

As automakers take the wheel on software stack, L&T Tech and Tata Elxsi stocks put up a big smile



Synopsis

Earlier, software was owned and delivered by tier-I suppliers like Bosch and Continental. Automakers now want to own a chunk of it. Part of the job is being outsourced to software-engineering companies, whose stocks have soared. Shares of L&T Tech, Tata Elxsi, and KPIT have zoomed 146%-350% over the last one year. The first of a two-part series.

When Marc Andreessen, the famous American entrepreneur and co-founder of Netscape, coined the phrase, “Software is eating the world”, in a *Wall Street Journal* op-ed piece in August 2011, little did he know that a decade later leading automotive companies would develop a taste for codes and algorithms. So much so that many of them are now implementing a software-first strategy.

Sample this.

“The car industry will change dramatically, radically. Profit pools will shift from conventional cars first into EVs (electric vehicles) and then radically into software,” Herbert Diess, chairman and CEO of **Volkswagen Group** said during an analyst call in March 2021.

The German auto major says it is 100% committed to become a software-enabled car company.

Closer home, Tata Motors, in its FY21 annual report, said, “We are also evaluating an automotive software and engineering vertical within the group that will help us lead in a new world of connected and autonomous vehicles.”

A transformation is underway in the supply chain as well.

This year, Bosch, the world's largest automotive supplier, pooled 17,000 employees around the world (including India), and across domains, for its new business unit, Cross-Domain Computing Solutions, to focus on software-intensive electronics, a market it expects to grow 15 % annually between 2020 and 2030.

While every new model is targeting to have more software content and connected features, auto companies are increasingly looking to take the technology reins in their own hands. But before going into that, let's first take a look at how the love for software is growing among automakers.

Software in focus

In 2020, Volkswagen picked employees from across the organisation to set up software as an independent business unit. It started with 3,000 people, which has grown to 4,500 now. The plan is to grow to 10,000 people by 2025.

The first shift towards software is underway at Volkswagen with electrification, and the next big thing that will happen is automated driving. "Developing the software stack is of vital importance," Diess had said in the analyst call mentioned above.

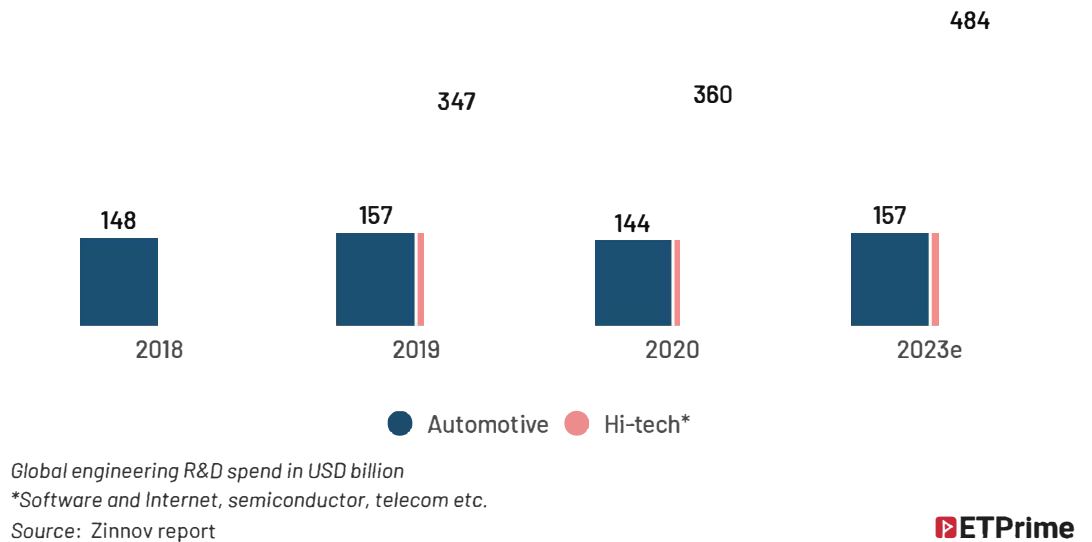
The company is investing EUR2 billion-EUR2.5 billion annually — a sizable portion of its EUR14 billion R&D budget (the largest in the automotive industry) — in car software. The company sees consolidating the software piece as key to customer experience. It is putting efforts to build a competitive standardised backbone architecture, which will culminate into Volkswagen operating system for cars.

