Foreign Source Software

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Reality

- Almost all software, proprietary as well as open source, has some form of foreign involvement.
- Foreign influences in modern software negatively effects the DoD’s security.
• In the past, proprietary software was typically developed using in-house resources.
• Now, most companies have at least part of their development off-shore.
• Systems use components developed by external sources.
Proprietary

- Proprietary software is developed and owned by a commercial entity, and sold or licensed.
- Proprietary software may not be redistributed without permission of the owner of the software.
• Any application developed as a public collaboration or whose source code is made available to be freely shared, used, modified, improved, or redistributed.

• Open source software may be distributed at no cost or may be sold as a “commercial” product.
  • No cost – CentOS
  • Commercial – Red Hat
• Commercial Off-The-Shelf (COTS) products may be either proprietary or open source
  • Ex: Red Hat Enterprise Linux v5 (RHEL5) is open source but distributed by Red Hat
• Software which was previously produced in proprietary form can become available as open source
  • Ex: Solaris went from proprietary source in Solaris 8 to open source in Solaris 10
Software Development

- Open source software development
  - Anyone can make changes
  - Changes to the source tree generally occur via a community vetting process
- Commercial, proprietary software normally has no such “community” vetting process
Vulnerabilities

• Usually defined:
  • Errors in the software requirements or implementation
  • A weakness in process, administration, or technology that can be exploited
• Probably exists in all source code regardless of its nature
Malicious Software

• Embedded, modified source code, or application
• Intentionally malicious
• Subverts intended operation, of the system, possibly covertly
• Maliciously embedded source code is equally likely in open source software and proprietary software
“Needle in the Haystack”

- Most software applications are at least 1 million lines of code in size
  - XP has 40 million lines
  - RHEL5 has 30 million lines

- US Naval Postgraduate School project to subvert a kernel in as few lines as possible
  - A student inserted 8 lines total (5 lines in one location, 3 in another) into the Linux kernel
  - Successfully subverted several million line kernel
Code Review

- Not feasible to evaluate the assurance of source code to reveal any malicious intent
- As number of lines of source code increase:
  - Complexity increases
  - Increase misuse of principle of least privilege
  - Percentage of source code that can be reviewed per year decreases
For proprietary and open source software:

- Undergo verification and validation testing during evaluation or certification process
  - Should reveal known vulnerabilities
  - Mitigations can be instituted prior to implementation
- Follow good configuration management processes and software engineering practices
• Open source approaches do allow the potential for discovering how data is being processed, the protocols being utilized, and communication channels.

• Mitigations may be put in place prior to the software’s implementation.
Configuration Management (CM) Identification of Vulnerabilities

- Identify configuration based vulnerabilities
  - Responsible for roughly half of the vulnerabilities detected in systems
- Proactively managing systems by deploying, base-lining, and monitoring effective standardized, security configurations allows for the potential of identifying vulnerabilities
  - Integrity checking software to determine if key files have been modified from baseline configuration
CM potential for Malware

- Potential for preventing the subversion of the supply chain of software components
  - Libraries
- Good CM processes for both software and systems
  - Can decrease the potential of the insertion of malware
Assumptions

• Requirement for stronger software assurance
  • Information sharing links more information infrastructure together
  • Majority of DoD systems are low assurance
• No one size fits all solution
• Each situation must be assessed to determine if it requires high, medium, or low assurance
Technical Assurance Level

- Low assurance requirements
  - Validation and verification evaluation
- Medium assurance requirements
  - Review configuration management
  - Enforce good software engineering practices
  - Detect review
  - Random source review
High Assurance

- Requirement for software to perform only what is specified without fail
- Requires formal methods, or mathematical proofs of security properties of the software
  - Normally conducted on the security relevant aspects of software
  - Do not necessarily mitigate foreign involvement or incorrect/invalid assumptions
- Proofs are evaluation and certification artifacts that can be reviewed by the community
What is the extent of foreign involvement in software used by the DoD?
What are the associated Information Assurance (IA) concerns?
Are there possible mitigations for those concerns?
Questions?

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