

PCIe Switch SoM High Speed Data Storage

Delivering cutting-edge computing, networking, data center solutions



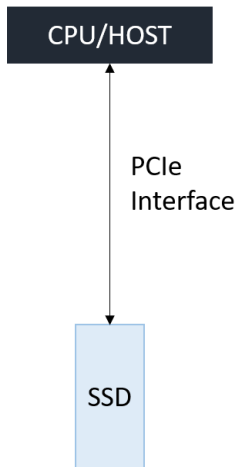
Introduction

In the rapidly evolving field of aviation, the demand for high-speed data storage solutions is paramount. Today's advanced aircraft require high-speed data storage solutions capable of handling large volumes of data from various sensors, avionics systems, cockpit voice, flight data recorders to secure and retain critical data, and mission-critical applications. These systems need to provide high throughput, low latency, and robust data integrity.

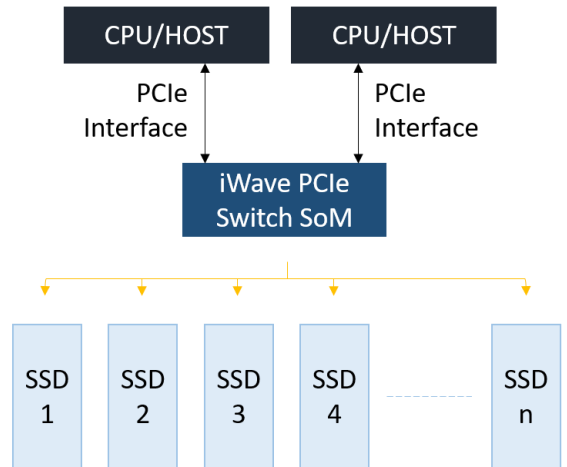
A prominent player in the aviation industry specializing in providing cutting-edge avionics solutions for military and defense applications was in pursuit of developing high-speed data storage solutions tailored for aircraft. The client sought a solution that could enhance the data storage capabilities of its avionics systems, enabling faster data transfer and storage while maintaining high reliability and security demands. To meet this challenge, they opted for a custom System-on-Module (SoM) development approach, which involved integrating PCIe switch technology from Microchip.

Currently, native PCIe interfaces lead as high-speed storage devices, favored for their superior data rates, backward compatibility, and optimized electrical links. While CPUs/hosts are limited to one or a maximum of two native PCIe interfaces, restricting memory device access, a PCIe switch plays a vital role. It facilitates access to multiple memory devices at consistent speed, data rate, and throughput, eliminating the need for multiple native PCIe interfaces on CPUs.

Only one or two device is accessed



Multiple hosts access multiple devices



Multiple SSDs increase the storage space and with limited Native PCIe interface

Fig: Why is PCIe Switch required?

Challenges & Requirements

- Design and development of custom hardware
- Leverage Microchip's PCIe switch family to achieve high-speed data transfer capabilities
- Ensure reliability and data integrity for mission-critical applications
- Achieve high data transfer rates using PCIe Gen4 (16GT) over optical links
- Comply with industry standards and safety regulations

Solution Highlights

Recognizing the need for high-speed data storage solutions in aircraft, the [iWave](#) embarked on a mission to design a custom PCIe Switch SoM that could meet the stringent requirements of avionics applications.



PCIe Switch SoM Features

- SoM powered by Microchip Switchtec PFX/PAX Gen 4 Fanout PCIe Switch family
- Supports PCIe Gen 4 16 GT/s
- 4 x PCIe Gen 4 switches supporting up to 52 lanes (with a total of 208 PCIe lanes)
- Interfaces: 4 x QSPI, 4 x UART, 4 x JTAG, 4 x SMBus, 1 x I2C
- High-speed board-to-board connector
- -40°C to +85°C (Industrial Grade)

By leveraging cutting-edge Microchip's Switchtec PFX Gen4 Fanout Switch fabric, iWave developed a custom PCIe Switch System on Module offering top-tier performance and reliability. Microchip's PFX Gen 4 switch fabric is renowned for its advanced features such as state-of-the-art error containment mechanisms, comprehensive diagnostics and debugging capabilities, end-to-end data integrity safeguards, high-quality yet energy-efficient SERDES (Serializer/Deserializer) technology, and a secure boot image authentication system. On the other hand, the PAX family includes scalable multi-host systems, SR-IOV-enabled JBOFs, composable GP-GPU fabrics, disaggregated systems, and rack-scale architectures.

Incorporating four PCIe Gen 4 switches, each capable of supporting up to 52 lanes leading to an overall 208 PCIe lanes distributed across the high-speed board to the connector, the SoM offers unparalleled connectivity options. The SoM goes a step further by offering configurable choices for multiple upstream and downstream PCIe lanes, showcasing its adaptability and versatility in addressing varied data transfer needs. This adaptability ensures smooth connectivity with a wide diverse range of storage devices like M.2, U.2, and EDSFF form factor (E1.L, E1.S, E3.L, E3.S), positioning the solution as an optimal choice for applications that require scalable and high-performance storage solutions. By facilitating a dynamic data flow to and from the PCIe switch SoM, this solution establishes a framework for highly adaptable and scalable architectures, underlining its prowess in meeting the evolving demands of modern computing.

Furthermore, the PCIe switch SoM's versatile interface capabilities include QSPI, UART, JTAG, SMBus, and I2C, temperature sensors & voltage monitoring IC to configure the som to the desired configuration and monitor the health status of the som's. This array of communication options allows the SoM to adapt to a wide range of connectivity requirements, enhancing its compatibility with various peripherals.

iWave conducted comprehensive testing of PCIe switch SoM over optical links, making it particularly well-suited to meet the stringent requirements of avionics systems. The optical connectivity ensures high-speed data transfer and contributes to the overall robustness of the communication infrastructure.

[iWave](#) with its unmatched expertise in PCIe interface configuration, positions the company at the forefront of embedded solutions. As a premium partner of Microchip, iWave gains early access to leading-edge offerings, and its hands-on experience with the ChipLink tool allows the designer to validate its functionality and test configuration settings in the development. This unique combination of technical proficiency and strategic alliances solidifies iWave reputation as a go-to provider for cutting-edge and high-performance solutions in the embedded systems domain.

For more information, please contact mktg@iwavesystems.com.



iWave Systems Technologies is a product engineering organization offering an extensive portfolio of Telematics Solutions, System on Modules and avionic solutions. With over 25 years of embedded industry experience and designing solutions for automotive customers across the globe, iWave is driven with the aim to be a reliable global technology partner. Learn more about iWave at www.iwavesystems.com.