It plans to reduce R&D intensity from 7.4% in 2020 to 7% in 2021 and further down to 6% by 2025. Absolute spends, however, are likely to be flattish.

Tata Motors, too, is reducing its R&D intensity both in India and at JLR. Top suppliers like Bosch and Continental have reduced R&D spends in their automotive-tech business units.

According to market-research firm Zinnov, the overall automotive R&D spending is consolidating after years of steady growth. It expects spending in 2023 to go back to 2019 levels of USD157 billion. In contrast, hi-tech-led verticals consisting of software and Internet, semiconductor, and telecom are expected to reach USD484 billion by 2023, registering a CAGR of 14% between 2019 and 2023.

Automotive R&D spends are no longer growing despite intensifying disruption



With intensifying disruption, R&D efforts are no doubt rising. “This push to do more with less is expected to push for larger outsourcing and will be a tailwind for the Indian engineering service providers like KPIT, L&T Tech, Tata Elxsi, and other,” says **Pareekh Jain, founder of engineering-services advisory Pareekh Consulting.**

Amid stability in overall investments, software and electronics monies are rising.

From Volkswagen, **Toyota**, and Tesla to GM Cruise, Google Waymo, Nvidia, and Intel – everyone is building ADAS (advanced driver assistance) technology. Ultimately, there will be a few winners, but a lot of people will try to come out with solutions, which is good for engineering service providers.

Why automakers are taking the driver's seat

Auto companies are increasingly outsourcing the engineering services to the likes of KPIT, L&T Technology, Tata Elxsi, and big-ticket IT companies such as TCS, Wipro, and HCL. Outsourced engineering-service companies largely had tier-I auto suppliers as customers in their automotive vertical. That is changing and now the ratio of revenue from tier-I vendors and automakers is between 70:30 and 60:40. But the rate at which order flows are coming from auto companies, automakers will soon dominate the mix, according to Jain from Pareekh Consulting.

Shaju S, head of the transportation business unit at Tata Elxsi, says five to six years ago, 10%-15% of revenue came from auto companies, mostly on the program-management, or from the system-engineering side. "Now, about 35%-40% of our revenue comes from automakers, and their share is growing," he says. According to him, earlier software and electronics were all owned and delivered by tier-I companies like Bosch, Continental, and **Valeo**. It was a black box for auto companies and tier-II vendors. Over the last five-six years, automakers have started realising that the huge reliance on tier-I suppliers is a pain point. So, they wanted to own the software. This made them go for service providers like Tata Elxsi and others.

Shaju says one key reason why vehicle makers are moving away from tier-I suppliers when it comes to software is cost. Earlier, automakers didn't own the software and only got executable files from tier-I suppliers. So, for example, if they needed to do any feature addition in the infotainment or ADAS system, they had to make a change request that was expensive. "Every single line change of code used to cost them (automakers) a few thousands of dollars, to say the least. So that became an expensive proposition," he explains.

By taking ownership of the software, an automaker can get the flexibility of modifying the features or introducing new ones as and when they like without a time lag. In a typical auto-industry environment, the ordering process takes

between 30 days and 45 days, then only the tier-I supplier starts working on it. But if the software is in-house, then features could be implemented in 45-60 days, even if part of the software is developed via outsourcing.

From a customer perspective, when they buy an Audi or a Jaguar, they want to see and feel the difference. But the differentiation between models became very less as most of the components have been commoditised. For example, in an infotainment system, the only difference was in the human-machine interface or HMI, which was custom developed for the carmaker.

"Now car companies want to take control of both the tech stack and data. Otherwise, they think that they will be displaced tomorrow," says Jain from Pareekh Consulting.

Automakers have also realised that to be technologically ahead, they need to start doing the research in-house and start building things in the new-technology area. It is also important to hold some intellectual properties (IPs). For example, in ADAS and autonomous driving, some of the core IPs auto companies would like to own themselves. So, that is another aspect which is driving the in-housing of software development.

