SAND2017-7566C

The Center for Cyber Defenders

Expanding computer security knowledge

Conan: Emulytics on the 1553 Protocol

Dalton Cole, Missouri University of Science and Technology;
Michael Reeves, Purdue University

Project Mentor: Chris Jenkins, Org. 5827

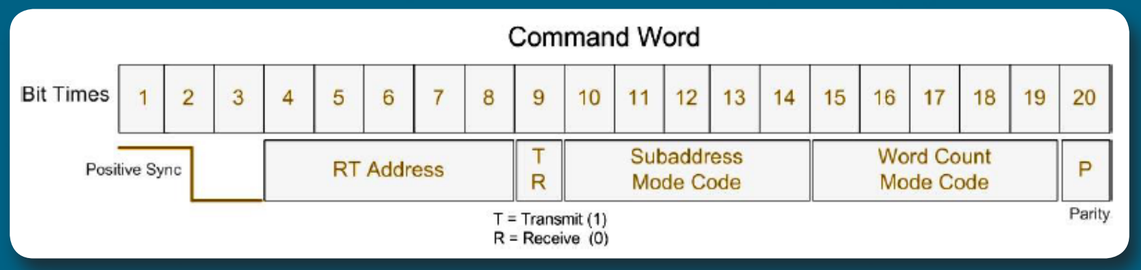
Problem Statement

- Adversaries have shown the ability to attack and disrupt cyber-physical systems through cyber-attacks
- No mature technologies exist to detect cyber attacks within 1553 data bus systems on aviation aircraft

Objectives

- Develop an emulytics environment to aid in the detection of vulnerabilities on a 1553 bus
- Take a multi-stage approach where we gradually add complexity to the emulated environment
- Capture and dissect network traffic to increase fidelity of emulation
- Be able to connect real 1553 hardware and have it interact with our emulated environment

Command Word Block Structure[1]



Approach

- Review literature on the 1553 Military Standard
- Write a simple program using the Excalibur 1553UNET API to create phase 1 prototype scenario
- Analyze 1553 protocol structure using packet captures within Wireshark
- Write a dissector for Wireshark to better analyze packet captures
- Write a program to emulate 1553 traffic using ZMQ sockets
- Integrate emulated program in the SCEPTRE framework
- Gradually add complexity to emulated environment as time permits
- Apply analytics to emulated environment to find vulnerabilities

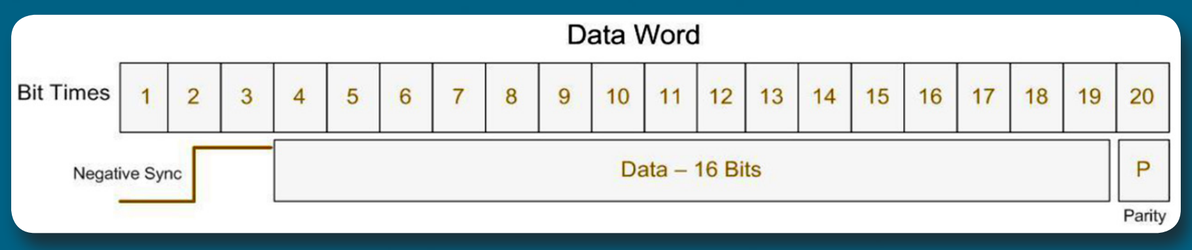
References

- [1] Alta Data Technologies LLC. MIL-STD-1553 Tutorial and Reference. N.p.: n.p., n.d. Www.altadt.com. Alta Data Technologies LLC, 21 Sept. 2014.
- [2] http://www.boeing.com/resources/boeingdotcom/defense/f-15_strike_eagle/images/f15_strike_eagle_hotspot_bg_960x410_mobile.png
- [3] "MIL-STD-1553." Wikipedia. Wikimedia Foundation, 24 June 2017. Web. 05 July 2017.

