Advances in Software Security Assessment and Verification Research

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CSMISS

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Research Goal

- **Reduce security risk to the computing environment by mitigating vulnerabilities in the software development and maintenance life cycles**
- **Provide an instrument and tools to help avoid vulnerabilities and exposures in software**
- **To aid in complying with NASA NPG 2210 and NPG 2810**

Security Instrument Components

- Software Security Assessment Instrument
  - Software Security Checklist (SSC)
  - Model-based security specification and validation approach (MBV)
    - Flexible Modeling Framework Instrument (FMF)

Security Instrument Components (cont.)

- Vulnerability Matrix
  - Categorize vulnerabilities and group them
  - Vulnerability properties
- Software property-based testing tool (PBT)
  - Developed for testing JAVA code
  - Developing testing instrument for C code
- Other Security Assessment Tools (SATs)
  - List of security tools for assessing software and systems, purpose, use, and alternatives

Software Security Checklist (SSC)

- NASA NPG 2210 and NPG 2810
  - External Release of Software
  - Software Security Checklist
- Two phases
  - Phase 1: Provide instrument to verify external release of NASA software does not present a security risk to NASA and its partners
  - Phase 2: Provide instrument to integrate security as a formal approach to the software life cycle

Software Security Checklist (cont.)

- Phase 1
  - Checklist for use prior to external release of software
    - Concerns include the following:
      - HR information
      - Operational processes
      - Internal processes
      - Sensitive IP addresses, Host names, etc.
      - Crypto Certificates and Keys
      - Embedded userids and passwords
    - Document describing purpose and use of the checklist

Software Security Checklist (cont.)

- Proposed procedure for using the checklist
- Examples for automating software checking to the greatest extent possible
  - Perl script for checking strings with IP addresses
  - Perl script for checking dangerous subroutines
    - gets, fgets, strcpy, strcat, sprintf, printf, and fprintf, because of format string errors
    - strncpy and strncat because of the oft-forgotten NUL byte problem, and possibly others
  - The specific set of functions is system dependent; for example, some Windows functions require parameter checks that UNIX versions would not, i.e., "system" is not a function that works on Windows

Software Security Checklist (cont.)

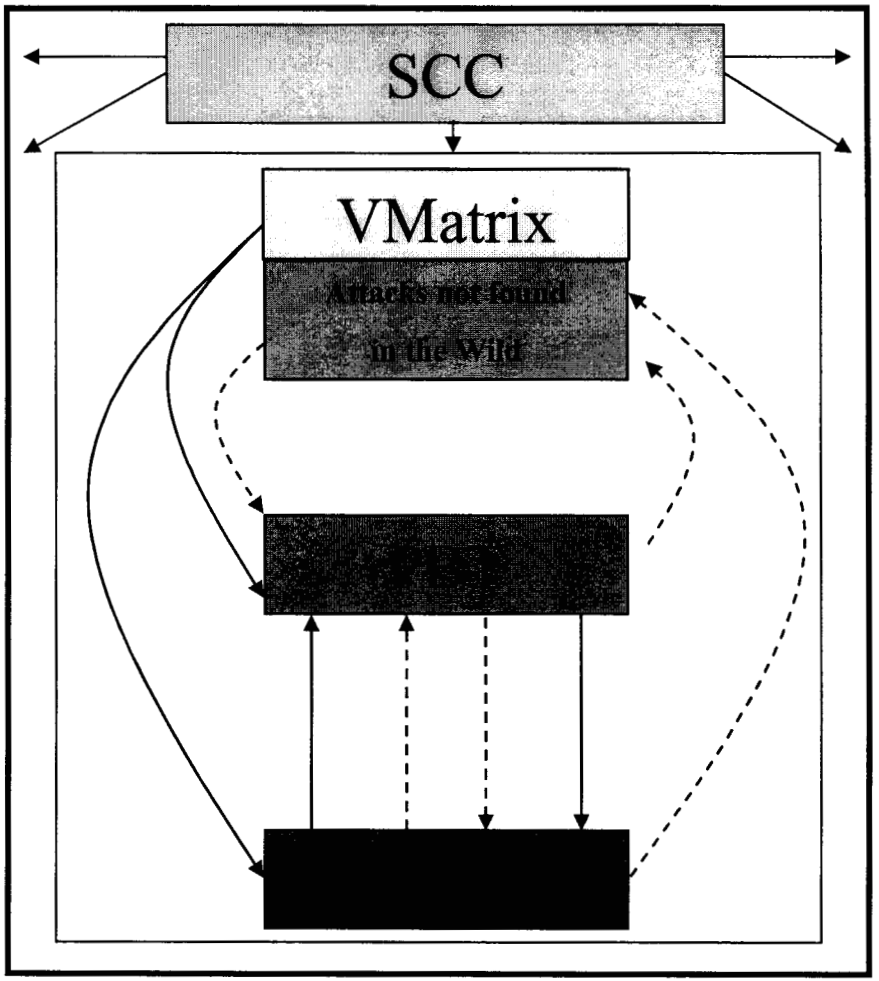
- Phase 2
  - Integrating Security in the Software Lifecycle
    - Analyze and prioritize what items are of concern
      - Cost of life cycle (Risk cost grows exponentially throughout software life cycle)
      - Cost of where problems occur
      - Security risk analysis
    - Determine and prioritize most effective solutions for addressing the concerns
      - Need for software security for architect?

Software Security Checklist (cont.)

- Develop Checklists for use through the software life cycle process
- Develop Document describing purpose and use of the checklists
- Develop or Provide list of Tools/Instruments that can assist in automation of checks
  - these tools help a good analyst, but they cannot replace him or her (Halting problem, etc.)
- Provide Recommendations and lessons learned for software security architecture

Instrument Integration

- **SCC Guides the process of identifying security needs of software before release**
- **Remaining parts of the security instrument provide analysts one means of support in addressing security needs.**
  - **VMatrix known vulnerabilities**
  - **PBT code level discovery of known/new vulnerabilities with feedback to Vmatrix and MBV.**
  - **MBV provides early lifecycle discovery of known/new vulnerability scenarios with feedback to Vmatrix and PBT**
- **Improved traceability through an integrated approach**



Conclusion

- Assessment Instrument composed of four tools and reports:
  - Vulnerability Matrix (VMatrix)
  - Tester's Assistant (PBT)
  - Flexible Modeling Framework (MBV, FMF)
  - Software Security Checklist (SSC)
- Tools can be used collectively or individually
- There is a potential for wider application of the instrument beyond assessment of security of software

FOR MORE INFO...

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