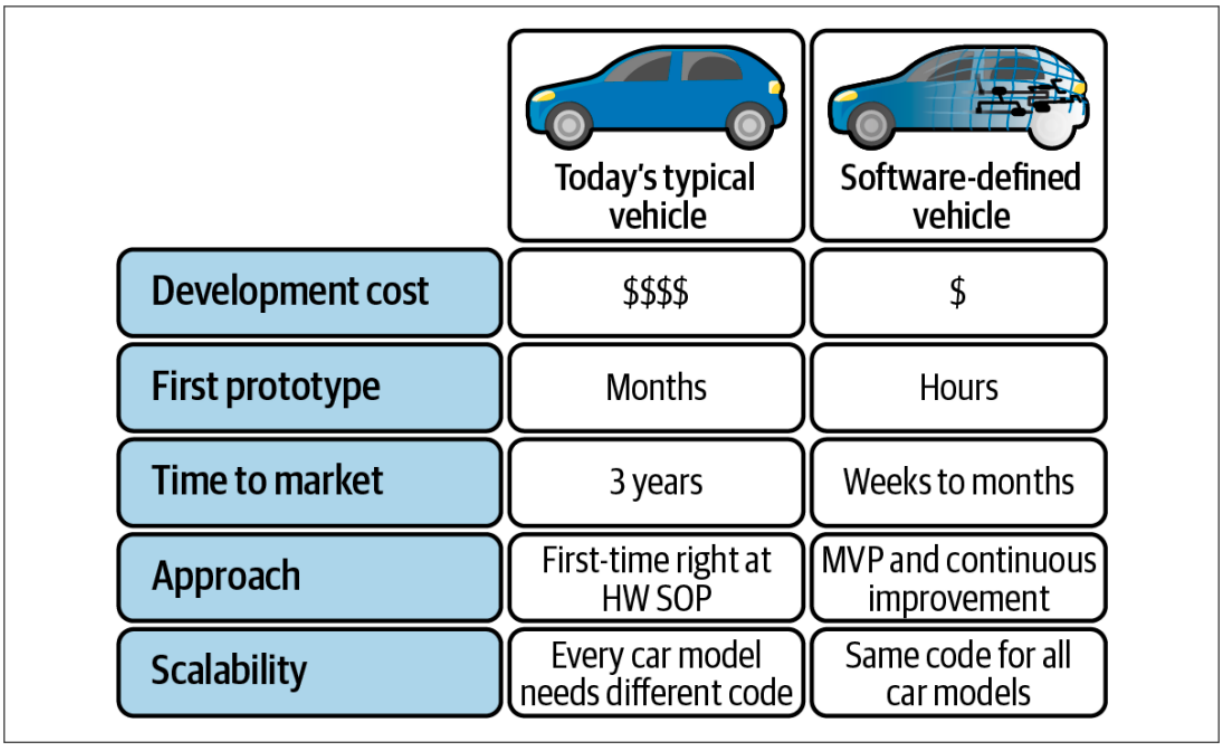


Image 2. “The Need for Speed” [10]

The analysis suggests that if executed effectively, the transition could yield significant benefits: up to a $7,500 increase in margin per car in the premium segment and up to $2,600 in the volume segment, achieved through higher realized prices and reduced bill of materials. Additionally, there's a potential for $2 billion to $2.5 billion in savings and margin improvement across OEMs' value chain through HW standardization and lowering number of HW components. [8]

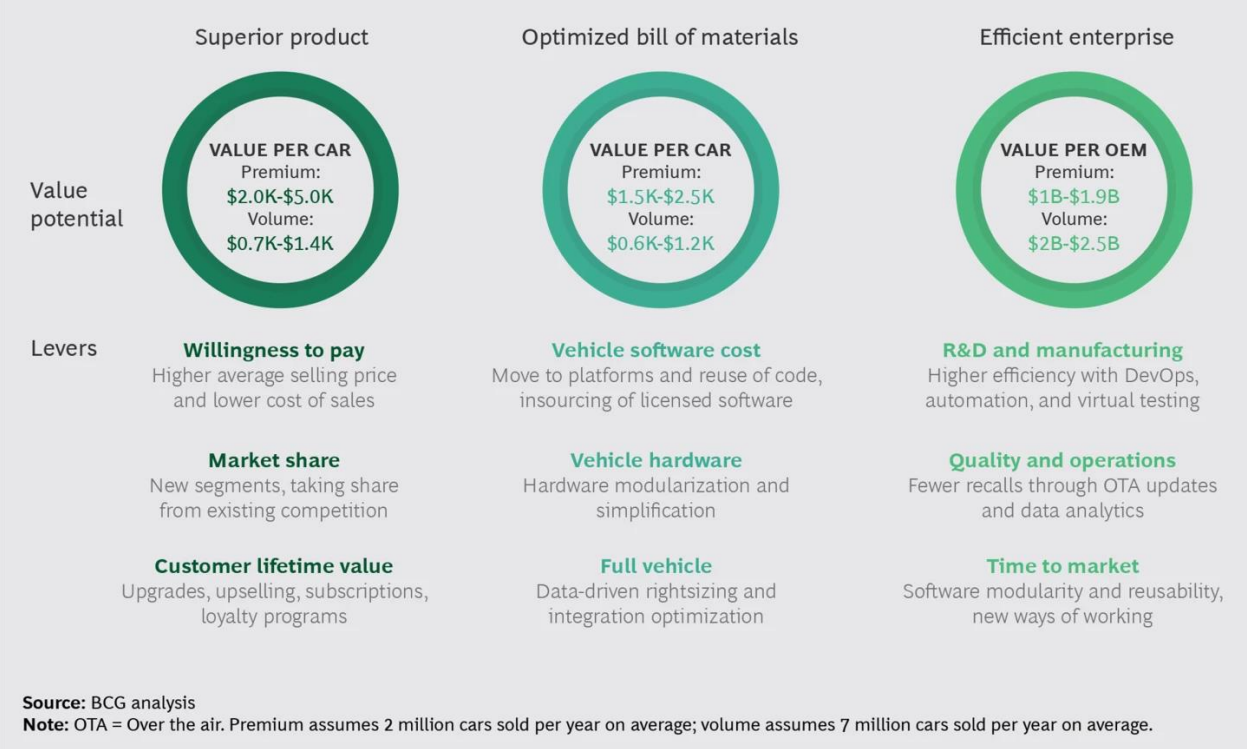


Image 3. “Three Ways to Create Value from Software-Defined Cars” [8]

Growing Software Complexity in Vehicles

Due to transformation, the complexity curve of Software in a Vehicle is growing exponentially, creating a massive challenge for Automotive enterprises and requiring a new way of working.

Up until the early years of the previous decade, automotive engineering primarily focused on mechanical design. Electrical and electronic (E/E) components and software were mainly utilized for basic functions like infotainment, body control, security, and safety features. These elements were typically compartmentalized and controlled through separate systems. The majority of complexity stemmed from the interactions between mechanical systems. In a system with N mechanical elements, the maximum complexity could be represented as N

elements interacting with N-1 elements, resulting in complexity following an N^2 curve. [18]

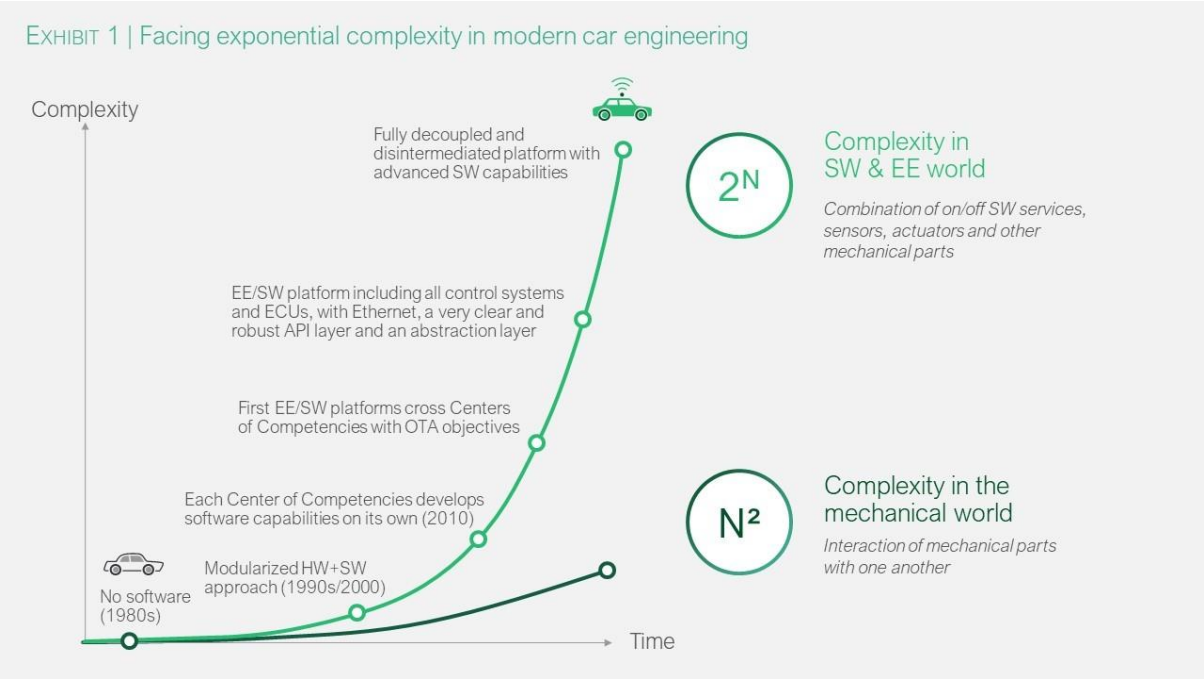


Image 4. Facing exponential complexity in modern car engineering [18]

The complexity of automotive software is increasing significantly at both the functional and architectural levels, yet development productivity is not keeping pace with this growth. According to McKinsey research, software complexity has quadrupled over the past decade, while software development productivity has only increased by a factor of 1.0 to 1.5. This challenge becomes especially evident when dealing with extensive modules like infotainment and advanced driver-assistance systems (ADAS), whose complexity is continuously growing. Productivity for these modules is approximately 25 to 35 percent lower than traditional deeply embedded software.

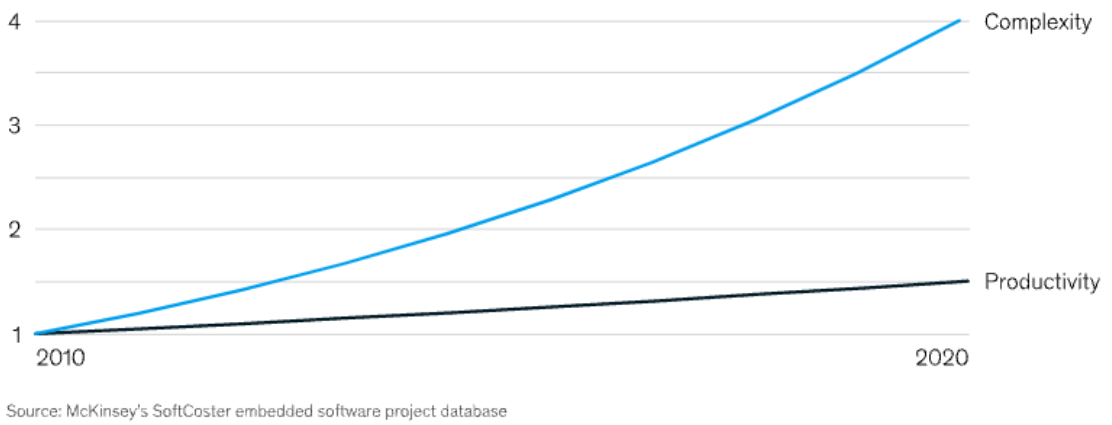


Image 5. Relative growth of software complexity and productivity over time, indexed by automotive features [19]

Besides that, Automotive players are falling behind in productivity compared to the tech leaders.

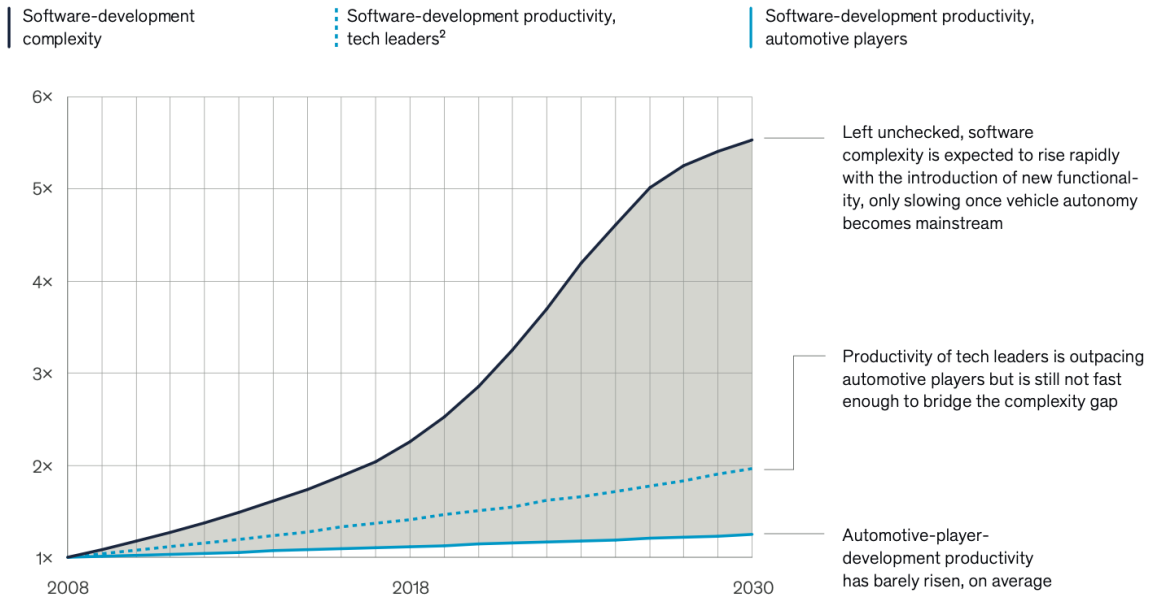


Image 6. Relative growth over time for automotive features [25]

Data collected at Volvo Cars [20] indicates that a vehicle from 2020 contained approximately 100 million lines of code (LOC). To put this into perspective, this amount of software is equivalent to the content of about 6,000 average-sized

books, sufficient to stock a decent town library. This extensive software is responsible for implementing various functionalities such as electronic fuel injection, transmission control, engine control, cruise control, integrated powertrain control, adaptive suspension, multiplex networks, navigation systems, stability control, infotainment, collision mitigation, collision avoidance, advanced driver-assistance systems, active safety features, connectivity, and numerous other advanced features.

Suppose this trend persists over the next ten years, particularly with the advent of autonomous driving and connected cars. In that case, it is projected that by 2030, Volvo Cars vehicles will contain software equivalent to the number of books in the MIT Science Fiction Society Library. This collection encompasses 90% of all science fiction books printed in English (as of 2010). That means that future vehicles will contain from 300 to 500 million lines of code [23], making vehicles one of the most complex software products on the planet [24].

Platform	Lines of Code
MS-DOS	~4,000
Windows 10	~10 – 80 million
MacOS X	~84 million
Android	~12 million
iOS	~12 million

Image 7. The average amount of lines of code in the operating system [26]

According to measurements taken at Volvo Cars [20] up to the year 2020, the entire source code contains approximately 10 million conditional statements. These statements are responsible for decision-making and looping within the code. Additionally, around three million functions are defined throughout the

source code, which is called upon at approximately 30 million locations within the code. Many of these functions perform tasks during the vehicle's runtime.

