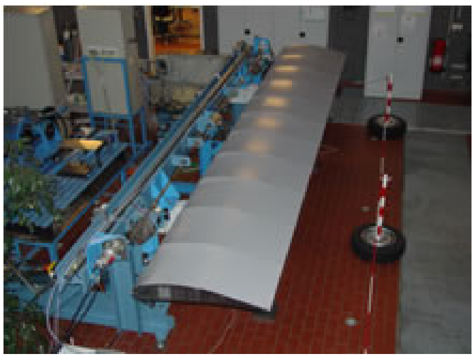
Integrating embedded systems

April 25 2008



DECOS researchers test the technology on an airplane wing flap. Source: DECOS

Embedded digital control systems are powerful and ubiquitous in the technologies we use, but getting them to cooperate is difficult. That situation is changing.

Researchers at the EU-funded DECOS project say they have created tools to allow such embedded systems to operate more smoothly together, a benefit to industry and ultimately to users who depend on the technologies to operate in a safe and predictable manner.

The use of embedded system controls is increasing apace, with expensive cars containing up to 80 engine control units (ECUs). They can range from the simple, like the smarts in your digital watch, to the critical, like the fly-by-wire systems of modern jets. We entrust them with our lives in our cars and trains.

Already, embedded systems account for half of the revenue in the computing market, and almost every technical advance, from ABS brakes to personal video recorders to avionics, rely on them.

The problem is, modern embedded systems often behave like individualists. This behaviour can be a result of the development process. Software can be the work of different programmers. Different manufacturers may develop the design specifications and interfaces.

The result is federated, often autonomous modules that must co-operate to achieve an overall goal, and to avoid ultimately endangering life or property.

Now, we're talking

The integrator – say, a car company or aircraft manufacturer – wants embedded systems to talk the same language using well-defined linking interfaces, and to perform in a predictable way under all circumstances. But this goal is complex and costly, and can often result in unreliable performance.

"The idea behind [our research] was to fight the growing complexity of distributed architectures," says Manfred Gruber from Austrian Research Centres (ARC), and coordinator of the DECOS project. "Each new function in a car needs a new ECU, and creates a highly federated structure with maybe 70 ECUs or more."

This situation means modern, co-operating embedded systems are difficult to develop, and very difficult to test and maintain.

"We want to reduce the number of necessary processors to a few, integrated systems," says Erwin Schoitsch, project deputy coordinator, also from ARC. "But if you integrate several applications – some safety critical, some not – you have to make sure they do not interfere with each other."

The DECOS team sought to achieve these goals by developing a dependable middleware of high-level services based on several time-triggered core protocol services: time-triggered architecture, layered FlexRay and time-triggered Ethernet.

These time-triggered protocols were developed to respond to safety-critical applications requirements, with a special focus on real-time applications. The development means lower costs and higher protocol efficiency and predictability.

DECOS developed the middleware architecture, components and tools for design, development, deployment, diagnosis, and validation and verification.

The project created a prototype tool-chain and test-bench, guiding the complete process, from model to deployment. The package includes validation and certification support, as well as hardware and software components and basic software building blocks.

DECOS test-bench

For example, the generic test-bench guides engineers through the verification and validation process, and supports a modular verification process.

"It provides a framework, with some new specific tools and the integration of existing external tools and safety standards," says Schoitsch.

To validate the approach, DECOS applied their results to three vital application fields for embedded systems: automotive, avionics and industrial control.

These application demonstrators come with domain-specific tests and established the applicability of the DECOS middleware and tools.

DECOS' architecture for automotive systems work with such functions as adaptive lighting and door positioning. For industrial control, the DECOS architecture helped to suppress critical vibrations when nano-imprinting.

Within the aerospace domain, the DECOS team developed a demonstrator for a shift in airplane flap control. Flaps give an aircraft its lift at lower speeds. DECOS shifted the current state of the art – a mechanic synchronisation control – to all-electronic synchronisation.

"It's a long-term proposition, but we demonstrated that it was feasible," says Schoitsch.

Safety-critical avionics systems are a critical way to demonstrate the capabilities of the DECOS tools. But the project's results can be used anywhere, from trains to medical systems, mechatronics or robotics.

TTTech, one of the partners, developed and will now commercialise a time-triggered Ethernet system. The tool-bench has led to the development of another new product, which was integrated into the Certified Software Factory developed by Esterel Technologies.

DECOS also led to a spin-off by the Budapest University of Technology and Economics. everal spin-off and follow-up projects, such as MOGENTES, again run by ARC, are planned.

Leading lights

The project took 42 months to complete, was funded with €15m and involved 18 of Europe's leading companies. Global players such as Infineon, Airbus, Thales, EADS, Liebherr Aerospace, Audi, Fiat, and Hella were involved.

Source:

Citation: Integrating embedded systems (2008, April 25) retrieved 26 April 2024 from https://phys.org/news/2008-04-embedded.html