ICT GROUP
ICT Netherlands
Smarter Solutions

WHITEPAPER

Software quality will be key in the car of the future

Working with A-SPICE will increase the quality of the developed software

Cars are slowly turning into computers on wheels, and a car's quality is determined more and more by its software quality. Each new generation of cars has more features on board than the last, and they depend on each other more heavily. The shift towards fully self-driving cars also increases the software complexity. What does this mean for the software development process and the required quality of the developed software?

The automotive industry is going through its greatest transformation ever. This is mainly driven by the trend that vehicles are becoming Autonomous, Connected, Electric, and Shared (ACES). This development has a major impact as it is not only the car itself that changes, but also the way people use them and pay for them (for instance shared use models). The electrification also makes it much easier for newcomers to enter the market and speed up the development.

Launch excellence will become decisive

All of this means that success is no longer determined by the design and driving properties, but rather by the time-to-market regarding new functions. Like a smart phone or a computer, a car's functionality will only increase during its lifetime, so a car factory's ‘launch excellence’ will make or break its success in the future. They will have to add specific vehicle software expertise to their mechanical knowledge and skills, because the development of high-end software for digital ACES cars will become a core activity. The time-to-market related to new software functionalities will become one of the main competition factors.

Depending on the brand and model, a new car has ten to a hundred times more lines of code than an airplane. This development has taken a giant leap. Where a car had about ten million lines of code ten years ago, it has about 100 million lines of code today, and this number will grow to between 500 million and a billion lines in a fully self-driving car. To put this into perspective: the space shuttle had about 400.000 lines of software code.

Software platforms where everything comes together

The old E/E architecture of a car is no longer good enough in this modern world. Where car software functionality used to be divided between many ECUs, the car of the future will have just a few large IT systems that bring many software functionalities together, separating hardware and software as much as possible. The car also receives more and more information from outside the car, for instance about the road, road users, traffic jams, charging point locations, and weather conditions. The car will have to react to all of this information.

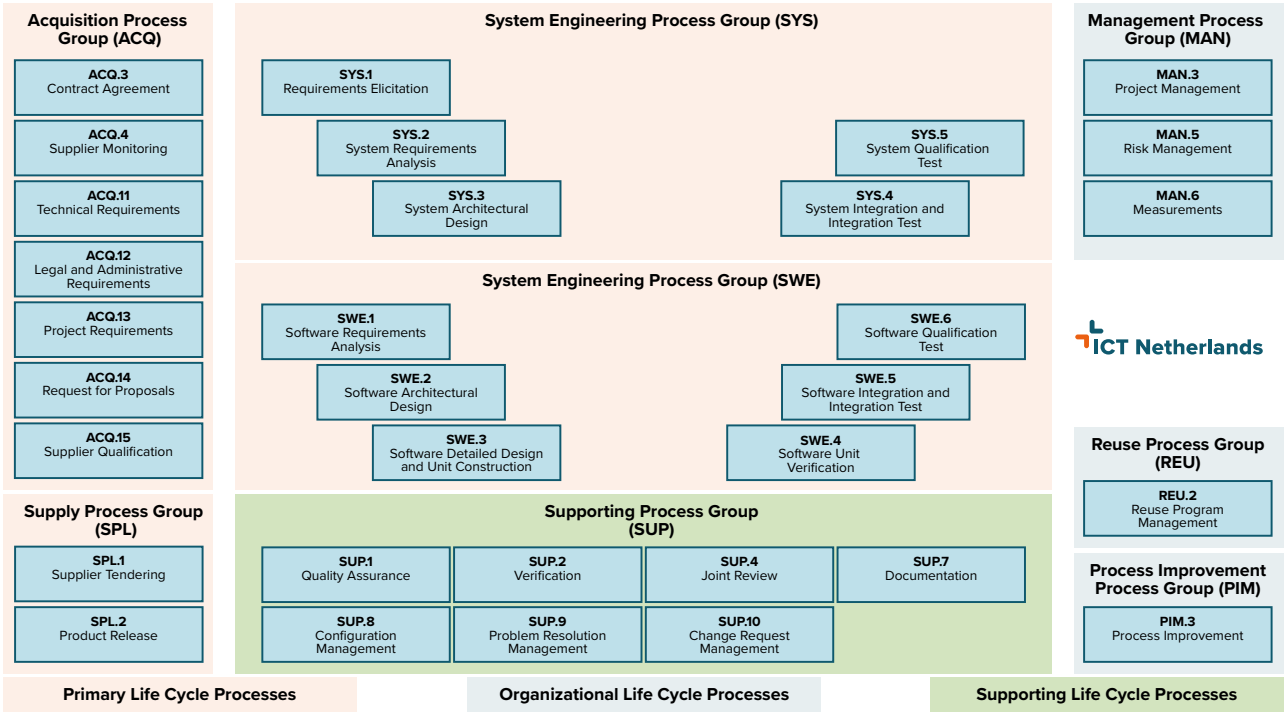
This asks for a whole new approach to software development and the integration of different functions. Although you could define domains in which the functions play a part (such as infotainment, body, chassis, and ADAS/AD), these domains also affect each other.