The likelihood of a function producing incorrect results depends on various factors, such as the programmer's skill, the code's cleanliness, and the quality of tests. Even if this probability is extremely small, such as 0.0001, post-development defects can still accumulate into the hundreds. This is not necessarily due to a lack of skill among developers or poor testing practices but rather because the overall complexity of the code is remarkably high. Such complexity inherently increases the probability of defects occurring purely by chance.

Based on the 2023 State of Automotive Software Development report by Perforce, 32% of surveyed professionals indicate that the existing code base is too complex [21]

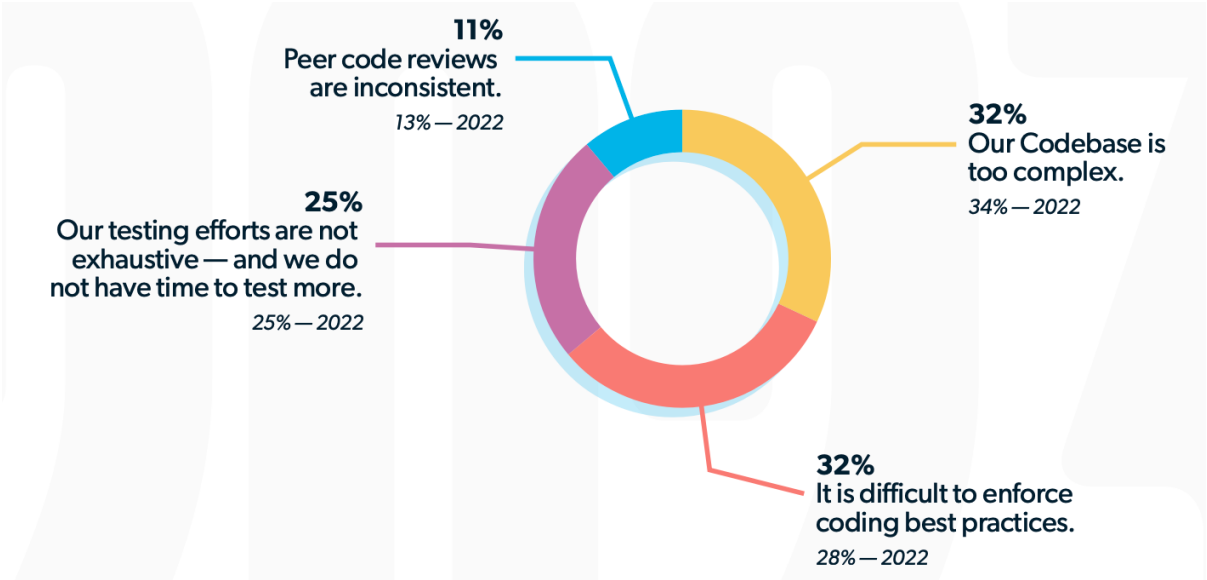


Image 8. Quality concerns [21]

Most people indicate significant testing concerns and efficiency [21].

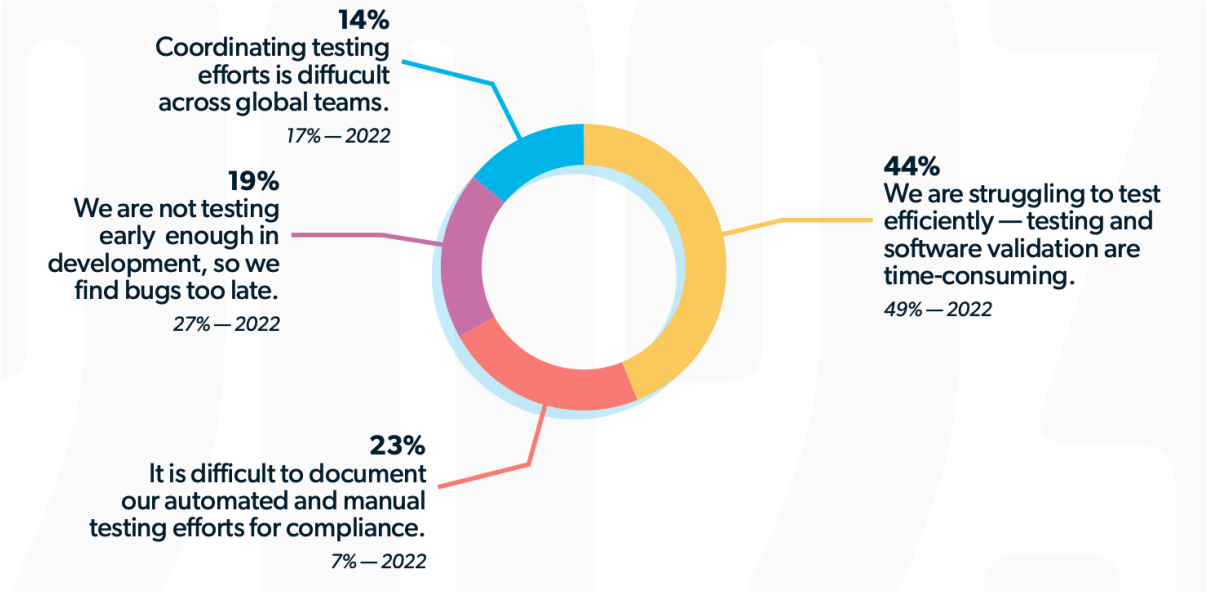


Image 9. Testing Concerns [21]

OEMs are the ones who struggle with testing the most, as they have to work with all component software issues.

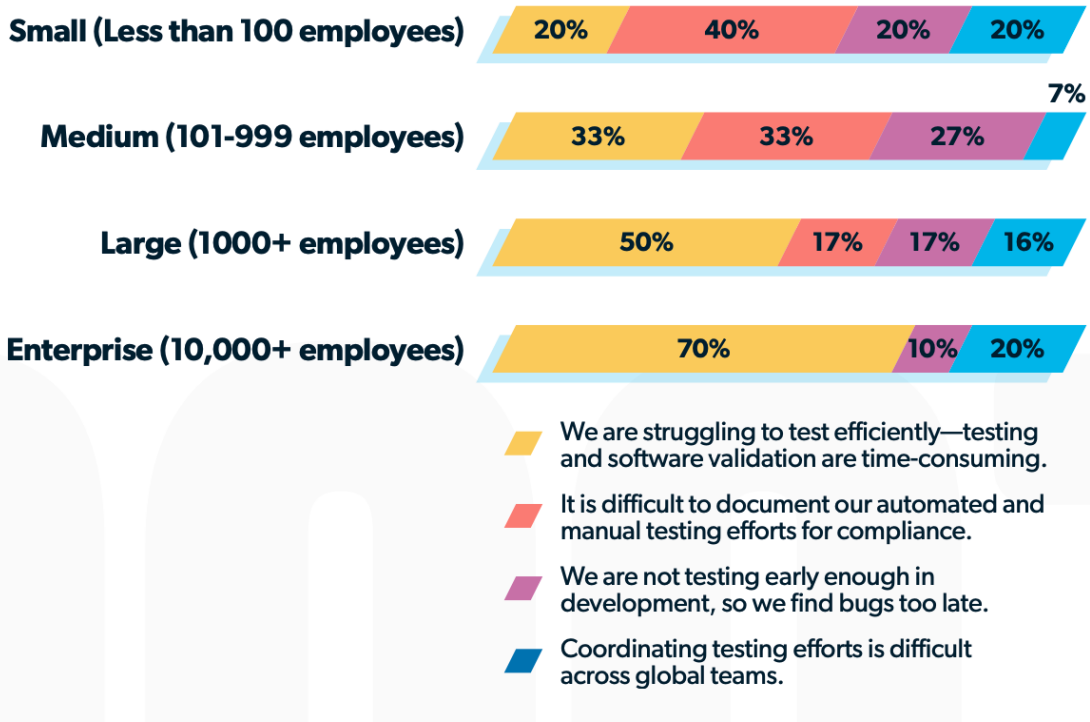


Image 10. Testing Concerns by Organization Size [21]

Both complexity and quality challenges are pushing OEMs to review their architecture and ways of working and creating tectonic shifts in automotive software development, which we will explore further.

Shift in Vehicle E/E Architecture, the era of Zonal and SOA

Today, "E/E architecture" refers to the overall design and arrangement of electrical and electronic systems within a vehicle. This architecture covers how power, data, and control signals are distributed throughout the vehicle and how various electrical and electronic components and systems are integrated and connected. Many vehicles still employ a distributed architecture, where hundreds of Electronic Control Units (ECUs) are distributed across the vehicle, each of them having a specific function and interacting with other ECUs and domain-centric E/E architecture, where different vehicle domains (like the powertrain, chassis, passenger compartment, and body) are grouped logically and linked by dedicated bus systems, such as the Controller Area Network (CAN) bus. The CAN bus is a protocol designed to facilitate reliable communication between ECUs and other computing nodes in a vehicle in a prioritized manner.

Due to the complex and heavy wiring harnesses resulting from the domain-centric E/E architecture, OEMs are adopting zonal architectures.

Current E/E architectures with domain controllers and a central gateway have grown over time and become very complex and require a lot of wiring that leads to [16]:

- The Wiring Harness is 3rd heaviest part, is up to 80 kg and growing
- The absolute length of wiring is up to 5 km and is growing
- 3rd highest cost component, with a high cost of labor (1000+ production minutes)

Image 11. Modern Car Wiring Harness [16]

Wiring harnesses are less needed in a zonal E/E architecture, leading to simplified connections within individual zones. Reducing complexity and weight enables easier integration of new features and technologies. Zonal architectures typically involve combining dedicated zone controllers with high-performance vehicle computers. These zone controllers are locally connected to various sensors and actuators, often utilizing legacy bus systems like CAN, Local Interconnect Network (LIN), and FlexRay. The zone controllers are then interconnected with each other and high-performance vehicle computers via new on-board, high-speed networks based on Ethernet, which form the foundation of today's internet. [10]

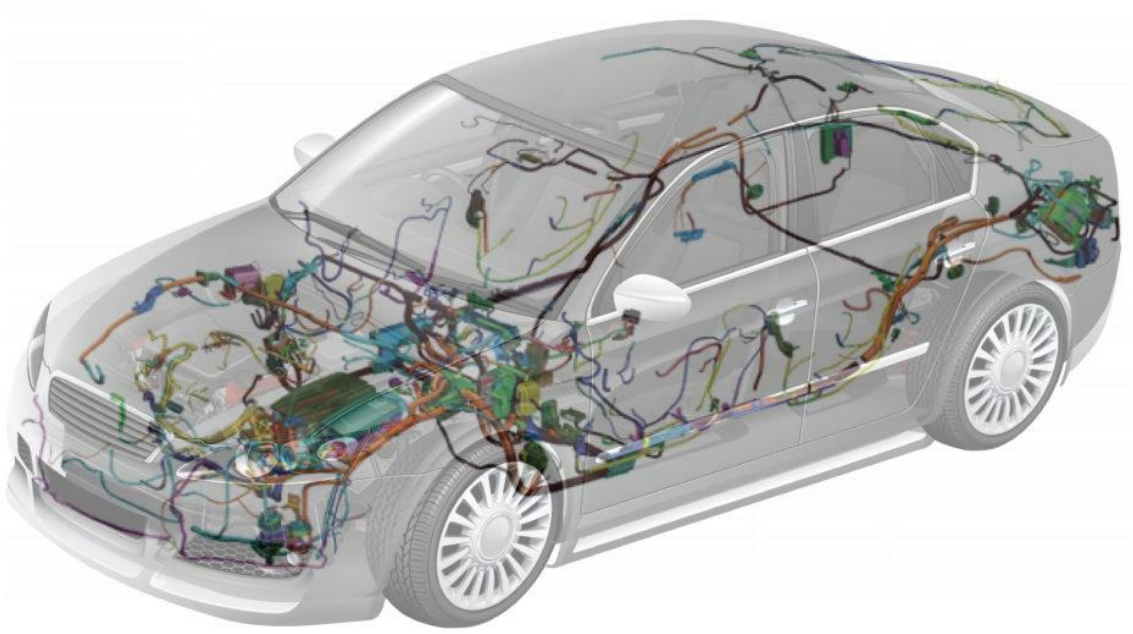


Image 12. The growing electrical and electronic content in vehicles is increasing bandwidth demands in the vehicle. [17]

Because of hardware and software binding, components in traditional vehicles are black boxes for OEMs. To support the continuous iteration of software in the future, functional hardware needs to standardize the interface and abstract the function to be replaceable and upgradable [11].

With growing data generated in the car, the demand for computing and communication ability in vehicles is increasing. Therefore, the computing unit evolves from the ECU to the Domain Control Unit to the Central Computing Platform with high-performance computers (HPC), and EEA evolves from distributed architecture to domain architecture to central centralized architecture with high-performance computers[11]

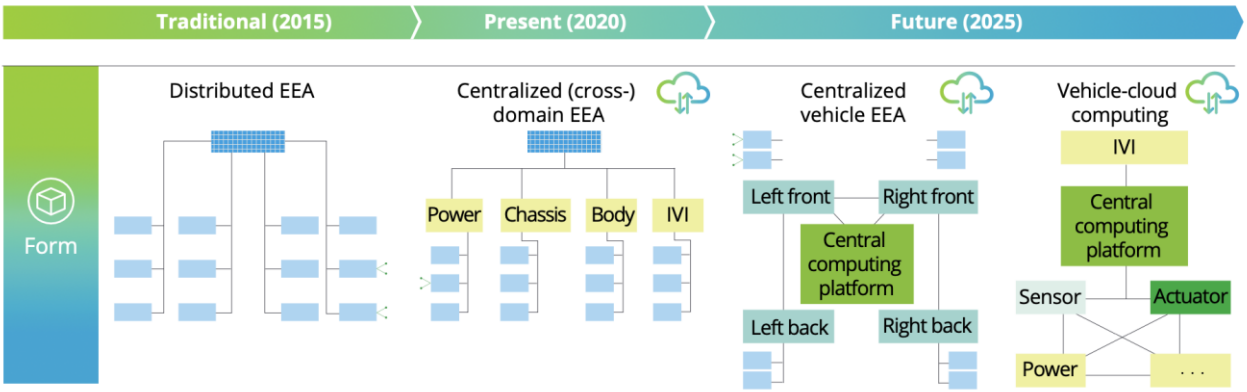


Image 13. “Evolution of Vehicle Electronic Architecture” [27]

The transition from hardware to software occurs within HPCs, where hardware functions are accessible through APIs (Application Programming Interfaces). These APIs serve as the framework for communication between application-level microservices and the underlying hardware. Interaction between microservices (a self-contained software module that performs a specific function) always occurs through APIs, which can abstract specific hardware functions or provide application-level interfaces. An application consists of a collection of microservices orchestrated to deliver a specific feature or digital service. [10]

Current E/E automotive architecture is based on the concept of “signal-oriented communication” using stand-alone ECUs connected via a network of relatively low-bandwidth bus systems, such as controller area network (CAN), local interconnect network (LIN), FlexRay, Media-Oriented Systems Transport (MOST), and the like. Signal-oriented communication is a static paradigm used in architectures where software and hardware are closely coupled, and data is sent over the network whenever the value is modified, regardless of the need. [48]