Last, there is a move to consolidate electronic control units (ECUs) in the automotive industry. A typical high-end car could have between 80 and 120 ECUs that have software residing in them. This increases complexity and the need for wiring harness, which contributes significantly to the overall weight of the car.

So, there is a cost factor, and there's also a complexity factor in terms of vehicle weight. And if that has to be reduced, ECUs need to be consolidated. But today, a tier-I supplier may not be able to provide the solution alone and may need to talk to other suppliers. Thus, it is better that the carmakers lead the conversation, as they know what features need to be deployed.

Advantage outsourced engineering services

The automotive industry, which is used to incremental changes for decades, is forced to take drastic steps to cut emissions, offer driver assistance and connectivity. The pace of technological change is expanding opportunity for India-based R&D. This has opened new doors for both software companies and captive global-delivery centres.

The stocks of companies focused on outsourced-engineering services have soared. L&T Tech, Tata Elxsi, and KPIT Technologies have soared 146%-350% in the last one year. And most analysts are bullish on these stocks even now.

Snapshot of engineering-service companies

	L&T Tech	Tata Elxsi	KPIT Technologies
Financials			
Revenue (INR crore)	5,450	1,826	2,036
Ebit (INR crore)	790	478	177
Ebit margin (%)	14	26	9
PAT (INR crore)	663	368	141
Key metrics			
Number of employees	16,400	7,362	6,366
Revenue/employee (INR lakh)	33.2	24.8	32.0
Ebit/employee (INR lakh)	4.8	6.5	2.8
Transportation revenue mix (%)	31	41	100
Offshore revenue mix (%)	56	67	50*
Valuation			
PE (FY21 actual)	59	71	54
PE (FY23 estimate)	37	44	25
Market cap (INR crore as on July 30, 2021)	39,100	26,310	7,580
1-year stock price return (%)	146	350	339

Note: All figures for FY21 except market cap; *estimates

Source: Companies, ET Prime research, Refinitiv

 ETPrime



Karan **Uppal**, research analyst at Philip Capital, favours KPIT Tech because of its valuation comfort and strong profit-growth expectations.

Tata Elxsi and L&T Tech have given 415% and 328% returns (excluding dividend), respectively, in last five years. KPIT Tech was demerged in April 2019 and has given 159% returns since. Tata Elxsi and L&T Tech are more diversified companies, with transportation accounting for 41% and 31% to their revenues, respectively, compared with 100% at KPIT.

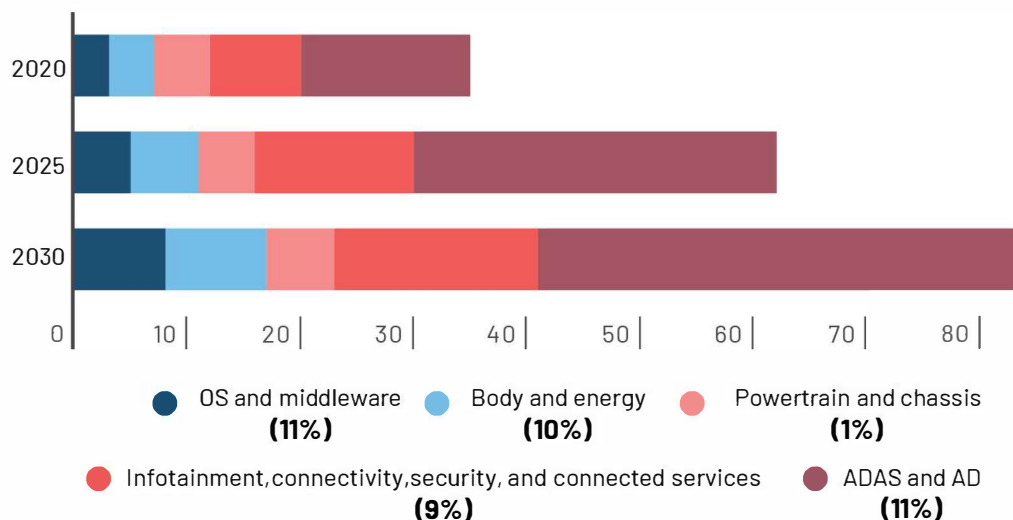
Among them, L&T Tech is the largest by revenue. It is also the most diversified company across verticals. Tata Elxsi has the highest relative valuation on forward earnings based on its exposure to fast-growing verticals like hi-tech and healthcare. The company's Ebit margins are double the other two due to higher offshore component, and possibly because it focuses on more-profitable areas of business. Incidentally, the transportation segment at Tata Elxsi has lagged, as its top customer JLR reduced spending. According to Uppal, from accounting for 21% of Tata Elxsi's revenue in FY19, JLR accounted for only 11% in FY21. "Only now, JLR is regaining its health," he says. The company has bagged orders worth INR250 crore for both FY22 and FY23 from JLR, its annual report shows.

