Design Code Basis for Secure Cyber Resilient Engineering

Foundation for a Secure System

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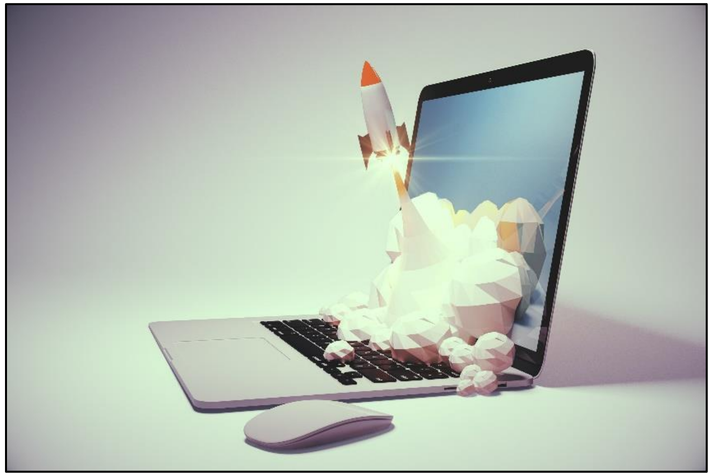
Agenda

- **The Need**
- **The Concept**
- **History – Trusted Computer Security Evaluation Criteria (TCSEC)**
- **Design Code Basis for Secure Cyber Resilient Engineering (SCRE)**
- **Production Nucleus**
- **What the Design Code Will Establish**

The Need for Design Code

- **Design code: *criteria* to guide activities to establish and mature the design of trustworthy, secure, and resilient weapon systems**

- **The criteria is targeted for use by system engineers, architects, designers, and developers for activities such as:**
  - System requirements derivation and decomposition
  - System architecture development
  - System design definition
  - System analysis
  - Requirements analysis



- **Design code will assist in developing and executing SCRE practice activities and tasks**

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The “Code” Concept

- ***Code* is a form of expression to a specific audience.**
- **Code addresses:**
  - Capability, performance, and constraints.
  - Verification methods and overview acceptable solutions.
- **Code is structured and phrased specifically to facilitate its use within the scope of control or authority of its intended audience.**

- **Code continuously evolves to reflect need changes, technology evolution, practitioners’ experience growth, and research and development.**
- **Examples in other domains:**
  - Building Code: A set of rules specifying standards for constructed objects. Its main purpose is to protect public health, safety, and general welfare.
  - Electrical Code: A set of regulations for the design and installation of electrical wiring in a building. The intention of a code is to provide standards to ensure electrical wiring systems that are safe for people and property.

History of Design Code: Trusted Computer Security Evaluation Criteria

- **The Trusted Computer Security Evaluation Criteria (TCSEC) was the first instance of design code for trustworthy secure design.**
  - It served as the basis for the design, development, and evaluation of trusted operating systems.
  - The design code basis for the TCSEC was the seminal work that established the principles, concepts, objectives, and capabilities of an inherently secure system.
- **TCSEC motivated efforts to refine and extend aspects of design code criteria and its representation.**
- **However, none of these efforts established a principled design code suitable for use in the engineering of trustworthy secure systems.**

Design Code Basis for SCRE (Concept)

- **The capabilities, properties, and characteristics that are necessary and inherent to any trustworthy secure and resilient system**
- **Design code basis**
  - Enables the system to satisfy stakeholder expectations but is not dependent on any specific protection requirements
  - Encompasses
    - The core security protection mechanisms for the system to function security
    - The capability of the system to protect itself
  - Enables
    - The system to deliver the protection capability that fulfills the stakeholder’s protection needs

SCRE Design Code (Principled Basis)

- ***Design for Security and Cyber Resiliency* expectations (DoD Instruction 5000.83)**
  - Manage access to, and use of, the system and system resources
  - Be structured to protect and preserve system functions or resources
  - Maintain priority system functions under adverse conditions
  - Interfaces with the DoD Information Network or other external services
  - Monitor, detect, and respond to security anomalies
  - Be configurable to minimize exposure of vulnerabilities
- **Transforming these expectations led to further characterization of the *protection nucleus* for secure cyber resilient systems**

Protection Nucleus

- **The concept of protection capabilities and characteristics that are necessarily an inherent part of any secure system (Anderson Report*) expands to be the *protection nucleus***

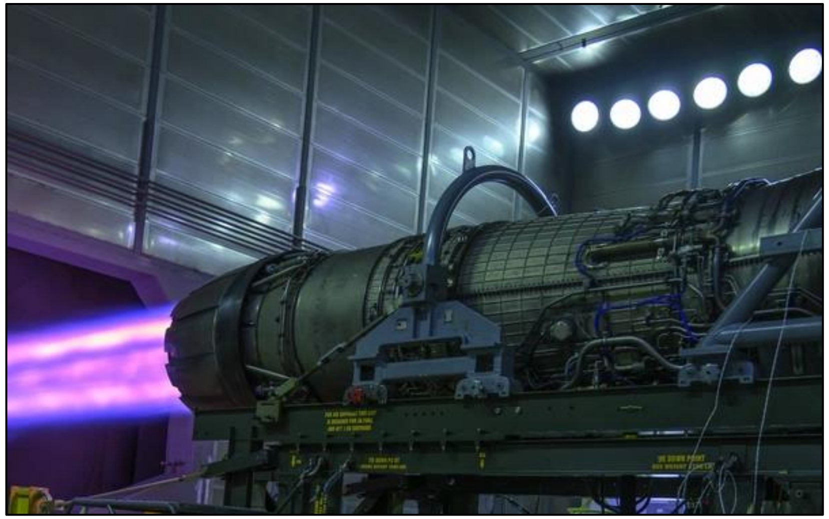
- **Key protection functions**
  - Protect what the system does functionally
  - Protect the interfaces necessary to provide functionality
  - Protect the configuration that determines the functionality
  - Protect the data associated with all the above

- **Core capabilities for the protection nucleus**
  - *Mediated Access*: enforce authorizations for all system interactions (internal and with external)
  - *System Control*: achieve only the intended system behaviors and outcomes associated with the authorization enforced by mediated access, and prevent and limit loss

*J. P. Anderson, "Computer Security Technology Planning Study, ESD-TR-73-51 Volume 1, Deputy for Command and Management Systems, HQ Electronic Systems Division (AFSC)," 1972. AKA The Anderson Report

Design Code Criteria Development

- **Criteria for the *protection nucleus functions, capability, and its mechanisms***
- **Criteria for the *system***
  - To enable success of the nucleus
  - To not interfere with nucleus function
- **Criteria for *related engineering activities*, including verification**



Next Steps

- **Work with industry for inputs**

- **Continue activities to standardize SCRE practice to inform specific needs in design code**

- **Pull applicable criteria from existing documents and build additional candidate criteria for comment**

Questions?

References

- J. P. Anderson, "Computer Security Technology Planning Study, ESD-TR-73-51 Volume 1, Deputy for Command and Management Systems, HQ Electronic Systems Division (AFSC)." 1972. AKA The Anderson Report.

- Department of Defense, “DoD Instruction 5000.83: Technology and Program Protection to Maintain Technological Advantage.” July 2020. https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodi/500083p.pdf

- National Research Council, “Computers at Risk: Safe Computing in the Information Age.” 1991. https://doi.org/10.17226/1581