The SDV world will be enabled by service-oriented architectures (SOAs), where data is requested and sent only when needed. [48]

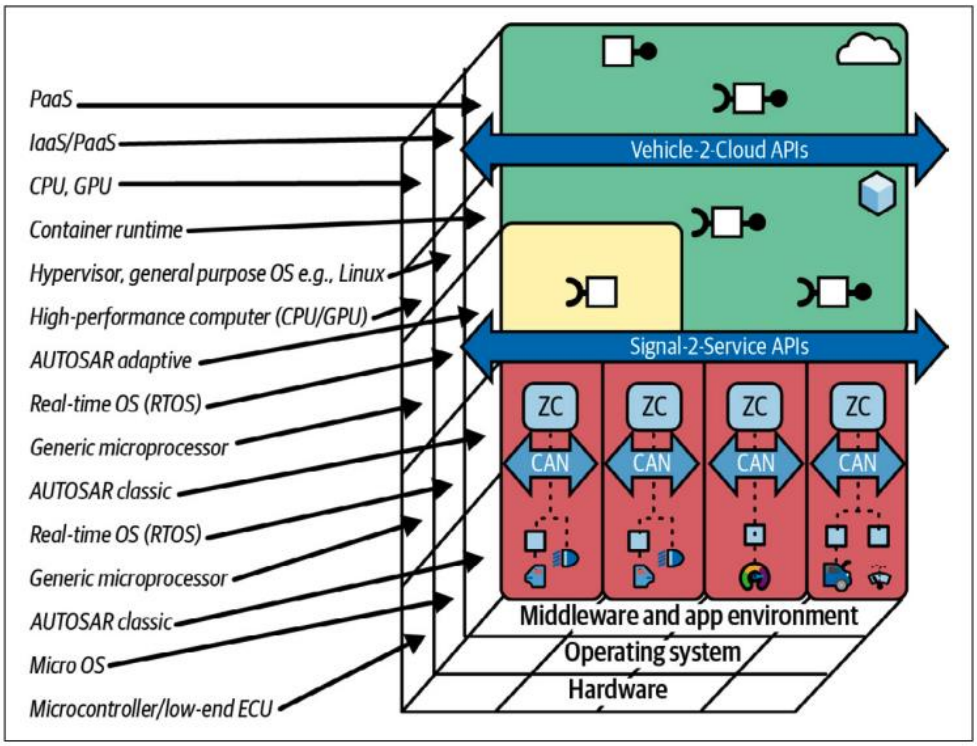


Image 14. “SDV SOA and Software Stack” [10]

SOA introduces a structured approach to architectural layering, effectively managing the unique characteristics of various microservices. In the context of the internet, for instance, the frontend layer of an application encompasses microservices that undergo frequent changes to optimize the user interface continuously. On the other hand, the basic services layer comprises more stable, data-centric services that experience far fewer changes over time. This layering scheme is vital for facilitating the streamlined evolution of systems. A similar approach has already been adopted across other industries, like Telecom, Finance, and e-commerce.

Three tectonic shifts to support Digital First approach

Given the constantly changing preferences of today's consumers, it's challenging to predict which features will be in demand tomorrow accurately. The ability to

innovate swiftly and effectively isn't just desirable - it's essential for staying relevant. Zonal architecture and SOA introduced the needed foundation to enable the Digital First approach for OEMs.

OEMs must undergo three significant shifts: the northward shift (toward the vehicle API), the leftward shift (toward early-stage testing), and the shift toward virtualized development. We'll examine each of these shifts in more detail.

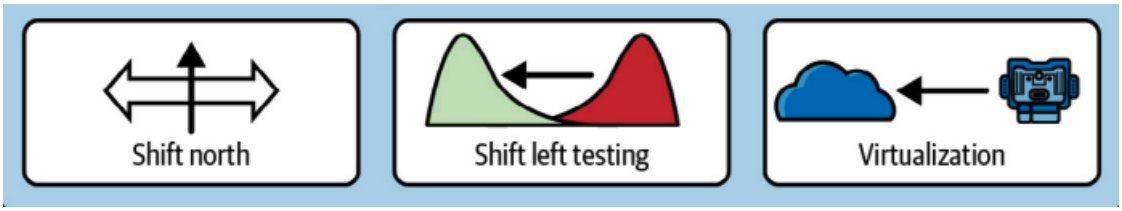


Image 15. The three tectonic shifts underlying Digital First [10]

Shift North

In traditional E/E architectures, each function had its own ECU. However, developing functions on over 100 distributed ECUs became excessively complex and costly. As a result, E/E architectures evolved to incorporate fewer domain controllers and/or zonal controllers on HPCs, allowing multiple functions to run simultaneously on a single device. This transition was facilitated by standardized operating systems and middleware, which provide the necessary hardware abstraction.

SDVs further this "shift-north" by extending it to the upper layers of the stack. This means implementing functions on edge or cloud computing resources instead of in-car devices.

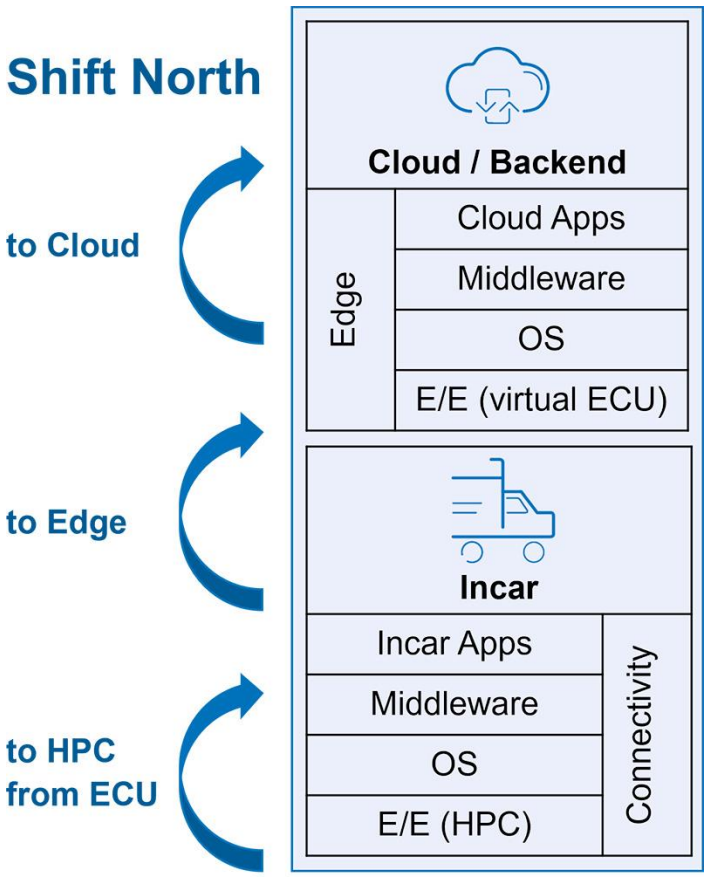


Image 16. Shift North Concept [13]

Shift Left

The "shift left" involves examining customer features and conducting testing as soon as feasible in the development process. Moving activities to earlier stages of the engineering process, where change is quicker and more cost-effective, is not a novel concept.

Replacing hardware prototypes with simulation models has long been a fundamental aspect of virtual product development, including the progression of model-based systems engineering. However, SDVs are pushing further this evolution by introducing cloud-based virtual engineering workbenches. These platforms provide simulations of ECUs with binary parity and Human-Machine Interfaces (HMI), enhancing developer experience for globally distributed teams.

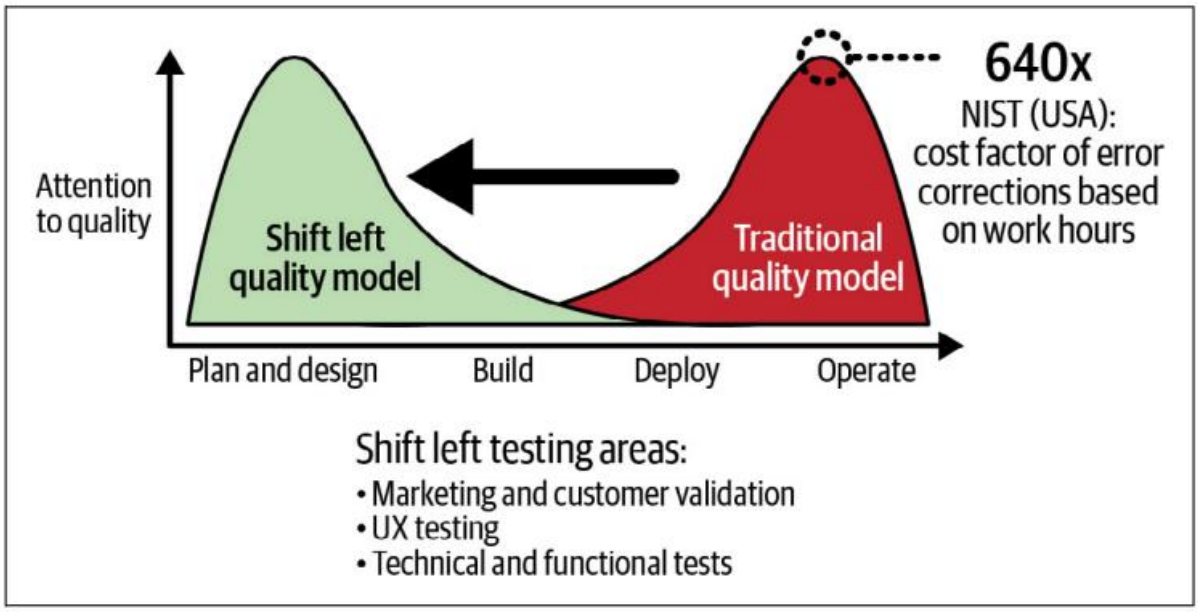


Image 17. Shift-left testing [10]

The "shift left" concept offers several benefits in the software development process:

- **Early Detection of Issues:** By moving testing and validation activities to earlier stages of development, issues can be identified and addressed sooner, reducing the likelihood of costly errors later in the process.
- **Cost Savings:** Identifying and fixing issues early in the development cycle is typically less expensive than addressing them later. Shift-left practices can reduce overall project costs by minimizing the need for extensive rework.
- **Improved Quality:** Early testing and validation allow for more thorough quality assurance processes, resulting in higher-quality software products that meet user expectations and requirements.
- **Faster Time to Market:** By catching and addressing issues earlier in the development process, teams can accelerate the delivery of software products, getting them to market faster and gaining a competitive edge.

- **Increased Collaboration:** Shifting testing and validation activities left encourages closer collaboration between development, testing, and other project stakeholders. This collaboration fosters a shared understanding of requirements and goals, leading to more effective communication and problem-solving.
- **Enhanced Agility:** Identifying issues early enables teams to respond quickly to changing requirements or priorities, increasing the overall agility and flexibility of the development process.

BUGS	STAGE FOUND					
Stage Introduced	Requirements	Coding/ Unit Testing	Itegration Testing	Beta testing	Post Release	Total
Requirements	5.0	8.0	2.3	0.2	0.2	15.6
Coding/Unit Testing	-	32.0	40.5	4.5	4.5	81.5
Integration Testing	-	-	2.3	0.4	0.4	3.0
Total	5.0	40.0	45.0	5.0	5.0	100
Cost per bug	1x	-	10x	-	100x	-

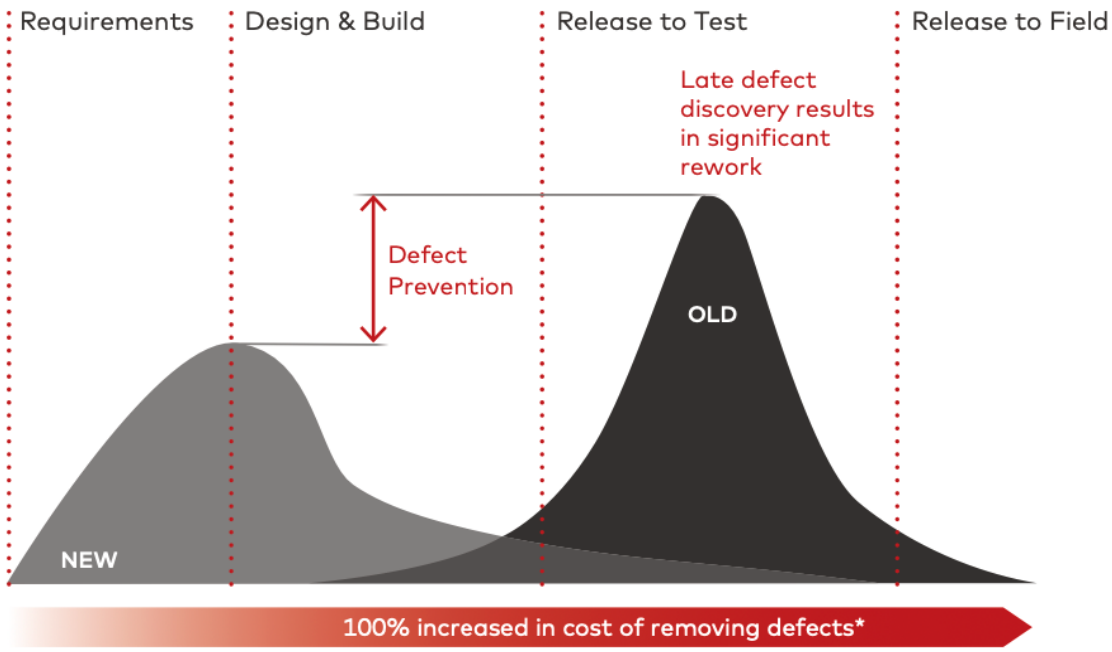


Image 18. Cost Escalation and Early Error Detection Effect [14]

Virtualization

Virtualization focuses on developing and testing systems within virtual cloud environments. One notable organization in this field is SOAFEE [15], pioneering virtualization concepts tailored explicitly for ARM-centric hardware architectures. The primary goal is to address the traditional tight coupling between hardware and software in automotive development. Software engineers often face delays when waiting for expensive, early hardware versions for development and testing. Also, distributing and supporting hardware across teams that are spread all over the world can be a big challenge for OEMs. Additionally, integration and testing of components can be complex and costly due to limited prototypes and various vehicle variations, such as different engines, trim levels, or country-specific requirements.

Cloud environments offer significant advantages in terms of scalability and cost reduction. By leveraging virtual electronic control units (vECUs) or virtualized cars, these environments provide solutions to the challenges mentioned above.