Let us now understand what the focus areas of development are when auto companies talk software.

The emergence of ADAS

According to a McKinsey analysis, ADAS and autonomous driving (AD) are the largest and biggest growth area in car-software development.

Breakdown of software development efforts into domains



Figures in brackets refer to CAGR 2020-30

Source: McKinsey analysis

For Tata Elxsi, ADAS is the biggest revenue generator followed by electrification and connected technology. For KPIT, it is power train followed by ADAS and connected vehicles.

ADAS is seeing the maximum investments. It has been in play for 10 or more years now. But it gained more traction with the concept of AD. And even though there were attempts to go to level 5 autonomous driving straightaway, that did not quite happen. Now there is more focus on level 1 and level 2, which are more of driver-assistance features. Tata Elxsi is involved in projects relating to software development, testing, scenario generation, or even data labelling (identifying objects caught through sensors).

In EVs, Shaju says there is work going on at Tata Elxsi on software development for various components like DC-DC converters, inverters, battery-management systems, traction control, and traction motor-control software. Tata Elxsi has a mechanical division, too, which has started motor design and packaging, battery packaging, etc.

The challenge for the Indian market

The main challenge working with Indian companies is that the market is very cost-sensitive, says Shaju. Also, the legislations in India are not as strong as elsewhere. “The kind of technological trends that we see in the Indian market are less, compared to some of the overseas markets in Europe or the US for example. There, many of the ADAS features are becoming mandatory, and hence there is a lot of push for implementing them. Whereas in India, it is not mandatory, and only a desirable feature, which becomes optional when it comes to cost considerations.”

Shaju says Indian automakers do come to Tata Elxsi for directions and advice in some cases because of the company’s experience working with tier-I suppliers and vehicle manufacturers outside India. “Hence, they would like to take advantage of the knowledge that we have gained, and, in some cases, they do reach out to us for consultation.”

An average modern high-end vehicle has millions of lines of code and electronics, and electrical content comprises nearly 15% to 25% of the total vehicle value. On-board computers with software capability provide control on range of attributes such as emissions, fuel efficiency, brakes and stability, and connectivity, says Rajendra Petkar, president and CTO, Tata Motors. With growth in software and

electronics there will be an associated increase in the people involved in this area at Tata Motors. There is also an increasing multidisciplinary approach and new products are emerging through cross-pollination of ideas from various streams.

Clearly, the Indian auto industry is undergoing a big change.

Can automakers' drive to steer the car-software ecosystem open new roads for vendors, tech players?

Synopsis

Carmakers are not software-development companies. So, they can't make software fully in-house and will need the help of software-engineering firms. They can own and maintain it once the software is developed. We are likely to see more specialisation and bundling of related components by tier-I players. The last of a two-part series.

The auto industry is undergoing a big change, as we told you in the **first part** of this series. The automakers no longer want to depend on tier-I suppliers for car software. They are increasingly outsourcing the job to engineering-services companies so that the control remains in their hands, and any change or addition in features can be done without much delay.

Companies like **Volkswagen** and **Toyota** are leading this march.

The German auto major aims to boost in-house share of car-software development from less than 10% at present to at least 60% by 2025. It is using several partners to build the VW OS. Ultimately, Volkswagen will own it. Once the software is developed, Volkswagen can maintain it in-house and not rely much on suppliers.

