CASE STUDY

Bridging Legacy Fiber Channel and Modern Ethernet On-Board A Fighter Aircraft

CURTISS-WRIGHT

DEFENSE SOLUTIONS

Challenge

- Upgrade storage technology while maintaining existing fiber channel sensors
- Encryption certified to international standards
- Increase storage capacity
- NAS with support for iSCSI

Solution

- Modern NAS with FC target front end
- FIPS 140-2 certified encryption
- Removable 4 TB SSD with 100 k insertion cycle connector
- Unique bridge between NAS and FC data

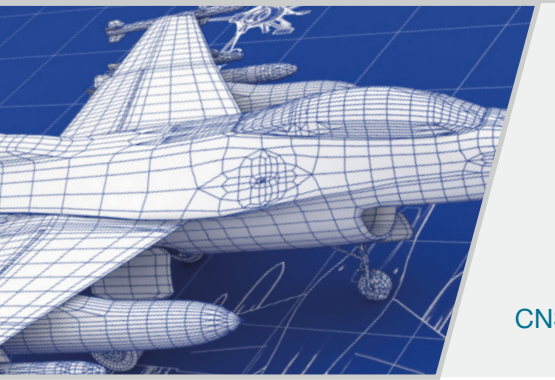
Results

- Re-use of legacy FC sensors lowered cost
- FC block data accessible via files
- Clear upgrade and expansion path
- Solution successfully fielded in over 15 vehicles

Challenge

Multi-role fighter aircraft design was originally envisioned to reduce costs through the use of a common airframe, adapted to a number of different roles. As the airframe changes roles, it's often upgraded with the latest technology, which typically involves adding data sources to the on-board network. Two decades ago, this data was reliably transported over significant distances with Fiber Channel (FC) technology. Today, however, Internet Protocol (IP) networks are at the forefront of technical development and the use of Fiber Channel over Ethernet (FCoE) and Internet Small Computer System Interface (iSCSI) is on the rise. With millions of dollars and lots of time invested in FC-based sensors on military platforms, how can a system architect upgrade a legacy platform with modern data storage and recording while retaining the FC sensors? When a customer was faced with this challenge they contacted Curtiss-Wright because they knew we had decades of fielded experience with FC technology.

It was determined that continued use of legacy FC sensors was the best approach to incrementally upgrade the customers ISR system with modern storage technology. The challenge was finding a way to increase data storage capacity while retaining the FC front end. Existing FC storage has bulky mechanics and obsolete rotating FC disks, while today's Network Attached Storage (NAS) depends on solid state drives (SSD), reducing weight and cost while increasing storage capacity. In order to re-use the legacy FC-based sensors,



CNS2-FC Compact Network Storage Device
and FSM-2 Flash Storage Module

the customer required a modern NAS with an FC target front end. Due to the sensitive nature of the data on-board the fighter, the NAS also required encryption and a clear upgrade and expansion path with increasing storage capacity.

Solution

Though there are encrypted data recording and storage options available on the market, including those that are ruggedized to withstand the harsh environmental conditions present on-board a fighter aircraft, finding a system that can interface with legacy FC technology presents a challenge.

When contacted in 2015, Curtiss-Wright had an existing high-performance NAS product, the Compact Network Storage, 2-Slot (CNS2), that was proven to be flexible, reliable and SWaP-optimized. With FIPS 140-2 certified encryption, the CNS2 fulfilled the customer's encryption requirements. Designed to hold up to two Flash Storage Modules (FSM) with up to 2 TB capacity, the CNS2 also met the customer's data storage requirements. However, the device didn't interface with legacy FC sensors. The consistent, ongoing FC development at Curtiss-Wright since the early '90s has resulted in a wealth of FC knowledge. Leveraging this, Curtiss-Wright launched an Independent Research and Development (IRAD) project to update the CNS2 with an emulated FC front end.

The IRAD project resulted in a flexible, low cost approach through the use of the new CNS2-FC. The CNS2-FC was developed with an FC front end that emulates an FC disk and a SATA-based SSD storage back end, which leverages the current commercial storage market. The back end offers encryption in order to protect the data-at-rest and supports iSCSI protocol so that block data saved by legacy FC sensors can be easily accessed and used by Ethernet network clients. This unique ability to straddle both FC Storage Area Network (SAN) and Ethernet Local Area Network (LAN) provided the customer with a tool to save and re-use valuable FC-based sensors. You can read more about Bridging Legacy Fibre Channel and Modern Ethernet Clients with iSCSI and NAS in the white paper.

iSCSI is a low cost, low risk method of making data more easily available to more Ethernet clients and does not require special FC infrastructure. FCoE was explored as a possibility; however, it was found that most Ethernet clients supported iSCSI while few supported FCoE. In order to readily support the most clients without added expense, it was decided to use iSCSI.

A new file based concept was developed to take advantage of the iSCSI protocol and NAS functions – without adding extra complexity or cost. Previously the two FC ports (emulating FC targets) were directed to separate partitions resulting in data access issues. In the file-based concept, the two FC ports store their block data into a common file, allowing easy FC data access. The CNS2-FC software was also updated in order to support the new file-based concept. With FC block data being written into one common file, any of the iSCSI initiators on the LAN can access the block data. Additionally, this approach reduces ground station cost and complexity, enabling any NAS to access the SCSI block data in a single, big block file using NFS or CIFS protocols.

Results

Most modern system upgrades now include Ethernet. It would be unusual today for a new LRU to be developed and deployed without either 1 GbE, 10 GbE, or both. For ease of communication, Ethernet has become the preferred choice with a huge infrastructure of NAS, switches, and routers. With NAS devices in the network, any client can store or retrieve required data. In order to meet both needs, a storage device with both FC target emulation and NAS capability was developed.

In addition to the unique approach to bridging FC and Ethernet, the CNS2-FC also provided the customer with FIPS 140-2 encryption protecting the critical data-at-rest. The original CNS2 used two FSMs, totaling 2 TB of storage capacity. The CNS2-FC uses the latest FSM-2, resulting in both an increase in storage capacity to 4 TB, and an upgrade to the high insertion cycle connector (from 500 insertion cycles to 100 k). The FSM-2 covers the customer's existing capacity needs, with room to grow, while significantly increasing the system reliability and usability.

During the platform upgrade development and test (D&T) phase, five CNS2-FCs were delivered to the customer in 2016. Because the program to update the original CNS2 to interface with legacy FC sensors was an internal IRAD project, the customer didn't need to incur non-recurring engineering expense (NRE) but did require Curtiss-Wright program management services, as well as program specific environmental testing to be performed on the device. A year after the D&T devices were delivered, a contract was put in place to deliver the remaining systems over the life of the program. To date, approximately 15 CNS2-FCs have been supplied (approximately 30 will be delivered in total).

INFO: CURTISSWRIGHTDS.COM
EMAIL: DS@CURTISSWRIGHT.COM