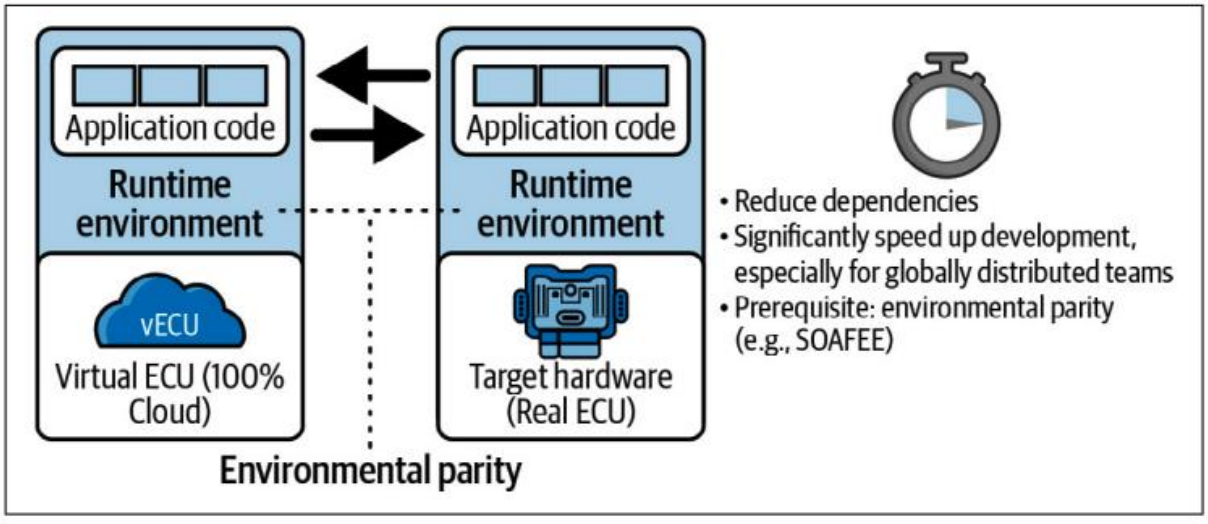


Image 19. Virtualization [10]

SDV Hidden Cost

Currently, Automotive companies worldwide invest more than $1 billion annually in software research and development, equating to an expenditure of $1,000 to $3,000 per vehicle sold. [28]

In response to considerable disruption in both consumer automotive competitive markets and the expansive supporting supply chain, OEMs are now allocating substantial resources to software research and development to maintain their competitive edge. These resources are directed toward new features and greater control over vehicle systems and functionalities through modern and robust software development infrastructure.

OEM	2021 Software R&D Estimate[1]	Approximate Per Vehicle Cost	Estimated Software Staffing Commitment
BMW	**$1-$1.5** billion	**$3,000**	3,000-5,000
Ford	**$1.5-1.75** billion	**$1,500**	7,000+ [2]
GM	**$1.5-$1.75** billion	**$1,000**	3,000 new between 2020 and 2021[3]
Mercedes-Benz	**$1.3-$1.7** billion	**$3,000**	4,000-7,000
Toyota	**$3.5-$4** billion	**$1,100**	18,000 across Toyota and all subsidiaries[4]
Volkswagen	**$3-$3.5** billion	**$1,750**	10,000+ by 2025[5]

Image 20. Hidden Cost of SDV [22]

Even with that huge spend, software costs currently account for less than 10% of BOM (build of material costs), which is expected to increase to 50% in 2030. This includes application development software, AI algorithms, operating systems, software-hardware integrated controllers, chips, and other electronic HW. [26]

However, software platforms powering edge computation require significant investment to develop. According to SBD Automotive, building and maintaining

the basic cloud and in-vehicle software components for managing vehicle data and algorithms would require an OEM investment of $65M to $115M over a decade. However, this represents only a tiny portion of the necessary software investment. [29]

Market analysis conclusion

SDV transformation creates a lot of challenges but also opens up huge opportunities for market players who can adapt quickly and address both technical and organizational challenges.

As the role of Software grows, OEMs will need to adopt and take control of Software development. However, the current organizational structure in traditional OEMs may not be the best suited to do so [12], nor does their vehicle development process incorporate a comprehensive agile methodology and deployment, so OEMs will definitely need strong Software partners in this transformation to build and manage all of this Software complexity.

This creates an opportunity for software-first players, who have needed experience both in Automotive and similar transformations in other industries (Telecom, Finance, etc.), who can become a reliable partner for OEMs.

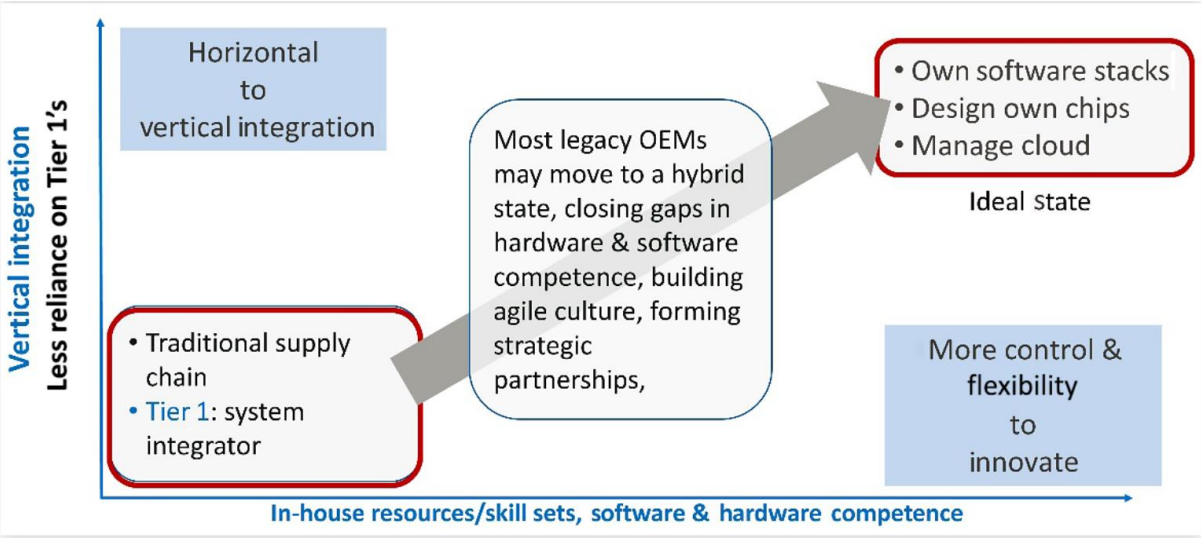


Image 21. Traditional OEMs with a mix of make or buy [48]

Problem Definition

About GlobalLogic

GlobalLogic, a Hitachi Group Company, is a leader in digital product engineering. We help our clients design and build innovative products, platforms, and digital experiences for the modern world. By integrating our strategic design, complex engineering, and vertical industry expertise, we help our clients imagine what's possible and accelerate their transition into tomorrow's digital businesses. Headquartered in Silicon Valley, GlobalLogic operates design studios and engineering centers worldwide, extending our deep expertise to customers in the automotive, communications, financial services, healthcare & life sciences, media and entertainment, manufacturing, semiconductor, and technology industries. [30]

In Ukraine, GlobalLogic is one of the three largest IT companies. Over 6500 Ukrainian engineers of the company create digital products in key sectors such as medicine, automotive, telecom, construction, media, finance, semiconductors, etc.

According to Forbes ratings, GlobalLogic has been recognized as one of the most sustainable companies, the largest exporter of Ukraine, and one of the largest private companies in Ukraine.

The company is also one of the best employers, according to research by Ernst&Young. [31]

GlobalLogic helps brands create value across the entire product lifecycle by developing cutting-edge technology and by helping make mature products more relevant to digitally savvy consumers. We show businesses how to engage their consumers better, innovate within predictable budgets, and bring the next

generation of digital products and services to market quickly. Using human-centered design practices, superior engineering skills, and Agile delivery — we help customers re-imagine their business-consumer interactions and develop innovative products and services with an accelerated time-to-market.

GlobalLogic Company Facts At-A-Glance

For over 20 years, GlobalLogic has partnered with businesses across every major industry to make unique products and connect the dots between people, products, and business opportunities. In 2021, GlobalLogic was acquired by Hitachi Ltd.

- Founded in 2000
- Acquired by Hitachi Ltd. in 2021
- 30,000+ employees in 23 countries
- 6,500+ employees in Ukraine
- 2000+ product releases per year
- 500+ active clients
- 70+ private label customer labs
- 62 product engineering centers (4 in Ukraine)
- 8 design studios (1 in Ukraine)

GlobalLogic Automotive

GlobalLogic has more than 20 years of experience working in the Automotive field. With over 20M vehicles on the road powered by our software, we help OEMs, Tier 1 suppliers and aftermarket service providers make connected, autonomous, smart, and electric (CASE) mobility possible, with more than 4000+ engineers worldwide working in the automotive industry.

Ukraine plays one of the central roles in GL Automotive's expertise. It is a leading engineering center for automotive innovation, with more than 500 engineers working within the domain. GlobalLogic has advanced expertise in multiple

automotive works across the whole mobility ecosystem and supports automotive clients across the vehicle life cycle.

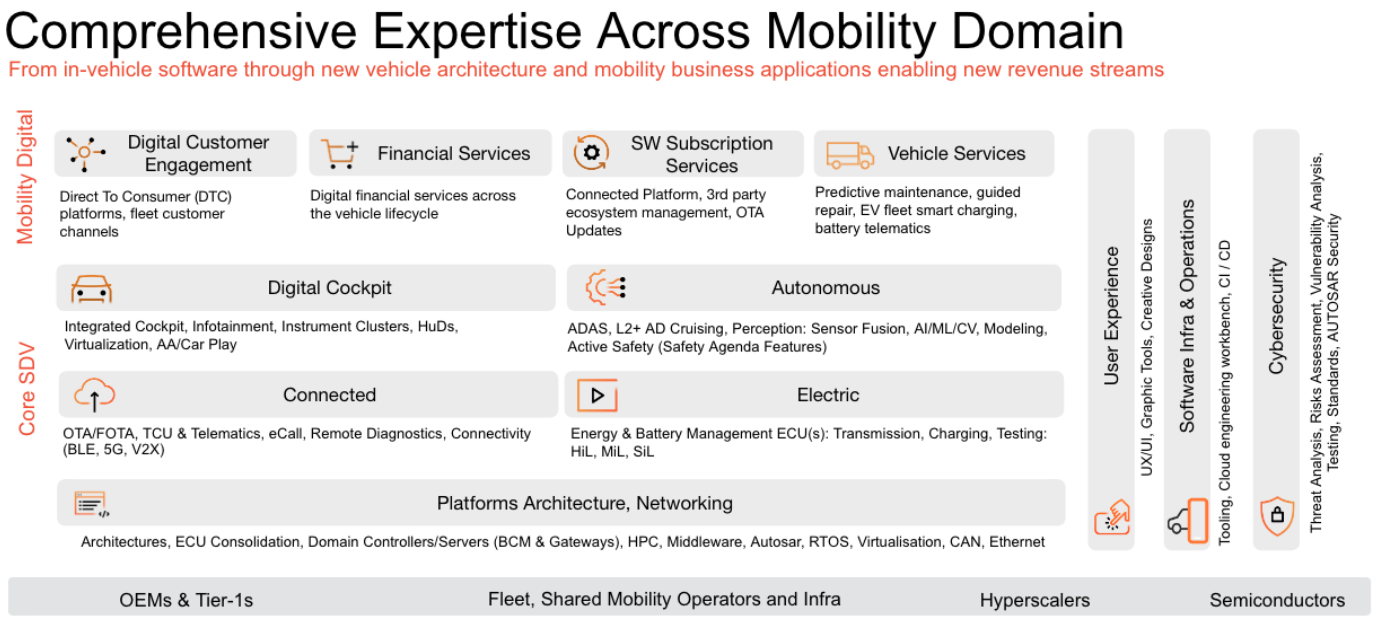


Image 22. GlobalLogic Expertise Across the Mobility Domain

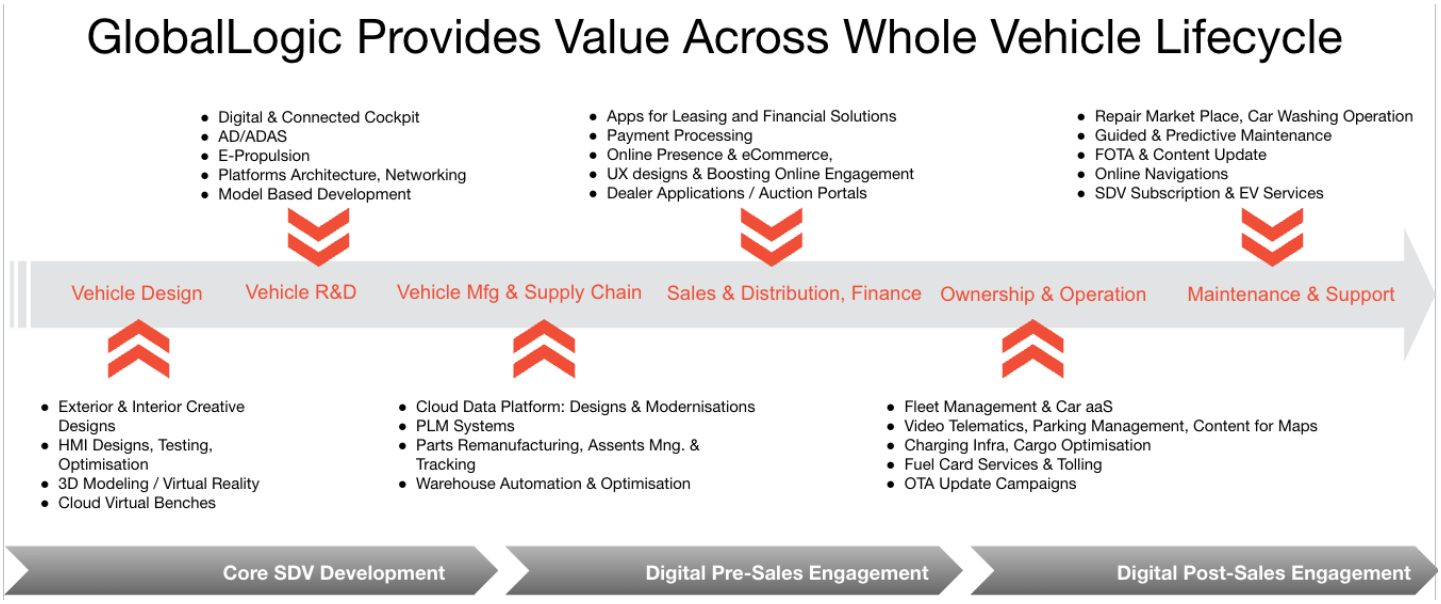


Image 23. GlobalLogic Value Offering Across Vehicle Lifecycle

My Role in This Project

My primary role in GlobalLogic is Delivery Unit Head. I'm managing a portfolio of clients, primarily automotive, from the delivery side, and I am responsible for Delivery Quality, P&L, NPS, and Attrition.

This project stands out from my primary responsibilities.

My role was to lead a team of talented individuals to execute a market study and develop a General Offering to create PoC, Accelerator, and product roadmap. In a way, you could call me the CEO of this venture, as I was responsible for the following:

- Helping to shape the initial concept
- Pitching ideas to internal stakeholders
- Securing needed funding
- Driving internal PR and communication activities
- Leading offering creation
- Leading pre-sales activities with clients and pitching our offering with my team's support
- Leading sales activities of the pilot project
- Leading partnership discussions with internal and external stakeholders
- Responsible for governance of the pilot project

The Problem to Solve

For over 5 years, my team has worked within multiple Automotive complex programs with OEMs and Tier1s. We were able to observe first-hand issues, processes, and tool inefficiencies our clients were facing, which led to problems with product quality and multiple production delays that were very painful for the whole company and its leadership.