"These companies (automakers) are not software-development companies. So, our experience in developing software will help them," says **Sha ju S**, head of the transportation business unit at Tata Elxsi, a leading design and technology-services provider.

This is bad news for most large tier-I suppliers. Not only because auto companies are doing more tech development themselves but also because companies such as Nvidia and CATL are getting to play a much bigger role be it in software, chips, or batteries.

This could, however, lead to some changes in the way the tier-I supplier ecosystem functions. We are likely to see more specialisation and bundling of related components by tier-I players. These specialised companies will control both tech development and integration. Even in mobile systems, Qualcomm, for example, controls the ecosystem and has development partners or companies certified by it to design PCBs (printed circuit board). The ancillary layer, augmentation, integration, or support can be provided by engineering-service providers.

Vadiraj Krishnamurthy, vice-president and head of technology and innovation at **Robert Bosch Engineering and Business Solutions**, believes the tech stack will become so complex and higher in value that it will allow space for everyone.

The opportunities from software-hardware decoupling
“With software-defined cars, software-hardware decoupling is imminent,” says Krishnamurthy. However, this decoupling is proving to be a lot harder in a car unlike in a mobile, as the former doesn’t have a single operating system (Android or iOS).

Also, instead of one microprocessor, cars have 70-100. Here, Autosar, a worldwide partnership to develop a standardised software framework for intelligent mobility, comes into play. It provides a common base for electronic control units (ECUs). All one needs is a middleware that abstracts the application later. This will allow the same functions and features to run on different processors. The industry now needs to build consortiums to standardise interfaces.

Autosar is also an attempt so that companies can pick and choose components from different vendors. “That stage of flexibility has not been reached yet though,” says Shaju from Tata Elxsi.

Software-hardware decoupling could open opportunities for new business models.
“The mainstay will continue to be software bundled with hardware,” says Krishnamurthy.

We have seen several software-focused companies bundling their solutions with hardware as that is the business model.

In the future, car software can be a product sold on licence per unit. For example, the valet-parking feature, which is part of advanced driver assistance (ADAS), can be sold like an app. So can be a feature that will offer autopilot driving on the highway. Then there are cloud services like Bosch's battery as a cloud solution, which can be transaction-based or can follow an annual recurring-revenue model.

Bosch is building three key products -ADAS, advanced network and gateway, and infotainment with dashboard and navigation pieces. “We used to think of a car as the system. But now car is just a device in an IoT ecosystem and there will be various use cases emanating from that,” Krishnamurthy says.