Challenges

- Difficulty of acquiring data captures to improve model fidelity
- Integrating hardware into SCEPTRE and still meet latency on the order of microseconds

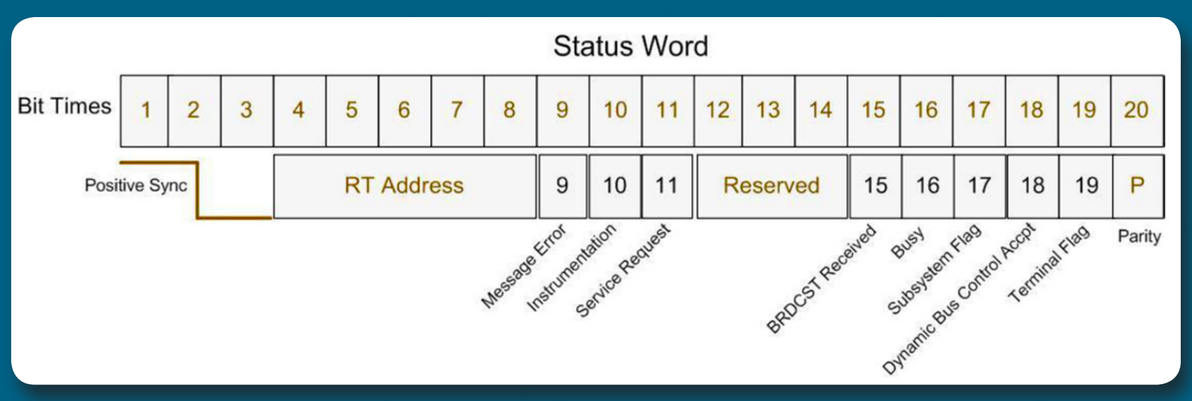
Data Word Block Structure[1]



Components

- Bus Controller
  - Initiates all message communications
- Bus Monitor
  - Monitors and records bus transactions
- Remote Terminal
  - End application, such as motor controls and sensors

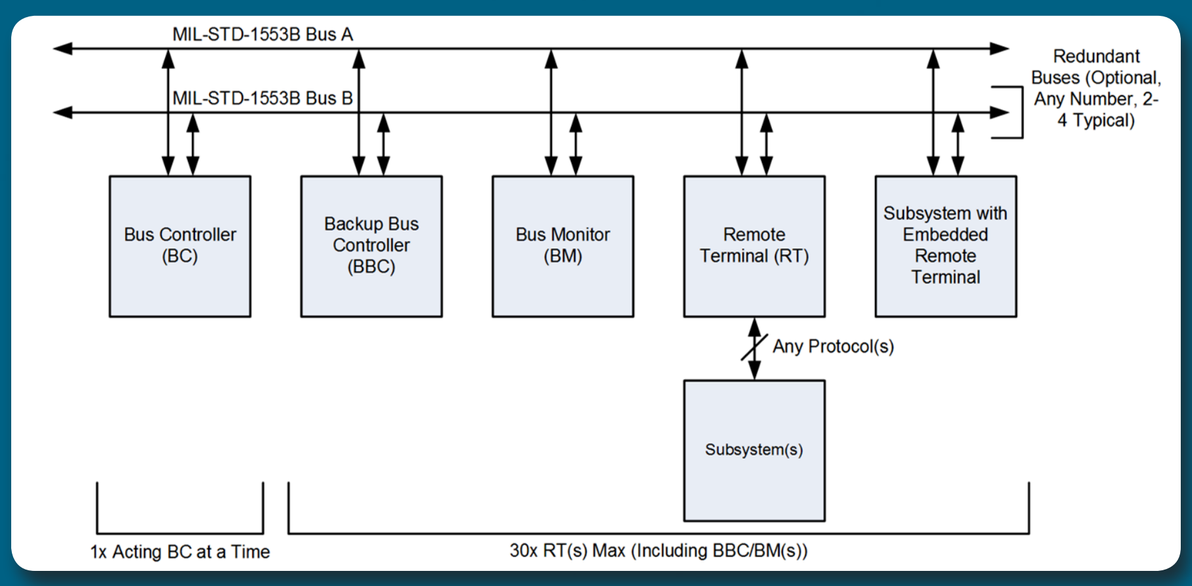
Status Word Block Structure[1]



Impact and Benefits

- Improve cyber security posture of military aviation systems
- Emulate possible vulnerabilities
- Maintain avionic bus integrity and provide mission assurance for the DoD

Typical 1553 Architecture[3]



Sandia National Laboratories is a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia, LLC., a wholly owned subsidiary of Honeywell International, Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525. SAND2017-XXXXC.