Issues that we have been able to observe firsthand*:

- **Need for Software Architecture Governance.** Lack of reusability that leads to an additional $2 - $2.5 million in development costs annually
- **Underdeveloped Quality Management of the Software.** Quality management inefficiencies lead to redundant work and unnecessary troubleshooting, losing $1 - $5 million annually. Integration issues can lead to a 65% slowdown in time-to-market. Underdeveloped quality management hinders the introduction of new features, closing up potential post-SOP revenue streams.
- **Ineffective Domain Isolated Development Approach.** High dependency on Test Benches and poor utilization led to a 45% slowdown in time-to-market. The traditional approach reduces the variety and complexity of vehicle configurations, making the product less attractive to customers. The isolated approach leads to redundant hardware infrastructure maintenance, costing $300,000 - $500,000 annually.
- **Lack of 3rd Party Collaboration.** Existing on-premises infrastructure was built for local team collaboration only. It did not account for proper remote IP management, creating a lot of guardrails for the remote team to collaborate effectively and get access to all needed resources. Also, OEMs' mindset and culture are very protective of their IP, limiting potential collaboration opportunities.

* All commercial impacts are calculated on the 100FTE Engineering Team size assumption, based on average Ukraine rates from the Yourteam.io report [47].

Observations of these problems have triggered us to do market research to see if the software issues we experience are unique or similar to those of other automotive players and also to understand market trends better.

Even a quick internet analysis has shown that most OEMs are struggling with software now, which significantly impacts their existing business, with a visible impact on the OEMs' business and even changes to the company's senior leadership because of software issues.

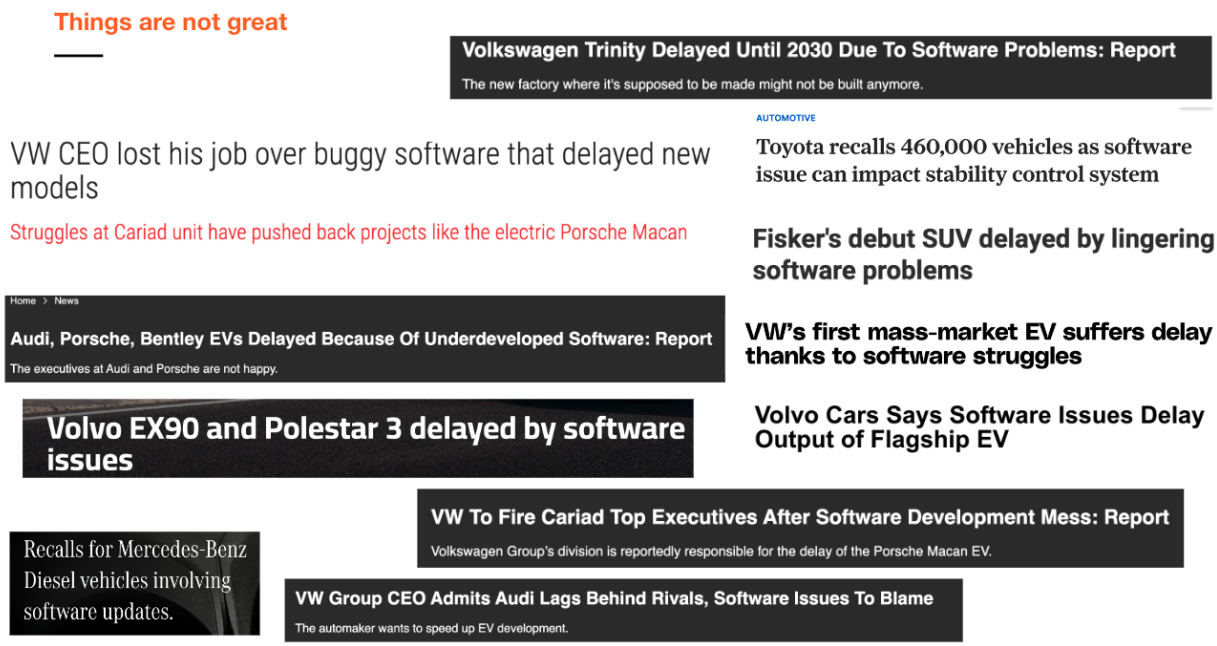


Image 24. Headlines of Automotive SW Issues and Delays

Only in the US are automakers expected to lose $900 million in software recalls due to lacking or inadequate over-the-air update capability. [32]

At the end of 2022, our team was inspired by the AWS re:invent event. AWS showed the concept of Virtual Workbench and overall Automotive Cloud Infrastructure based on their Stellantis collaboration case [33].

Based on this event and a follow-up meeting with the AWS Automotive team, it became clear that we need to work on SDV offerings for our clients, who are

starting to take the first steps in their SDV transformation journey and create significant business opportunities.

The automotive infrastructure focus in SDV was specifically synergetic for GlobalLogic, as with OEMs taking more control of their software development, our business was also challenged due to some work considered Core and should not be outsourced to software vendors.

Despite being a vital component, infrastructure was never considered a core competence that OEM had to develop, and it could be easily outsourced. Considering that, the decision has been made to focus on the Infrastructure part of SDV.

Based on UCU learnings, it was decided to try and adopt different frameworks to structure work around Offering creation properly.

We have used the Goldsmith Technology Commercialization approach and started with the Concept Phase, specifically Technology Analysis.

		Technology	Market	Business
Concept phase	**Investigation**	1. Technology Analysis	**2. Market needs**	**3. Venture assessment**
Development phase	**Feasibility**	4. Technical Feasibility	**5. Market study**	**6. Economic Feasbility**
	Development	**7. Engineering Prototype**	**8. Market plan**	**9. Business plan**
	Introduction	10. Business Start-up	**11. Pre-production Prototype**	**12. Market validation**
Growth phase	**Growth**	13. Production	14. Sales and distribution	15. Business growth
	Maturity	16. Production support	17. Market diversification	18. Business maturity

Image 25. Goldsmith TC Approach

Besides that, we have used Jolly's approach to stakeholder mobilization early in the ideation process to get awareness through the organization and access the critical decision makers - the Automotive Business Unit Head and the Automotive Group Delivery Head. Such an approach allowed us to mobilize needed stakeholders early in the process, which provided needed support further and allowed quick decision-making.

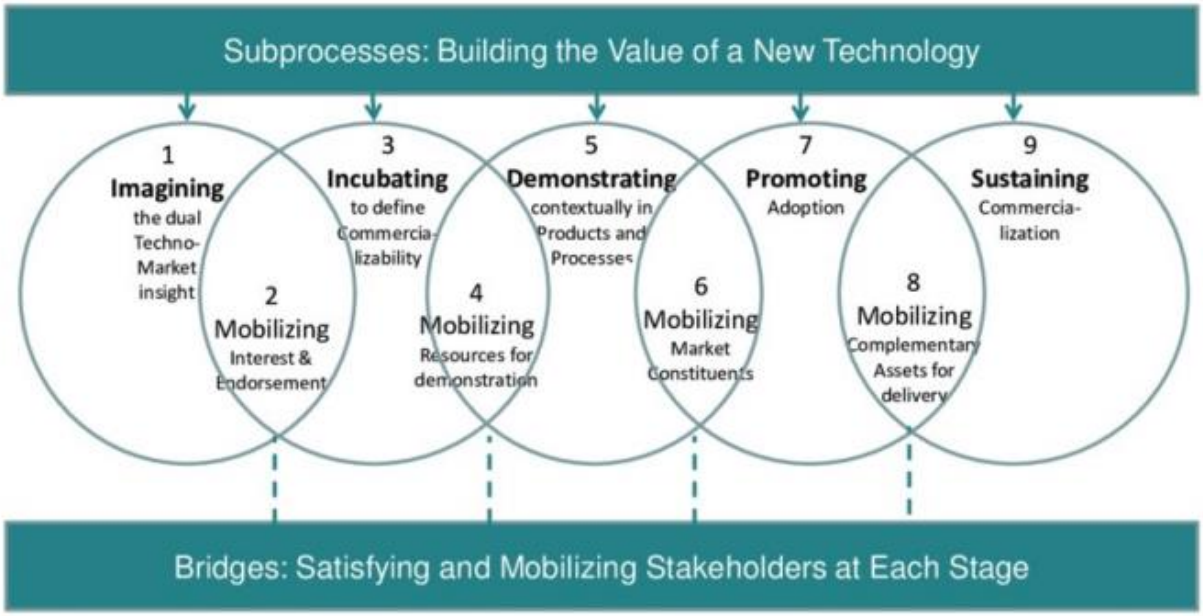


Image 26. Jolly's approach to stakeholder mobilization

Based on early client conversations both with clients and internal leadership, the team understood that in that fast-paced, innovative environment, the only way to get valuable feedback and do a market validation was to create a Demoable PoC that could form a basis to discuss details, as on the concept level, most of the clients have been questioning the feasibility of the Virtual Workbench and Cloud First Infrastructure in Automotive and the discussion could not progress to the billable project discussion space.

Leveraging Goldsmith Technology Commercialization approach **Goals for Feasibility and Development phases were defined:**

- Create PoC and start doing market validation (mainly through existing client base and internal Sales and Delivery teams Demos)
- Validate problem understanding and solution feasibility with key market players - Hyperscalers (AWS and Azure specifically, as the most advanced that that space at the time)
- Create an SDV-focused offering to enable the GL Automotive Sales team to start working with potential clients

Project Kick-off and Development

The Start - Concept Phase - PoC

Based on established goals, the PoC Proposal was pitched to the Automotive BU Head, Automotive Group Delivery Head, and other Automotive leadership in GlobalLogic (the PoC proposal can be found in Appendix 1).

Articulated PoC Goals

- Create a full-scale cloud-first infrastructure architecture - point of view
- Create an end-to-end-use case for Cloud-first SW update (re-configure SW on the embedded device via Cloud)
- Create a working demonstrator (that can be used to show ideas to clients)
- Gain experience in
    - Cloud infrastructure for SDV setup
    - Software development according to SDV principles

Image 27. PoC Goals - **CONFIDENTIAL**

Expected PoC Results and Artifacts

- Artifacts
    - AWS cloud architecture documentation (point of view)
    - Automotive grade quality PoC based on Renesas/NXP development board
    - Toy cars with installed boards and cameras for presales and live demos
    - AWS cloud infrastructure (accelerator):
        - Developer’s Unified Environment in the Cloud
        - AWS infrastructure for SW development and integration
- Real-time demos with scenarios: SW re-configuration via Cloud
- Team skills and competence to fastly develop similar functionality for adjacent projects
- Proven practical limits and demonstrable visual results to discuss with the potential clients
- Gain Automotive domain expertise for the GL Technology office

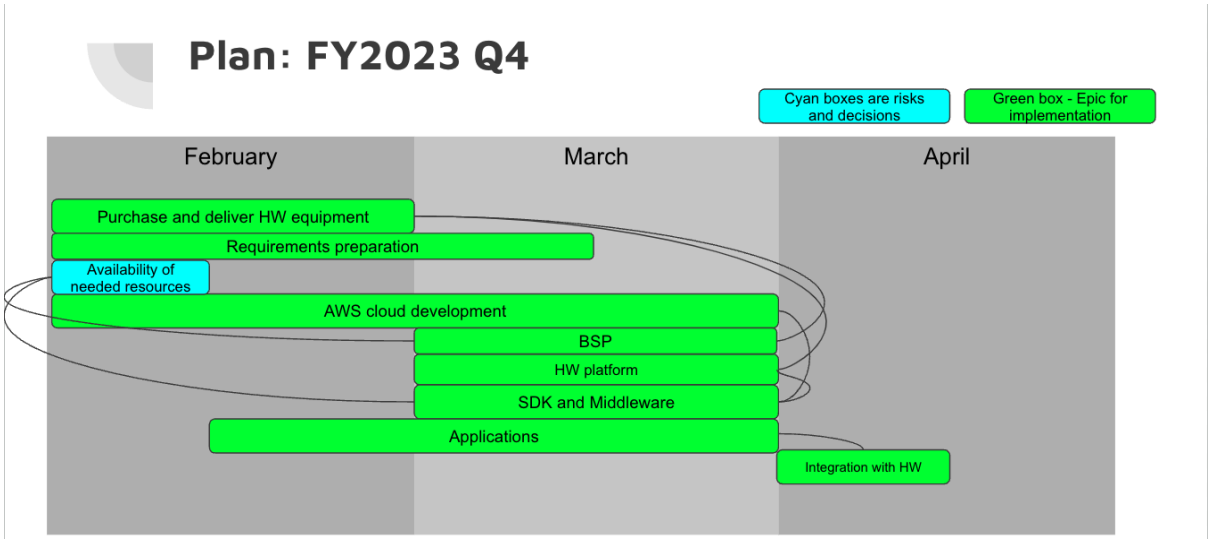


Image 28. GL SDV PoC Roadmap

AWS has been chosen as a primary Cloud Provider for PoC due to:

- AWS had the most advanced infrastructure for Automotive, and AWS has already invested in Automotive Development Toolchains [34]
- AWS had a dedicated Automotive team that was open to collaborating with GlobalLogic and providing advisory support

Image 28. Cloud Solution Architecture Concept - **CONFIDENTIAL**

Estimated Budget

The initial PoC estimated effort was 21 man/month and $6,000 for HW and licenses. The decision was made to create a dedicated team for PoC development to maximize the chances of having a successful Demo in place and in time.

Estimated Team - 9 FTEs total

- Product owner - 0.5 FTE
- Requirement engineer - 1 FTE
- AWS Cloud Architect - 0.5 FTE
- AWS DevOps - 2 FTE
- Senior Embedded Engineer - 1 FTE
- Middle Embedded Engineers - 2 FTE
- Middle ML Engineer - 1 FTE
- Project Manager - 1 FTE

The team split was slightly different, but it was still within the allocated budget.

					2023						
№	Cost item	Role	Median Market Salary	Involvement	February	March	April	May	June	July	August
1	Team Member 1	Associate PM	2,300	100%		2,300	2,300	2,300	2,300	2,300	2,300
2	Team Member 2	Product owner	3,000	100%	3,000	3,000	3,000	3,000	3,000	3,000	
3	Team Member 3	Requirement engineer	4,500	50%	2,250	2,250	2,250	2,250	2,250	2,250	2,250
4	Team Member 4	Senior embedded engineer	4,700	100%		4,700	4,700	4,700	4,700	4,700	4,700
5	Team Member 5	Middle cloud/devops engineer	3,000	100%		3,000	3,000	3,000	3,000	3,000	3,000
6	Team Member 6	Junior Embedded engineer	1,200	50%	600	600	600	600	600	600	600
7	Team Member 7	Junior Embedded engineer	1,200	50%	600	600	600	600	600	600	600
8	Team Member 8	Junior Embedded engineer	1,200	50%	600	600	600	600	600	600	600
9	Team Member 9	Cloud Architect	6,500	50%	3,250	3,250	3,250	3,250	3,250	3,250	
11	Team Member 12	Senior AQA	4,000	50%			2,000	2,000	2,000	2,000	2,000
12	Team Member 13	Middle Embedded Developer	2,500	100%				2,500	2,500	2,500	2,500
10		Hardware components			2,500	500			1,000	1,200	900
	Total expenses				12,800	20,800	22,300	24,800	25,800	26,000	19,450
	Project Allocation Labour Costs				5,850	15,850	15,850	18,350	18,350	18,350	15,350
	Part-Time involevement Labour Costs				4,450	4,450	6,450	6,450	6,450	6,450	3,200
	Hardware and Licenses				2,500	500	0	0	1,000	1,200	900

Image 29. SDV PoC Investments and Spend Example

Image 26 is an example of PoC Budget calculation. All used costs are the market average for SW engineering services in the Ukraine region across different companies, based on the DOU salary report [46].

Important note: GlobalLogic is a service company primarily focusing on providing services with no end goal of building final products. Accelerators aim to help show clients new concepts and proof of our expertise. Also, accelerators help decrease the time to market for new initiatives and help clients' business cases.