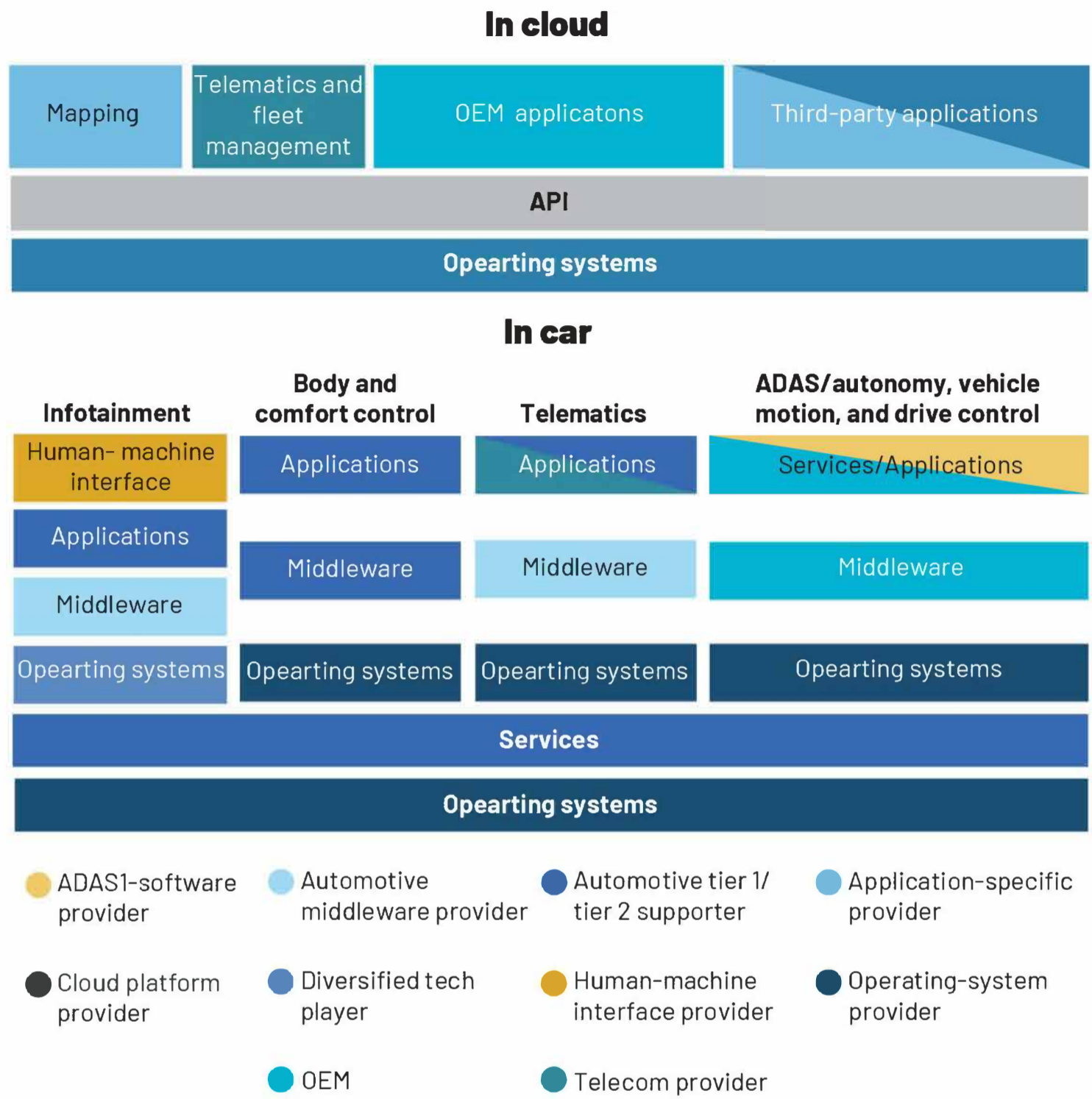
He believes that given software and hardware are now so intricately bundled, putting the value of software is impossible. “But over time, we could see the value of the software piece constitute the majority of the value of the car,” he says.

In a Bajaj Chetak, Bosch's value of content is greater than what it sells in many cars. Bosch is providing a motor, a controller, an IoT device that basically tells where the vehicle is, and an app that shows, among other things, what the battery charge position is. With the bundle of offerings from Bosch, an automaker has to build a chassis around it. It will tell Bosch the temperature range its vehicles should be able to operate in and the battery capacity. The design of the battery-management system

(BMS), how it reacts, and everything else is a proprietary information from the BMS manufacturer, which knows the logic of, say, tweaking the battery output by another 10% when the speed crosses, say, 60kmph.

Vehicle-software components

Today, OEMs are stitching disparate software components together to build proprietary platforms



OEM: Original equipment manufacturer
Source: McKinsey & Company



Software getting complex, deal sizes getting bigger

For automakers, software development, following the 'platformisation' framework, can be very complex, as there is a high level of variation. In a BMW, for example, the features in the infotainment system vary between different variants in the 3 Series. So, the software is created with all the features, and then a subset of these features moves into different variants.

Samsung, which has a big share in car audio, video, and multimedia, provides touch panel, user-interface features, does software development and vehicle integration. For example, when a car manufacturer says it needs the system to play mp3 or .WAV files, Samsung decides how it should compress the file, how to make sure there is no lag in hearing, and the speed at which the file is playing. A common example is when we set the system to, say, jazz or rock, the software has to take the audio input and adjust the sound system in real time based on what setting you like. That is the kind of know-how that Samsung Harman has acquired through the long experience in this business.

