

TTTech

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A Single Network for All Data Traffic

Hi-Rel Solutions for Space Launch Vehicles



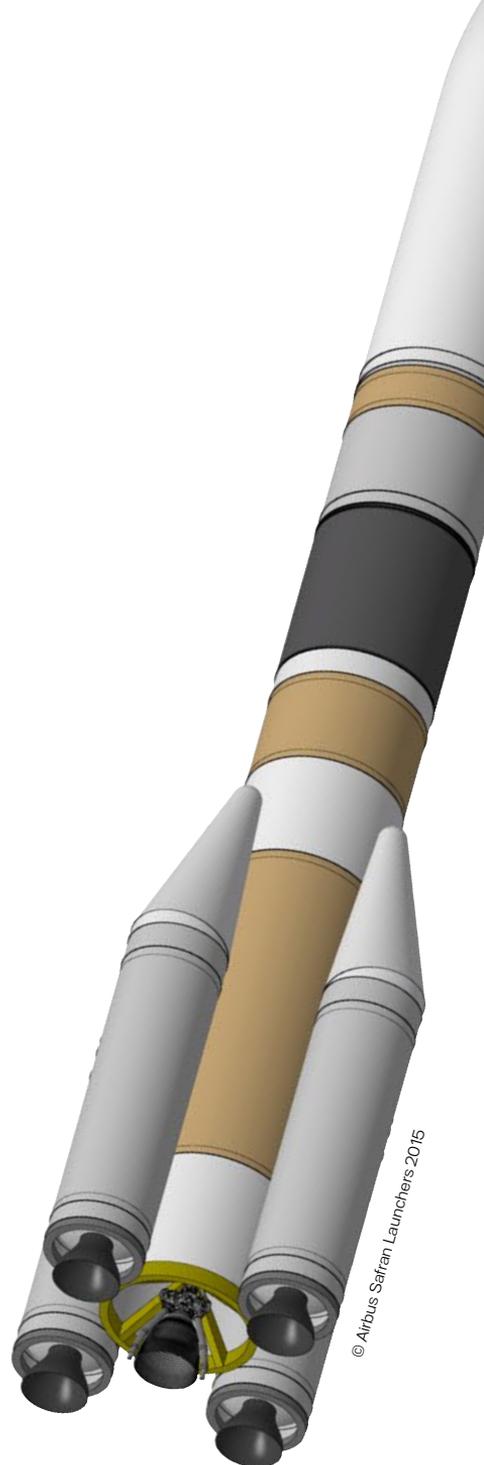
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TT Ethernet

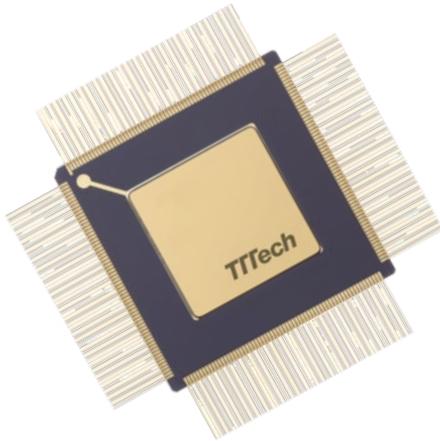
“ We are delighted that our network solution based on Deterministic Ethernet is providing a very powerful platform simplifying the electronic architectures of launch vehicles worldwide! ”

Georg Kopetz, Member of the Executive Board,
TTTech Computertechnik AG

Over the last 25 years, space launch vehicle designs have utilized several different solutions for their on-board data handling. For the safety-critical command and control data, the very robust MIL-1553 bus served as a standard solution, originally designed as a military avionic data bus. For redundancy purposes, this widespread standard enforces two MIL-1553 buses running in parallel. This fact creates the first challenge, namely managing redundant field buses in software and in parallel separate channels for additional data, e.g. telemetry. The second challenge arises from increasing data rates: MIL-1553 is limited to 1 Mbit/s, while there actually is both a need for higher control data rates and an interest in new types of sensors like video cameras. Adding more field buses would be possible, but would increase both weight and software complexity, as well as qualification efforts. Finally, despite the need for higher bandwidth and a simplified network, no system cost increase can be tolerated, as in recent years the market for launch vehicles has become extremely competitive. This has led launch vehicle manufacturers worldwide to look for automotive or industrial solutions in order to reduce the cost of the electronics used throughout their vehicles.



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After several years of research funded by the French space agency (CNES) and afterwards by the European Space Agency (ESA), architectures based on TTEthernet are considered a great fit for launch vehicles. TTEthernet solutions combine strictly deterministic Time-Triggered Ethernet with regular IEEE 802.3 “best effort” Ethernet and a third, rate-constrained traffic class, which can be used for video (camera) data. The bandwidth is at least 100 times higher compared to MIL-1553, i.e. 100 Mbit/s, while scalable to 1 Gbit/s where needed. As all data is safely and securely partitioned, a single network can be used for both control and telemetry data. In addition, increased cable lengths are possible without the need for repeaters. All this simplifies the required software and related integration and testing efforts to a large extent. The familiarity of the engineering community with Ethernet and the usage of moderately priced, off-the-shelf Ethernet test and monitoring equipment are added benefits. Recurring component cost is minimized by using automotive-like packaging and qualification instead of a full-blown space grade approach and by standardizing on a single interface to the network. Finally, built-in fault tolerance and safety features allow for superior reliability and availability needed in launchers and other spacecraft.

► PROJECT

Launcher avionics

► CHALLENGE

Avionics need to cope with increasing data rates and enable more modular architectures. At the same time, launchers face strong market pressure through increased competition, affecting both development and recurring cost. Further challenges are avoidance of both obsolescence and export restrictions at component level.

► SOLUTION

TTTech offers a family of radiation tolerant TTEthernet controller ASICs in cost-efficient plastic BGA housing. They will, for example, be designed into all avionics equipment of Europe’s flagship launch vehicle, the Ariane 6.

► AT A GLANCE

TTEthernet[®]

The core services of “Time-Triggered Ethernet (TTEthernet)” have been standardized in SAE AS6802.

Exploring New Ways to Simplify Spacecraft Software and System Architectures

About TTTech Computertechnik AG

TTTech Aerospace provides deterministic embedded network and platform solutions for aerospace and space applications. Its proven solutions increase safety, fault-tolerance and availability and have reached over 600 million flight hours in demanding aerospace safety-critical applications.

TTTech Aerospace has been engaged in the space market since 2000. With TTEthernet, it offers a standardized (SAE AS6802) networking technology with outstanding characteristics. The platform solution's values have been acknowledged by several space agencies and leading industrial partners.

TTTech Aerospace is part of TTTech Computertechnik AG, which operates under the umbrella of the TTTech Group, a globally oriented group of high-tech companies, founded and based in Vienna, Austria.

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