The Accelerator is a half-baked product; it has a needed base (non-differentiating) and can be easily customizable for any client. The idea behind technology or industry accelerators - is not to reinvent the wheel in any client engagement but to reuse all needed basic components that do not have unique IP value for the client and, with such an approach, accelerate time-to-market for client products.

Accelerator type of PoC was enabled through the GlobalLogic Practices Office for potential PoC IP usage and transfer to GlobalLogic clients. A specific Accelerator contract type has been created to support that, allowing GlobalLogic to sell indefinite and unconditional accelerator licenses to a client and transfer the needed codebase for a potential project.

Estimate of Potential Addressable Market

The potential 5-year addressable market for SDV Cloud Infrastructure Services for GL was calculated based on the potential revenue GL could get from potential clients.

This estimate was built based on the critical assumptions jointly with sales and internal technical teams and consultation with selected clients based on an estimation of the team size and technology adoption timeline.

Overall Addressable Market Estimation with GL SDV Cloud Framework Infrastructure offering was estimated at $162M within the next 5 years.

All used rates for calculation below are market averages for SW engineering services in the Ukraine region across different companies. Rates are used based on based on Yourteam.io report [47].

Image 30. Potential SDV Cloud Infrastructure Addressable Market - **CONFIDENTIAL**

Development Phase

Immediately after, the PoC concept and investments team started working on the overall commercialization approach.

As the Cloud's first infrastructure approach and technology were new to the market, it was anticipated that clients and internal stakeholders would be very skeptical about the feasibility, and we had to make sure that we had proof points in our PoC and Offering.
The first Demoable version of PoC was planned to be ready in April, and we started to look for potential clients and partners to validate potential proof points and get early feedback. We were still in the incubating period for our solution offering.

As an active AWS partner in multiple areas, GlobalLogic was working to establish more connections with AWS dedicated Mobility (Automotive Team), and a workshop was organized to discuss GL capabilities and offerings there. We have decided to use this opportunity to get their feedback as an active player in that market.

Why AWS was a good validation partner:

- AWS is one of the leaders of the SDV transformation and an important ecosystem player
- AWS was one of the founding partners of the SOAFEE Alliance that is focusing on bringing Cloud Native Development
- AWS already has strategic partnerships with some OEMs and is creating new Automotive Tools [35]

The workshop took place on the 10th of May, and our team was able to present our general Automotive Competence and SDV Cloud Framework Offering and PoC Demo to AWS.

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After the AWS workshop, we continued our validation activities and presented a PoC Demo and Offering concept on a 2-day GL Mobility Workshop with all Sales and Delivery leaders.

The demo did not go well, but the validation served its purpose. We have received critical feedback, especially from the Sales team:

- The offering was not clear
- Client Problem Definition is not clear
- Commercial benefits were not clear
- The Sales team did not know how to approach the clients with our solution and start a conversation; they needed help with a more robust offering

After receiving that critical feedback, the team understood that we needed to create a clear offering, a go-to-market approach, and a marketing plan that could enable business growth and a go-to-market approach.

Client Problem Definition

To create a client problem definition, we looked at a few existing long-running programs (3-5 years of engagement) with several clients, where we observed the challenges they face. We have used that knowledge to map it to our offering and estimate a potential benefit case we can create for our clients with our SDV Cloud Framework approach.

The team has taken actual measures on the engineer time, which is being wasted for usual operations and inefficiencies that we are getting based on delays and gaps in the existing infrastructure.

A comparison of existing infrastructure with the SDV Cloud Framework PoC was used to determine potential benefit cases.

Table 1. Measured delays on existing running projects and comparison with movement to the Cloud - **CONFIDENTIAL**

*The calculations are based on high-level assumptions of the lead times predicted in the DEMO and are limited to 100 FTE.
All used rates and costs are the market average for SW engineering services in the Ukraine region across different companies. Rates are used based on based on Yourteam.io report [47].

** The current lead times are based on estimations and measured lead times conducted by team members. These will also have to be validated during a potential project.

Based on this activity, the team has analyzed potential improvements and savings effects that SDV Cloud Framework could bring. All used rates and costs are the market average for SW engineering services in the Ukraine region across different companies. Rates are used based on based on Yourteam.io report [47].

Table 2. Improvements Effect with SDV Cloud Framework -

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During the final workshop with the Sales team, where we formulated the Final Problem Definition and outlined measurable challenges*:

- Insufficient Software Architecture Governance
    - 30% increased time-to-market for new products due to a lack of software architecture traceability and transparency.
    - Lack of reusability leads to an additional $2 - $2.5 million in development costs annually.
- Underdeveloped Quality Management of the Software
    - Quality management inefficiencies lead to redundant work and unnecessary troubleshooting, losing $1 - 5 million annually.
    - Integration issues can lead to a 65% slowdown in time-to-market.
    - Underdeveloped quality management hinders the introduction of new features, closing up potential post-SOP revenue streams.
- Ineffective Domain Isolated Development Approach
    - High dependency on Test Benches and poor utilization led to a 45% slowdown in time-to-market.
    - The traditional approach reduces the variety and complexity of vehicle configurations, making the product less attractive to customers.
    - The isolated approach leads to redundant hardware infrastructure maintenance, costing $300,000 - $500,000 annually.

*The calculations are limited to 100 FTE. All used rates and costs are the market average for SW engineering services in the Ukraine region across different companies. Rates are used based on based on Yourteam.io report [47].

Marketing Plan

Having benefit case input, the team has started to work on the go-to-market approach.

Even though the SDV, especially the SDV Cloud Infrastructure market, was new, the competitive landscape has started growing, and the potential opportunity is enormous.

Client Segments and Competitors

We have outlined 3 potential client segments for our Solution Offering:

- Automotive OEMs. Based on studies and our observations in the running projects, they are on the edge of SDV transformation and have the most challenges. Also, they are the biggest benefits of SDV transformation if done correctly.
- Tier1s. They have a less complex environment, but they need to reinvent themselves, as they are losing parts of their core business to OEMs as OEMs are taking control of the software. Some Tier1s have already started investing in Cloud first infrastructure, especially if they will sell Software separately from Hardware.
- Hyperscalers. They need solutions and partners to create actual use cases and help with integration. It’s less sell to, but sell with the approach.

Competitors' Landscapes are more complex

As the automotive market is experiencing high disruption, the landscape is changing. New players are emerging, and old players are changing their roles.

We have identified the next potential competitors to our offering:

- **Hyperscalers** (AWS, Azure, GCP) themselves are very active in

collaboration with OEMs and use their internal professional services teams to help OEMs adopt new tools and approaches [38]

- Big **Tier1** players, like Continental [39] and Bosch [40], are developing their own end-to-end platforms that they would like to sell to the OEMs
- **Tool vendors**, like BlackBerry [41] and Elektrobit [42], are investing and expanding their standard offering and collaborating with Hyperscalers also to migrate their tools into the Cloud environment
- **Classical EDA** players like Synopsys [43] and dSpace [44] are looking into how to uplift their existing legacy tools and adapt them to the Cloud world [45], [46]
- **Service Companies** like GlobalLogic - Luxoft, and KPIT are already deeply embedded into the automotive software development lifecycle and, for many years, working with OEMs and Tier1s on creating and testing vehicle software

Based on our analysis, we have created a competitors' landscape view, where we have focused on two important axes:

- Product-Based or Serviced Based Offering
- Flexible Architecture and Tools and Proprietary Architecture and Tools

Based on this analysis, we understood that we are unlikely to directly compete with Hyperscalers, Tool Vendors, EDA Players, and Tier1s (who are also our clients). Service players have an Integrator role in this ecosystem and will leverage their infrastructure and tools in our offering, though we might compete indirectly for OEM attention.

We have decided to compete directly, mostly with service providers who already play an important role in vehicle software development, as we are embedded into the whole SDLC and have a unique vantage point.

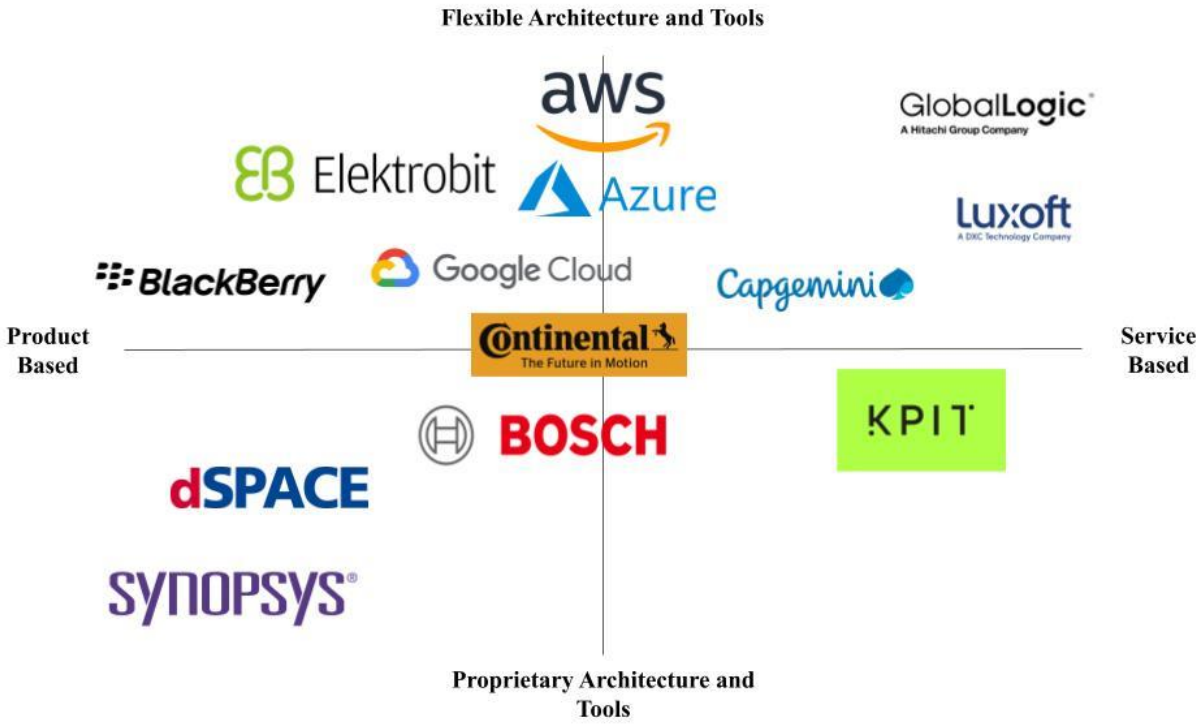

Image 31. Competitors Landscape

A clear offering and accelerator are critical components for proper differentiation that should open potential big projects and long-term partnership opportunities with OEMs (which is actually what we are looking for).

We have employed the Competitive Product Matrix to understand how to compete better with other service players and direct competition.
Based on this matrix, we have made an initial analysis and outlined three main competitors we should focus on in our offering development.

Competitive Product Matrix Template

	81	60	68									Us (future)		
	76	56	64								Capgemini			
	72	53	62					Luxoft						
	57	42	48			KPIT								
	OEM	Tier1	Hyperscaler	Problems	Us (right now)	Now	Future	Now	Future	Now	Future			
	4	3	2	Insufficient System Architecture Governance	2	3	3	2	3	3	4	3	Competitive Jockeying	
	5	5	4	Underdeveloped Quality Management of Software Products	4	1	3	3	4	3	4	5	Disruptive	
	4	2	2	Ineffective Domain Isolated Development Approach	3	2	3	3	4	3	4	5	Disruptive	
Importance of each problem to each customer	3	2	3	Rigid Traditional Approach to Software Development	3	2	3	3	4	3	4	4	Differentiation	
	3	2	5	Lack of Infrastructure Scalability	3	2	3	3	4	3	4	4	Table Stakes	
Importance of customer to our strategy	5	4	3											

597	285	168	144	KPIT	(future)
758	360	212	186	Luxoft	(future)
796	380	224	192	Capgemini	(future)
849	405	240	204	GlobalLogic	(future)

Overall relative strengths of all competitors, given relative importance of each customer group as a function of our selected strategy

Image 32. Competitive Product Matrix Analysis

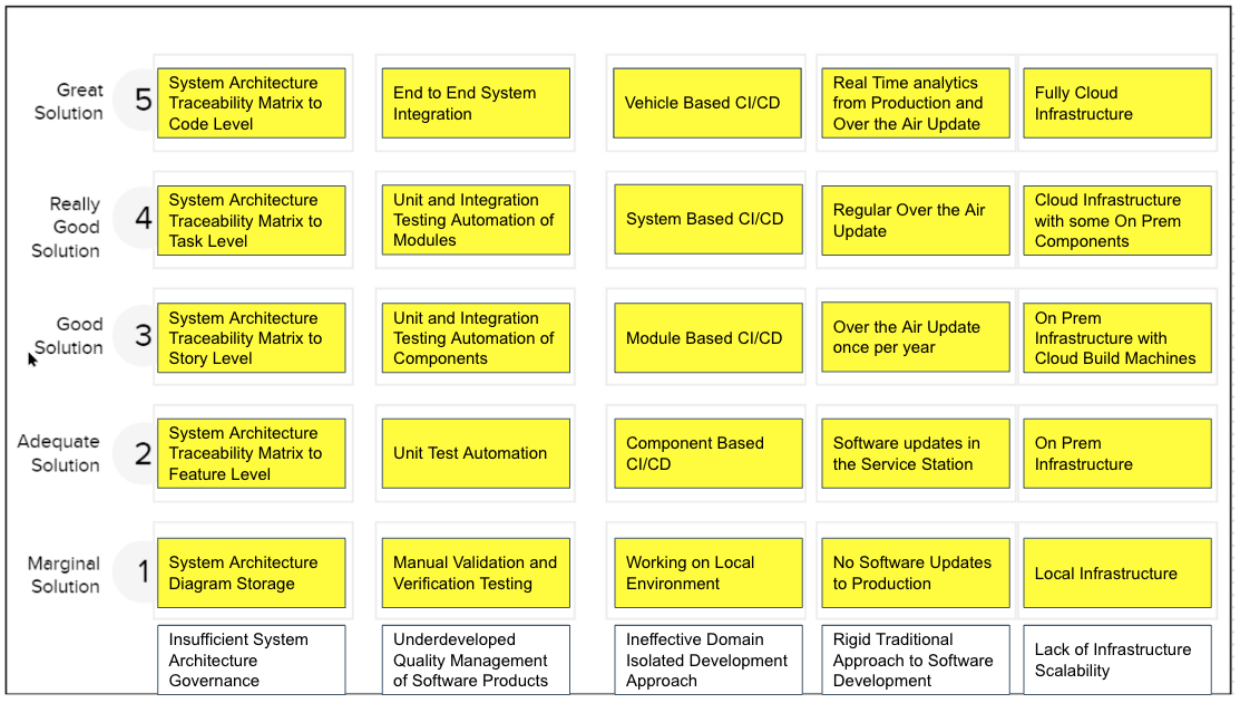

Image 33. Competitive Product Matrix Solution Analysis

KPIT, Capgemini, and Luxoft/DXC were chosen as the main competitors because, at that time, they already had solutions published on the AWS Solution Library website, linked to SDV, and were very active in the Automotive domain.