Earlier, with software working under different units like, say, suspension or brakes, localised decision-making would happen since teams were smaller. "Now, with software emerging as a separate business unit, the software head, controlling 4,000-5,000 people, can take an outsourcing decision/feasibility at a larger scale," says Pareekh Jain, founder of engineering-services advisory Pareekh Consulting.

The deal sizes are also getting bigger.

In engineering services, deals above USD10 million are considered large, compared to USD100 million-plus in IT, says Jain. Shaju from Tata Elxsi says larger deals to the tune of USD25 million-USD50 million are happening in auto software, and this will continue.

"We are involved in multiple discussions where the deal sizes are large. Bigger deals are better for us. It gives us better visibility and a more sustainable business for us. Now we see three- or four-year deals. Earlier, deals were smaller with shorter durations," he adds.

Large vehicle manufacturers are now all making five-year plans on investments. These, in turn, translate into assured long-term business contracts for partners.

But some automakers such as Volkswagen aim to make car-software development in-house. Is it a move in the right direction? Does coding your own vehicle pay?

The questions around in-house software and coding

"I don't think 100% development will go in-house," says Shaju. According to him, for automakers, maintaining a very large software team doesn't make sense. "They will have a team to maintain it (the software) properly and make some additions, and will use partners like us to develop the core software. Wherever the effort is manpower intensive, they will continue to use companies like us," he adds.

"We have gained it through experience, and we also do experimentation in-house," Shaju says. He explains that charging and discharging of the battery depends a lot on the chemistry. "We have many charging curves and discharge curves, which we have used to model and develop the battery-management system. Our work with several battery companies has given us access to these battery characteristics. We use that to fine-tune our algorithms. Likewise, motor-control characteristics are made available by customers, and we build the software based on those characteristics."

There are domains where Tata Elxsi has gained expertise by working with multiple customers over the years. In ADAS, for example, it has gained significant experience and knowledge. Shaju points out that there is a huge evolution happening in sensor technology. But high-speed sensing is still a challenge. Most of the sensors available today can sense around a 200m range. A company in the Bay Area in California, AEye, has developed a sensor that can sense up to 1km. It's a huge jump and Tata Elxsi is working with AEye.

When we hear that millions of miles of code run a car, it does make us sit up and take note. But does that directly correlate with revenue? "Directionally yes, but it isn't linear. We will get to know that correlation," says Krishnamurthy from Robert Bosch Engineering and Business Solutions.

The lines of code are not a measure of effort or the complexity of the system. The auto industry for a long time has been following a model-based development approach. It uses tools like Matlab and Rhapsody to generate codes. The code is generated automatically and the number of lines of code is more than what would have been if one had written them manually.

Software in a car broadly have three different layers. The software, which sits right on the top of the hardware, directly interfaces with a micro-controller. It is called the micro-controller abstraction layer (MCAL) and is predominantly handwritten. In many cases, an assembly code is used to optimise the functioning and provide better control over the micro-controller interfaces compared to the C programming language.

Then there is a layer above that, which is the middleware. This can be a mix of handwritten code and a model-based design or auto code. Above that comes the application layer, which is predominantly a model-based development. This code is generated and not written. The complexity is more in the application, and as more and more features are added in a car, the number of codes grow. Hence, pulling a model-based design approach helps in better maintainability, given modifications are common. Having a more readable layer than a manual code helps. "So, the number of lines of code is not a measure of effort in the applications. It is based on the feature and number of function points, etc., based on which we estimate and give effort estimates for a project," says Shaju.

The road ahead

The actual control of the vehicle and functions remain in the car. There are several features that need to stay within the car, as there cannot be any kind of latency for some of the critical features or functions.

As more and more cars get connected to the cloud, several features will be added. As it is, connected infotainment is gaining traction, and radio receivers are giving way to Web radio.

Data will be pushed from the car to the cloud, where analytics will run and provide inputs or decisions back to the car or send them to the carmaker.

With the advent of electrification, the amount of testing required is huge, particularly for high-voltage applications. Here, the digital twins will play a much larger role in virtual testing over multiple drive cycles instead of physical testing.

(Data support by Rochelle Britto; graphics by Manali Ghosh, Sadhana Saxena)

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