Domain integration

An example of this domain integration is an electric car's calculation of a long route. It will need two or three charging stops along the way, depending on the route, driving speed, outside temperature, and possible traffic jams. The car calculates a route beforehand and shows the most logical charging point locations through the navigation system. This calculation requires a lot of communication between the navigation system and the battery management system (BMS). The two keep communicating during the ride. Then there is the communication with the external environment as well, in this case, for instance, with the potential charging points to check if a spot is available and how fast the car can be charged at this point. Based on this information, the car will adjust the route and charging points during the ride if necessary.

Complex hardware and software chain under control with A-SPICE

This interaction means that the software chain will become much more complex and have a lot more interfaces. This means we will have to figure out how different functions affect each other in a very early stage and take this into account in the design. For this reason, ICT Group use the Automotive SPICE (A-SPICE) framework for improving and assessing the applied development processes. This standard can be applied to both software and hardware, as well as to mechatronic systems in cars. For now, however, the standard is mainly used for software development.



A-SPICE offers a framework for a reliable and predictable software development process. A process that leads to solid and high-quality software containing the functionality agreed with the client beforehand and delivered on time and according to budget.

A-SPICE starting point

Most car manufacturers ask for A-SPICE level 2 software development now. In summary, this includes the following aspects:

1. Clear requirements need to be defined: the reasons for which you need to build a piece of software, so that you can test it in a later stage;
2. You need to show how the design has been translated into code and verified with tests. This has to be done consistently. Traceability helps the entire process, from requirements to design to code and testing the newly developed software;
3. Everything has to be done by qualified engineers, and demonstrable reviews of designs, code, and tests are necessary to guarantee the required quality;
4. The work necessary to translate the requirements into tested and deliverable code, needs to be planned from beginning to end, making it possible to show and measure the activity planning and tracking by means of reports and any available metrics.

How does A-SPICE work?
A large number of processes has been identified within the A-SPICE framework that can be used for the development of a system. Sometimes, all processes are used for the development of a certain piece of software, but usually only a selection. Each process has process targets. Tasks and activities have been defined for each process, and these are important to achieve process targets. To what extent and in what way these targets are achieved, will decide the quality level (Capability Level, CL) of that process in the project. Assessments may be performed during the project to determine the capability level of the project.

ICT Group's added value in A-SPICE

ICT Group's Automotive business unit is certified for A-SPICE level 2 and, in reality, even works according to Capability Level 3 directives. ICT Group also have several employees who are certified assessors, which means they can perform A-SPICE project audits and assessments.
Capability Level 3 means that the organization can demonstrate that it carries out A-SPICE projects according to a defined process. This includes requirements regarding the quality management system (QMS). For this reason, ICT Group have implemented a specific expansion for the Automotive unit, based on their own QMS, which is used across the organization. This QMS contains all kinds of data for the execution of a project according to A-SPICE. In addition to the process definitions, it includes automotive specific work product templates, working instructions, and checklists.

A-SPICE in relation to functional safety and cyber security

The main reason to develop according to the A-SPICE standard is obviously that it improves the software quality, which can be proven by means of assessments. This is definitely needed in the dynamic automotive world, in which functional safety systems and cyber security are becoming more important as well.

Functional safety relates to the development of safe (sub)systems. This requires taking certain measures in the software, but also in the hardware, to prevent that a malfunction or error leads to downtime of systems that are vital for the safety of the car's occupants and/or the public. Given the complexity of the software chain, this is only possible if you design the software in accordance with the ISO 26262 standard from the very start.

Cyber security is important because modern cars are constantly in contact with the outside world, and need to be protected from unauthorized access (hacks). In a car, an access breach can lead to life-threatening situations. Some cars already get software updates 'over the air'.
The automotive industry works with the UNECE WP.29 directive, which is very similar to the way we handle the safety of critical applications in other sectors. After all, we work for many different sectors where it has been business as usual for years to connect critical assets like machines, tunnel installations, or wind farms to the internet. This allows for remote monitoring and even operation of such installations. We apply the same knowledge and valuable experience to the automotive domain.

Recognizing security and integration challenges in an early stage

Developing high-quality software is only possible if you recognize integration, security, and functional safety challenges in an early stage. Only by taking these into account from the very start of the software development can you develop the individual subsystems in such a way that they can easily integrate with other functions without losing quality. After all, the automotive industry's real challenge is not so much to develop individual functionalities, but to integrate them in such a way that the car always responds in a predictable way, even in unpredictable situations.

Why ICT Group?

Never before did the automotive industry have so much to gain from the knowledge acquired in other sectors as it does today. Concepts as the cloud, AI, and security are suddenly very important, concepts that the big tech companies have been familiar with for years. We have years of experience in other sectors and domains and know the challenges that come with these kinds of technology. Like no other, we are capable of integrating this technology in vehicles.

We have over thirty years of experience with the development of production-class software for vehicles, both for the passenger-car and the truck industry. We are familiar with the supply chain and work with both the large tier 1 and the OEMs. With our partners, we will help you with the service provision at an operational, tactical, and strategic level, during the whole life cycle of your in-vehicle software. Software quality is becoming the key to success.

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