

Concepts against supply bottlenecks

Modularity is the key

04. Oktober 2021, 06:00 Uhr | [Harry Schubert](#)



© Carel

Francesco Pesce, Programmable Controllers Platform Manager at Carel Industries: »The key factors in selecting a new chip in our chip pivoting strategy are supply chain reliability first and technical compatibility in second place.«

Necessity is the mother of invention. If electronic components such as microcontrollers are scarce and only available with long delivery times, alternatives must be found. In this interview, Francesco Pesce, Programmable Controllers Platform Manager at Carel Industries, talks about his concept.

? What was the impact of the supply shortage for a microcontroller at Carel?

! Francesco Pesce: Like many other industrial companies, Carel is also hit by the 2020/2021 chip crisis, but it was not new to this experience, since 2016 already defined and tested chip pivoting strategies to mitigate the consequences of sudden interruptions on the supply chain of critical components.

Few years ago Carel had to change the main MCU used in the c.pCO product line twice, as the original chip and later also the replacement model were affected by shortages.

In each case, thanks to the modular product structure, an hardware redesign had been carried out within a few weeks and, thanks to the use of Segger's all-in-one embedded OS emPower OS, the application software could be transferred unchanged to the new design. A production stop could thus be avoided.

Before facing shortage issues, the change of microcontroller was typically a consequence of designing new product generations, taking advantage of state-of-the-art components helping with our natural product innovation journey.

In that innovation process we periodically check with MCU vendors (especially with our trusted suppliers) what they have in their roadmap.

When we first hit in an allocation crisis five years ago, after a natural disaster stopped a silicon plant for long time, we started changing our mindset, understanding there's a value in changing MCU also within the product's lifecycle.

Our programmable controllers are now designed with a modular HW approach, where the MCU part is in a dedicated module, and not simply placed in the product's main PCB. This modularity definitely helps a lot in crawling between different MCUs, as the impact of the redesign is limited only to a small portion of the product.

The same modularity concept is also used for the Firmware: using a modularized embedded OS permits to change MCU solution just by replacing the low level BSP and leaving all our added value Middleware and Application layers untouched.

? *Which criteria are decisive for you when selecting microcontrollers?*

! Pesce: The key factors in selecting a new chip in our chip pivoting strategy are supply chain reliability first and technical compatibility in second place. This is quite different from a classical engineering approach where the technical fit is the first driver.

Nowadays, the ability to adapt to what's available in the market is more important than the perfect technical solution. The selection is privileging solutions with a stable supply chain, not endangered by highly rebounding markets, e.g. automotive, telecom.

? *How did the semiconductor manufacturer or distributor support you?*

! Pesce: Manufacturers typically give a valuable support in locating the most viable alternatives in terms of product similarities, footprint and component availability. Their FAEs are then a key resource in the necessary HW adaptations and FW drivers porting.

Distributors play a role in supporting with residual quantities of the component in shortage, in order to buy some precious time while performing the redesign. They also help a lot in the early booking of the new component replacing the one in shortage.

? *What support did you need from the OS provider Segger Microcontroller?*

! Pesce: The value of relying in an embedded OS like emPower OS is that we take advantage of the evolutions of a partner that has this as its core business, while we focus on our added values – middleware and application firmware.

Once we hit our allocation crisis, Segger already had all the necessary components to quickly adapt our firmware to a different MCU, so we acquired the new components and replaced the old ones. With their valuable support and the commitment of Carel R&D teams within few weeks we had the new product ready for production.

? *Were you able to avoid a standstill in production?*

! Pesce: Five years ago we were able to avoid a complete standstill, in spite of a serious stop of the silicon foundry, we just had some hiccups of couple of weeks.

2021 is surely more challenging, as all MCU manufacturers seem to be seriously affected by demand peaks and tight capacity, but Carel ability and flexibility to play between multiple alternative designs is definitely helping to mitigate the consequences of the global shortage.

Up to date, we have three different MCU cores that are easily interchangeable thanks to emPower OS.

Now the next challenge is on NAND memories, but also in this case we already have many alternatives thanks to the emFile NAND driver, already supporting many state-of-the-art NAND components.

? *What lessons have you learned from this situation and what do you think semiconductor manufacturers and distributors should learn from the crisis?*

! Pesce: Modularity is a key concept, as it poses the roots for activating multiple alternative designs with limited effort and seamless changes for end customers.

In my opinion the biggest challenge for many semiconductor manufacturers is they don't own the complete production process. They rely on few giant companies for some critical steps, such as bonding and testing. Moreover some critical parts of the process do not have geographical redundancies: the recent lockdown in Malaysia was giving consequences to many MCU vendors. I think it's now becoming clear for many industries, there are some critical parts of the supply chain we can't control anymore, and we'll probably have to find some sustainable solutions for the future.

Francesco Pesce

was born in Padova, Italy, and graduated in Computer Engineering at the University of Padova, while studying piano and composition at the Conservatory of Music in Castelfranco Veneto. In 2000 he joined Alcatel and started a 10 years career as a Firmware Designer and later Project Manager in Telecommunications, filing 5 patents on WiFi MIMO communication systems.

Today he is working as Platform Manager for Carel, managing the whole lifecycle of Programmable Controllers product lines. In his spare time he enjoys classical music playing the piano and grows bonsai trees in his home garden.

francesco.pesce@carel.com

Profile: Carel Industries

Carel Industries, based in Brugine, Italy, produces industrial controls for heating, ventilation and air conditioning. Founded in 1973, the company now has nine production sites worldwide and generated sales of 331.6 million euros in 2020. Carel develops and manufactures its own electronic circuits, including firmware and software, and operates SMT/PTH production lines in Italy, Croatia, China, USA and Brazil. More than 50 employees at Carel develop programmable controllers based mainly on 32-bit microcontrollers of the Renesas RX and STM32 product families.

Initially, Carel developed and maintained its own monolithic embedded firmware, which was used for over 20 years. Then in 2011, the company switched to an embedded OS, embOS from Segger, which is part of the current emPower OS operating system package.