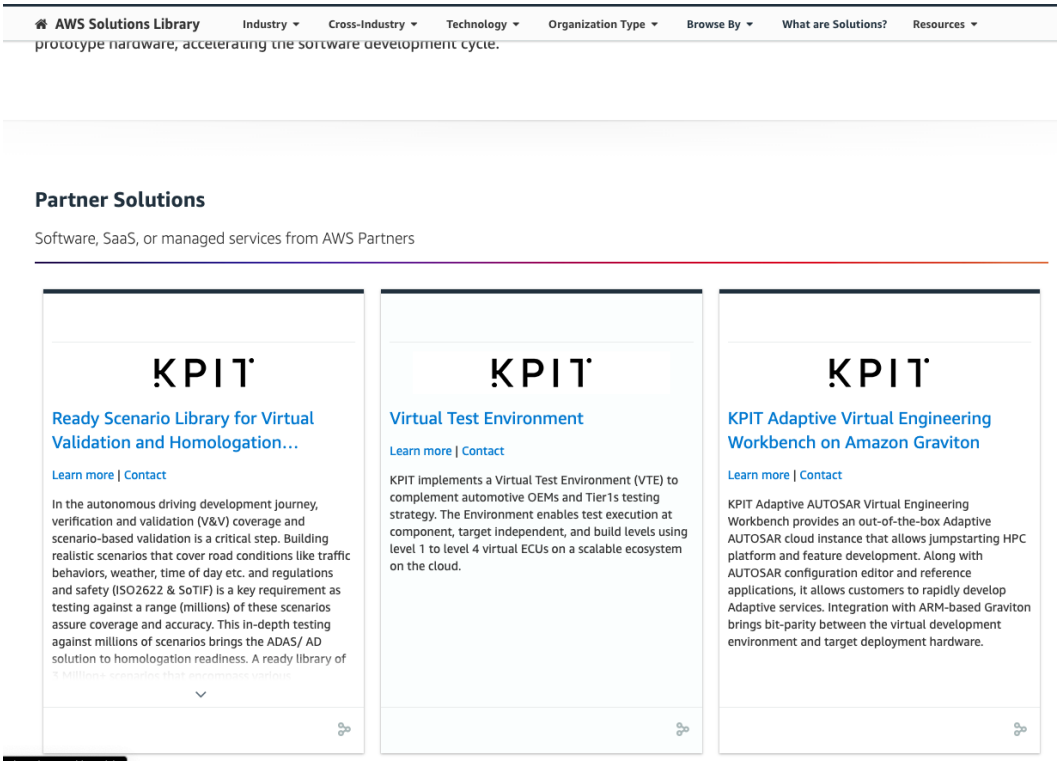

Image 34. KPIT solutions library on AWS

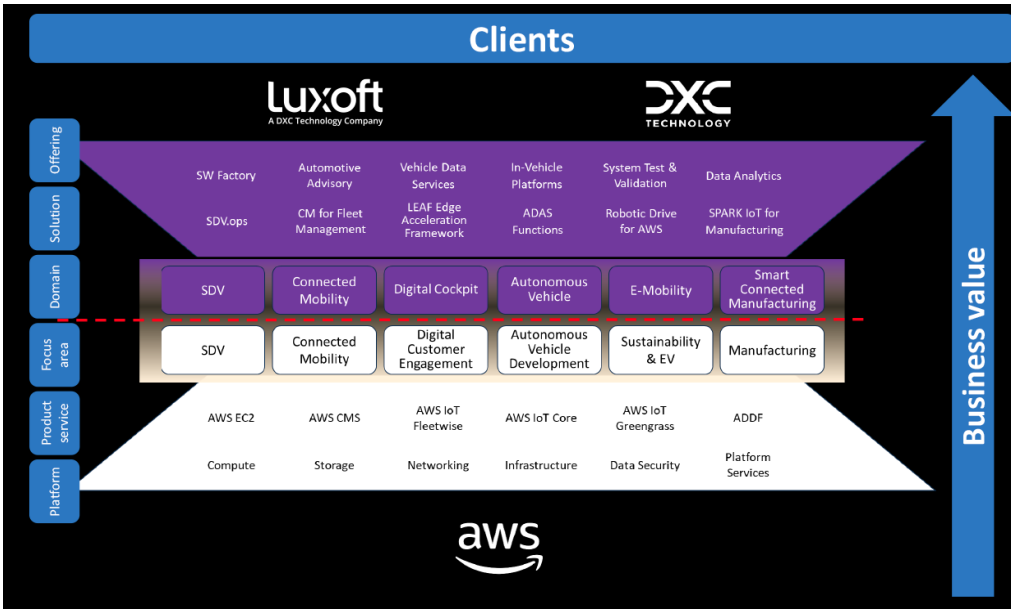

Image 35. Luxoft/DXC and AWS SDV Offering

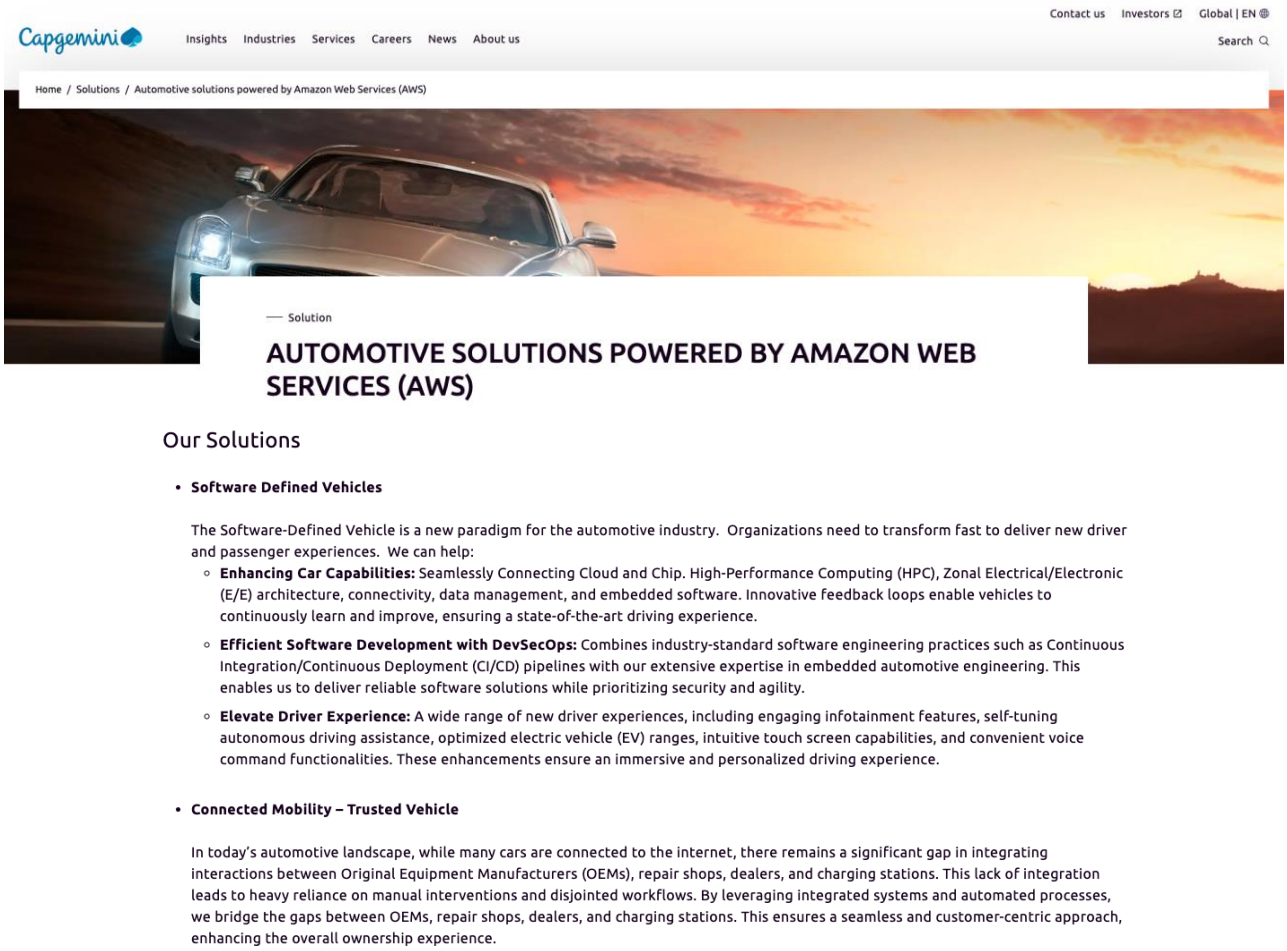

Image 36. Capgemini SDV AWS offering

Marketing Plan

Based on market analysis, OEMs should be the primary customer segment to target, and Tier1s could be a good validation and testing ground for our offering.

We have defined several stages of our Marketing Plan:

- Awareness stage (to generate leads pipeline)
    - Create internal awareness of the offering
    - Create external awareness and visibility of GlobalLogic capabilities in SDV space

- Market validation of the solution
    - External marketing materials
    - Client presentations
- Commercialization
    - Find a first pilot project with an actual client

With that, we have moved into the Introduction stage of the Goldsmith Technology Commercialization Approach.

The following goals have been set in our Marketing Plan:

- 10+ client presentations and touchpoints
- 1 Pilot client implementation
- 4x generated revenue with created offering compared to the investment made

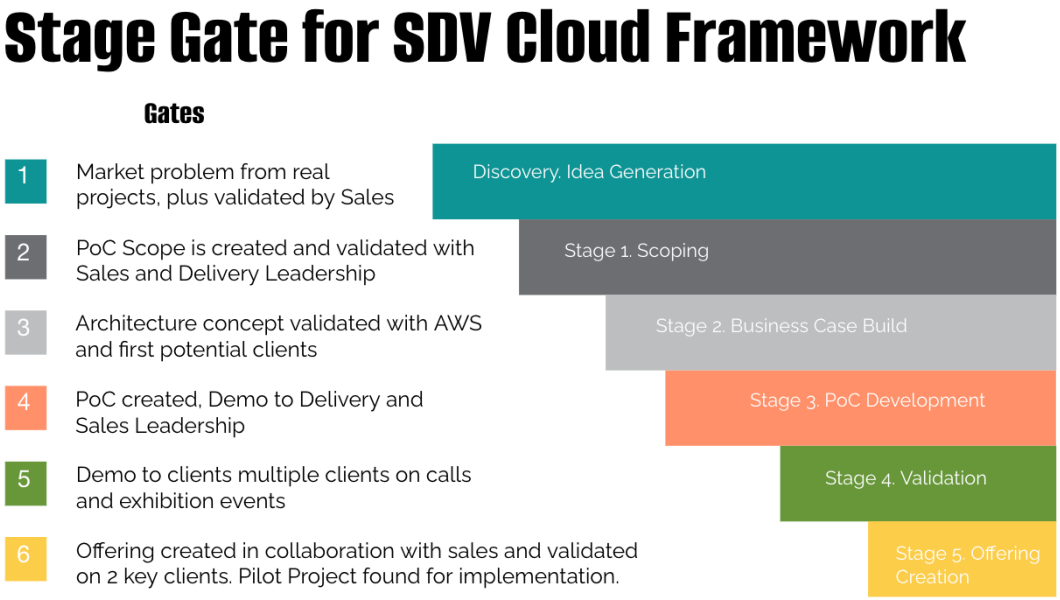

Image 37. Stage-Gate Commercialization Approach for SDV Cloud Framework

In retrospect, it was also visible that the approach for this Offering Commercialization followed a Stage-Gate Approach of R&D. This has served as a validation point that Stage Gate Approach can be used for new offering validation in Service organizations.

Awareness stage

For Market Awareness, we have chosen to test our view and ideas on one market - the German market. GlobalLogic was a Sponsor of Automobil-Elektronik Kongress 2023 in Ludwigsburg, Germany, and we have decided to leverage this opportunity to present our offering and validate it at the specialized automotive industry event.

To create opportunities for more traction and follow up with our clients, we have created a White Paper - Driving Automotive Innovation: Cloud-Powered SDV Infrastructure for the Future of Mobility [36]

The idea behind the White Paper was to:

- Validate interest in the topic
- Generate potential leads with whom we can talk during the event
- Use as a follow-up artifact for interested prospects

During that event, our team had dozens of client conversations, and we have seen an initial positive response from the market players. However, it became evident that this would be a challenging sell, as many clients have only started to look in the SDV direction and still need to understand all challenges and activities to be done.

But our White Paper got 10K unique downloads, much more than we have ever anticipated, which gave us confidence that we were on the right path, as there is a general market interest.

Based on the Automobil-Elektronik Kongress learnings and results, we have prepared an offering presentation for the GlobalLogic Automotive Sales and Delivery leadership teams. During this presentation, we have outlined:

- Our learnings on the market trends and client conversations
- Transformations that are happening in the market
- GlobalLogic SDV Cloud Framework offering highlights
- Progress on our commercialization traction and key validation points
- Reason for a Sales team to tap into those areas

Image 38. SDV Presentation to Automotive Sales and Delivery Leadership - **CONFIDENTIAL**

Market validation stage

Based on the sales awareness we created, we started to receive many requests for client awareness presentations, and overall, we have made a series of presentations for 14 clients (most of them OEMs).

All clients have shown great interest in adopting approaches demonstrated in the SDV Cloud Framework. Based on our meetings, we have learned that most OEMs are starting to work with Hyperscalers directly to understand the SDV adoption path.

So based on that learning, we have focused on tightening collaboration with Hyperscalers, specifically AWS and Azure (which have the most extensive market penetration in Automotive [37]), and we were able to pass their reviews and publish our solutions on their marketplaces.

AWS Marketplace Service Based Offering - https://aws.amazon.com/marketplace/pp/prodview-7zhrgr677cjqc?sr=0-5&ref_=beagle&applicationId=AWSMPContessa

Azure Marketplace Service-Based Offering - https://azuremarketplace.microsoft.com/en-us/marketplace/consulting-services/globallogic.sdv-cf-assessment

The fact that we have a published offering on their marketplaces acts as a validation of the quality of our solution and technical competence, as we had to pass technical reviews from their internal teams, and serves as a proof point of our capability for potential clients and partners.

Another learning was that it's hard to sell our SDV Cloud Framework Serviced-Based Offering to a client with whom we do not have well-established relationships, and in Automotive, establishing good relationships can take years.

It became clear that the best chance to launch a pilot project would be with an already existing client with whom we have a strong relationship and proven track record of performance.

So, we created a shortlist of potential clients, joined efforts with respective account managers, and started working on the tailored presentation and benefits case.

Our approach has worked, and in August 2023, we signed a contract for a Pilot project with one of our Strategic Tier1 clients.

The reasons for the successful selling of our SDV offering were:

- We have an excellent understanding of our client infrastructure, program, and pain points, so we were able to contextualize our offering for our client
- Good timing, as we just recently finished helping them recover a very troubled project, and outdated infrastructure was one of the main issues with the program
- Connect with the right stakeholders and decision makers both from the business and technical side

Image 39. SDV Pilot Project Implementation Roadmap - **CONFIDENTIAL**

Image 40. SDV Pilot Project Scope and Technical Details - **CONFIDENTIAL**

The Pilot project started in September. The total contract is estimated at 100 person-months of effort, and the MVP is estimated at 60 person-months of effort. MVP was successfully delivered in March and is migrating to production planned for June-July 2024.

Having one real implementation case will create a good base for the overall Solution and Offer commercialization, as it serves as the proof point of solution validity and also shows that some players are already making needed investments in the SDV field.

