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Irvine, Cynthia

Monterey, California: Naval Postgraduate School

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Cynthia Irvine

Assistant Professor

(408) 656-2461
irvine@cs.nps.navy.mil

Research Areas

Computer security, high assurance trusted systems and applications, evaluation criteria, and security policies.

Research Description

As the value of the assets stored in computer systems increases, attacks by highly motivated, technically capable opponents using malicious software and subversive techniques become more likely. A scientific foundation exists which may be employed to build secure computer systems and certified software to protect sensitive information. Several areas of research are being pursued.

The widespread use of commercial off-the-shelf (COTS) platforms enforcing security policies with a high level of assurance has been hampered by a lack of compatibility with existing COTS and government-off-the-shelf applications software. Trusted file system research is intended to permit the use of both high assurance security policy-enforcing platforms and the massive body of application software currently available. Our government-industry team plans to build a prototype system providing high assurance controlled sharing of information while allowing users to continue to run their favorite COTS workstation applications. An extension to the initial effort would be the development of a high assurance messaging capability permitting the selection of cryptographic keys and methods based on information security levels.

Without careful analysis, execution of application software can sometimes result in the corruption or exfiltration of sensitive information. We are developing a type system in which it is possible to prove that code is secure. The objective of this research is to construct a tool to detect places where either legacy or new software is leaking information. Standard type inference techniques will be used in the implementation so that, within a typical software development tool such as an editor, users will be informed automatically regarding the security properties

of their programs. It is anticipated that the system will be applicable to DoD systems processing classified information as well as in the context of Web agent software where privileges are required for execution at client machines.

Last, the use of covert techniques to export sensitive information from trusted systems is being explored. This research will include the analysis of encoding techniques for exploitative purposes as well as empirical studies of the efficacy of these covert techniques

Relevance to DoN/DoD:

Information systems will be part of the battlespace for military actions of the future. Timely access to shared information is of vital importance in today's DoD. Rapid changes in technology have resulted in the distribution and connectivity of systems and an accompanying increased vulnerability to attack.

Research on secure software architectures and systems as well as analysis of the limitations of these systems advance DoD information security objectives. The development of multilevel file systems on high assurance platforms which are accessible by users on PC-based workstations will be an important step toward protecting sensitive and classified information.

Recent Publications

Volpano, D., Smith, G., and Irvine C., A Sound Type System for Secure Flow Analysis. *Journal of Computer Security*: Vol. 4, No. 3, pp 194-201, 1996.

Irvine, C.E., A Multilevel File System for High Assurance, in *Proceedings IEEE Symposium on Security and Privacy*, Oakland, CA, pp 78-87, May 1995.

Irvine, C.E., and Volpano, D., A Practical Tool for Developing Trusted Applications, in *Proceedings of the 11th Computer Security Applications Conference*, New Orleans, LA, pp. 190-195, December 1995.

Schell, R.R. and Irvine, C.E., Future Roles for Balanced Assurance in Trusted Database Management Systems, *Proc. 5th RADC Database Security Workshop*, Oct. 1992.

Irvine, C.E., Schell, R.R. and Thompson, M.F., Using TNI Concepts for Near-Term Use of High Assurance Database Management Systems, *Proc. 4th RADC Database Security Workshop*, April 1991.