Hitachi Monozukuri Technology Award

In June 2023, our team was presented with the opportunity to be nominated for the Hitachi Monozukuri Technology Award.

The MONOZUKURI Technology Award is an annual internal Hitachi award awarded to cases in design and development, production technology/skills, quality assurance, and environment.

The Award focuses on cases that:

- Improved tremendously MONOZUKURI technology, including productivity improvement, quality improvement, cost reduction, speed increase, and lead time reduction
- Made significant contributions to the business performances of the relevant Business Unit/Group Company through the improvement of MONOZUKURI technology
- Made a significant contribution to the establishment of cutting-edge MONOZUKURI technology or business performances through company-wide transformation activities, committee activities, or Committee activities
- Established an excellent MONOZUKURI technology or mechanism compared to competitive companies

Our team has seen that as an excellent opportunity to elevate our Solution, Offering visibility to the Top management of the Hitachi group, get feedback on our service offering, and potentially creating additional proof points of the Solution and Offering validity.

In September 2023, GlobalLogic has Received the Excellence Award at the Monozukuri Technology Award for SDV Cloud Framework Solution Offering.
We were the only offering/product in GlobalLogic to receive such an award, and we were only 1 out of 3 nominees in Hitachi Group.
My team participated in the award ceremony session in November 2023.

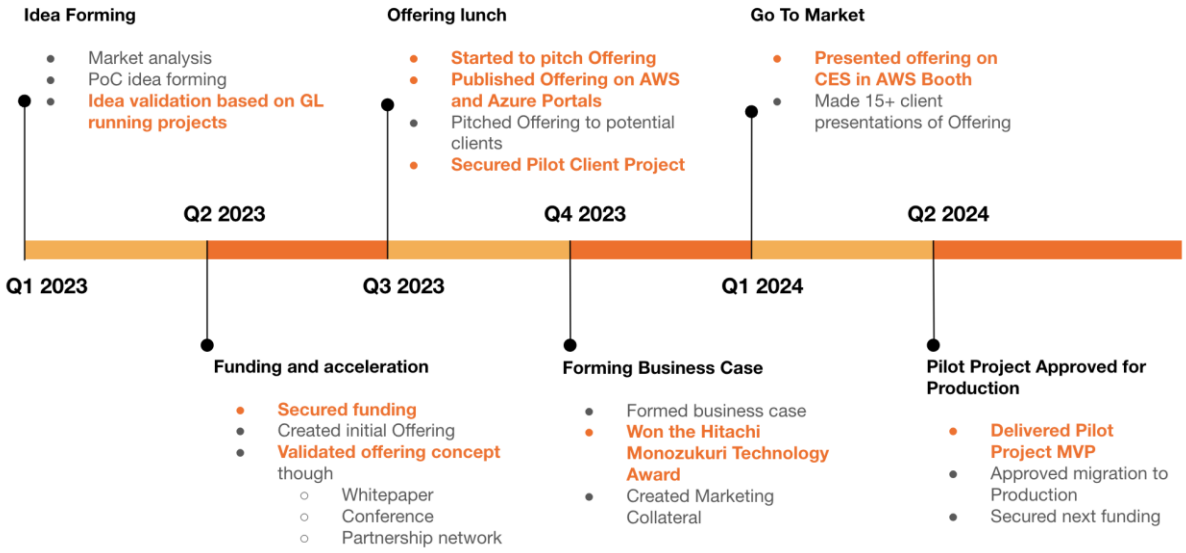

Image 41. Solution Offering Creation Roadmap

Commercialization Stage

Disclaimer: All calculations shown in this section of diploma work are used as an example and do not represent actual project numbers; instead, they use the actual model created during offering commercialization planning.

All used rates and costs are the market average for SW engineering services in the Ukraine region across different companies. Rates are used based on based on Yourteam.io report [47]. Costs are used based on the DOU salary report [46].

Currently, we are working on the commercialization stage of our SDV Offering, as we have received critical market validation and recognition.

The commercialization strategy consists of 5 critical steps:

- Make sure that our Pilot project with Tier1 will go into production, as this will allow us to have a proven case in our offering, and we will be able to validate the solution hypothesis. Also, this will serve as a differentiation point for GlobalLogic.

- Improving the accelerator and creating a solid demonstrator that will allow us to show multiple cases, explicitly focusing on feedback that we have received from AWS and our client meetings:
    - Add Admin Panel with User Interface
    - Add Inventory Management and license provision capabilities
    - Add Virtual ECU Integration scenario
    - Add flow for enabling collaboration between different simulated environments
    - Add HIL Integration scenario
- Combining our SDV accelerator with other GL accelerators in Digital Cockpit and ADAS areas to have a solid testing sandbox for our experiments
- Extending offerings in the area of HiL and Virtual ECUs, as this area has the most attention from our clients now
- Working closely with marketing on both awareness and lead generation through branding campaigns and important technology events

Image 42. SDV Cloud Framework Roadmap Highlights

Image 43. SDV Cloud Framework Enhancement Roadmap and Budget Estimate

- CONFIDENTIAL

We have ambitious plans for this year:

- Move the Pilot project to Production
- Secure additional investment for future offerings and accelerator expansion
- Acquire at least one new client with updated SDV Offering and accelerator capabilities
- Present Demo at CES 2025

Scenarios and Risk Assessment

To support commercialization planning, we have created several scenarios for an internal business case to justify additional investments into Offering and Accelerator.

We have made several assumptions. The main assumption was that we are using an offering and accelerator to acquire new clients and projects, and our accelerator serves as a differentiator and potential selling point.

Also, we have assumed that most of the projects will be long-term and will also create additional synergy revenue in other areas.

With these assumptions, one of our most important metrics to track is Client Acquisition Cost - CAC. It is assumed that all R&D investments in the offering and all marketing investments form the base cost, and CAC is calculated as an investment/new client during a year.

Also, it's important to track % of Investments compared to client-generated revenue, as based on that, we can establish proper price points to hit marginality targets.

Major Assumptions Optimistic			
5% ABR growth each year			
Average rate $8,500 with 5% YoY Growth			
Accelerator Team will be Billable 50% of the time on Client Engagements			
Synergy Revenue from Other Projects will create an additional 50% revenue of Previous Year Revenue, starting from Year 3			
SDV Cloud Framework Offering Services will be delivered out of Ukraine			
We will have a successful Pilot project to use in future sales			
Client FTE Growth	1st year	12	$102,000
	2nd year	25	$223,125
	3rd year	25	$234,281
	4rd year	8	$78,719

	5th year	8	$82,654

Table 3. Major Optimistic Scenario Assumptions

Major Assumptions Pessimistic			
2% ABR growth each year			
Average rate $7,500 with 5% YoY Growth			
Accelerator Team will be Billable 50% of the time on Client Engagements			
Synergy Revenue from Other Projects will create an additional 30% revenue of Previous Year Revenue, starting from Year 3			
SDV Cloud Framework Offering Services will be delivered out of Ukraine			
We will have a successful Pilot project to use in future sales			
Client FTE Growth	1st year	12	$102,000
	2nd year	25	$223,125
	3rd year	25	$234,281
	4rd year	8	$78,719
	5th year	8	$82,654

Table 4. Major Pessimistic Scenario Assumptions

All calculations shown in this section of diploma work are used as an example and do not represent actual project numbers; instead, they use the actual model created during offering commercialization planning.

All used rates and costs are the market average for SW engineering services in the Ukraine region across different companies. Rates are used based on based on Yourteam.io report [47]. Costs are used based on the DOU salary report [46].

The scenarios are created for five years, with 2023 being a factual reference point.

Client Live Time Value (LTV) is calculated as a sum of all client-generated revenue during five years.

Optimistic Scenario					
	2023	**2024**	**2025**	**2026**	**2027**
Total SDV Cloud Framework Investment	$ 176K	$ 392K	$ 610K	$ 766K	$ 789K
Total Revenue generated with SDV Cloud Framework Offering	$ 510K	$ 3M	$ 9M	$ 16M	$ 22M
Client Acquisition Cost	$ 176K	$ 392K	$ 305K	$ 383K	$ 789K
Client Acquisition Cost, % of Revenue	34.59%	14.39%	3.51%	2.35%	3.63%
Client LTV	**$ 8.3M**				

Investment Details											
		FTE	**Cost**	**FTE**	**Cost**	**FTE**	**Cost**	**FTE**	**Cost**	**FTE**	**Cost**
SDV Offering Solution	Team Labour Cost	8	$ 147K	11	$ 251K	15	$ 344K	20	$ 455K	20	$ 478K
	HW Cost		$ 6K		$ 6K		$ 6K		$ 7K		$ 7K
	Cloud Cost				$ 11K		$ 15K		$ 20K		$ 20K
Marketing	Marketing Support	1	$ 4K	2	$ 4K	2	$ 4K	2	$ 4K	2	$ 4K
	Marketing Budget		$ 20K		$ 80K		$ 160K		$ 160K		$ 160K
	Marketing Events	0	$ 0K	2	$ 40K	4	$ 80K	6	$ 120K	6	$ 120K

Revenue Details											
		# of clients	**Revenue**	**# of clients**	**Revenue**	**# of clients**	**Revenue**	**# of clients**	**Revenue**	**# of clients**	**Revenue**
SDV Cloud Framework License Revenue		1	$ 0K	2	$ 100K	4	$ 400K	6	$ 500K	6	$ 0K
SDV Offering Service Revenue		1	$ 510K	2	$ 3M	4	$ 7M	6	$ 12M	6	$ 15M
Synergy Revenue from Other Projects			$ 0K		$ 0K		$ 1M		$ 4M		$ 6M
Accelerator One Time Licence Cost					$ 100K		$ 200K		$ 250K		$ 300K

Table 4. Major Optimistic Financial Forecast

Pessimistic Scenario					
	2023	**2024**	**2025**	**2026**	**2027**
Total SDV Cloud Framework Investment	$ 176K	$ 392K	$ 610K	$ 535K	$ 443K
Total Revenue generated with SDV Cloud Framework Offering	$ 420K	$ 2.1M	$ 5.5M	$ 7.4M	$ 6.3M
Client Acquisition Cost	$ 176K	$ 392K	$ 610K	$ 535K	$ 443K
Client Acquisition Cost, % of Revenue	42.00%	18.68%	11.12%	7.25%	7.05%
Client LTV	**$ 3.6M**				

Investment Details

		FTE	**Cost**	**FTE**	**Cost**	**FTE**	**Cost**	**FTE**	**Cost**	**FTE**	**Cost**
SDV Offering Solution	Team Labour Cost	8	$ 147K	11	$ 251K	15	$ 344K	15	$ 344K	11	$ 251K
	HW Cost		$ 6K		$ 6K		$ 6K		$ 7K		$ 7K
	Cloud Cost				$ 11K		$ 15K		$ 20K		$ 20K
Marketing	Marketing Support	1	$ 4K	2	$ 4K	2	$ 4K	2	$ 4K	2	$ 4K
	Marketing Budget		$ 20K		$ 80K		$ 160K		$ 80K		$ 80K
	Marketing Events	0	$ 0K	2	$ 40K	4	$ 80K	4	$ 80K	4	$ 80K

Revenue Details

	# of clients	**Revenue**	**# of clients**	**Revenue**	**# of clients**	**Revenue**	**# of clients**	**Revenue**	**# of clients**	**Revenue**
SDV Cloud Framework License Revenue	1	$ 0K	2	$ 0K	3	$ 0K	3	$ 0K	3	$ 0K
SDV Offering Service Revenue	1	$ 420K	2	$ 2.1M	3	$ 4.9M	3	$ 5.9M	3	$ 4.5M
Synergy Revenue from Other Projects		$ 0K		$ 0K		$ 630K		$ 1.5M		$ 1.8M
Accelerator One Time Licence Cost				$ 0K		$ 0K		$ 250K		$ 300K

Table 5. Major Pessimistic Financial Forecast

#	Major Risk	Mitigation Plan
1	Clients will start investing in SDV Infrastructure themselves, working closely with Hyperscalers, hence our offering may be too late for some of the target clients	Start offering more classical Staff Augmentation or Managed Team services, using SDV offering to differentiate from the competition. Improve connections with Hyperscalers so they can recommend you as a partner in cases when they cannot support clients directly
2	Clients will not be willing to work with Ukraine based teams due to the war	Work with other GL offices in Poland and India to establish hybrid teams and competence backups. This approach will also be beneficial in case we need to provide flexible scaling options to clients.
3	We will not be able to create Synergies out of these projects and Synergy revenue respectively	Create a specific Account Plan with the Sales team to understand how to create Synergy revenue streams. Put Synergy revenue as one of KPI's for the Account Team
4	We are not able to sell our accelerator and get respective revenue	Provide accelerator for free if synergy revenue is significant enough
5	The pilot project will not be successful, and we will not have market validation; we will need to have more investments in solution	Set up a very concrete plan for the Pilot project. Put proper governance. Discuss the potential support and investments needed from the GL side with the client. Assure connection with client executive stakeholders to maximize chances of a successful Pilot project.
6	Planned Distribution Channels will not work	Set up clear KPIs and Stage Gates for existing distribution channels. Brainstorm with the Sales and Marketing team to define potential new Distribution channels

Table 6. Major Risks and Mitigation Plan

Conclusion

The automotive industry is going through an inspiring and complex transformation, with software taking a central stage in the further evolution. Such transformation disrupts the industry and completely redefines the overall market landscape. This opens up unique opportunities for strong Software Services players acting as Integration point.

On the other side, the market is very competitive. It requires a unique combination of knowledge, expertise, and market understanding, but if played correctly, it can create much value down the line.

The Automotive SDV market is a unique opportunity for Ukrainian software engineers and companies with excellent technology and domain understanding. With proper innovation, business, and marketing approaches, they can become a significant revenue stream for the services industry and the country.

Managerial conclusions:

- The survival of service companies will depend on their ability to differentiate. Clear offerings are the best way to achieve that differentiation in your niche (even for big players)
- Software Services players need to understand the actual pain points and be very quick and precise in addressing them. Also, it’s not enough to “talk the talk”.
- For every offering, you must demonstrate credibility and understanding of your client. Accelerators, demos, and case studies serve as a good proof point
- Also, it’s crucial to be fast and innovative, listen to the client's feedback, and adapt your offering quickly based on the client's feedback

- You need to activate your main stakeholders fast to get the required support and investments and especially speed in the later stages
- Proper talent is critical; even a small group of talented engineers in Ukraine, with all the world's limitations, can stand out if you have the right solutions to the very actual problems
- A clear commercialization framework is very helpful in the alignment of all involved parties
- Joint collaboration between Sales, Delivery, and Marking is essential for successful go-to-market, and clear value definition and accelerators are necessary components for proper lead generation and positioning

Product/Offering development conclusions:

- The R&D Stage Gate Approach works well in Service Companies as an innovation or commercialization framework
- Early Validation is very important, and you have a lot of tools even in the Enterprise B2B space. Clients, Partners, and Industry Events are a great and relatively cheap source for validation
- New Market = Speed. Get something fast to a new market to get feedback and continue iterating
- Marketing strategy is essential for Go To Market

Gratitude and Credits

Achieved results and projects would only be possible with the support of the talented team and stakeholders around. With that, I would like to express my gratitude to all people who were involved in the SDV Cloud Framework project and have supported me in making this happen (in alphabetical order):

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CONFIDENTIAL - Appendix 1 (PoC Initial Proposal Slides)

CONFIDENTIAL - Appendix 2 (SDV Cloud Framework Infrastructure Offering)