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COMPUTER AND INTERNET FORENSICS
EXAMINATION, ANALYSIS AND TESTIMONY

October 4, 2007

Honorable Michael Patrick King, Presiding Judge
Superior Court of New Jersey, Appellate Division
(retired on recall as Special Master)
216 Haddon Avenue, Suite 700
Westmont, New Jersey 08108-0815

RE: *State v. Chun, et al.*
N.J. Supreme Court Docket No. 58,879

Dear Judge King:

Kindly accept this letter as my report concerning the source code for the Alcotest model 7110 MK-III-C ["7110"] using firmware version NJ3.11. This report supplements my earlier report and *curriculum vitae,* which were previously submitted. A bibliography of selected reference works follows the report. Best regards, and I remain,

Respectfully Yours,

Thomas E. Workman, Jr.

cc: All counsel and *amicus* of record, by email

Summation of issues presented:

I. Science is the implementation of universally accepted best practices and truths, which in the context of source code, are best represented by industry standards.

II. Use of Standards is necessary for developing reliable software.

III. Draeger did not utilize Software Engineering Standards in the 7110.

IV. The 7110 software is overly complex, cannot be tested, and errors inevitably occur on modification of the source code.

V. The 7110 software employs unscientific formulas and algorithms.

VI. The 7110 software does not properly detect and handle error conditions.

VII. The 7110 software relies on a calibration check, with a uniform concentration of alcohol, which cannot detect the flawed formula for computing alcohol in a human breath.

VIII. The problems noted in both the SysTest and BaseOne reports are valid problems that make the 7110 scientifically unreliable.

IX. The testimony of SysTest and CMX contradicts SysTest's and CMX's reports, is based upon a lack of experience and knowledge, and is not based on sound scientific principles.

X. BaseOne's report was based upon appropriate qualifications, experience, and knowledge, and employed sound scientific analysis.

XI. The 7110 is not capable of measuring and accurately reporting the concentration of alcohol in a human subject's breath, and should not be used to report alcohol in any proceeding where the results are important.

I. Science is the implementation of universally accepted best practices and truths, which in the context of source code, are best represented by industry standards.

A. Scientific method is based on accuracy and truth.

B. Scientific method builds on the work of others.

C. Scientific methods can define processes as well as tangible things.

D. In the context of source code, the scientific community documents best practices in the form of Industry Standards.

II. Use of standards is necessary for developing reliable software.

A. Software Engineering Standards are important.

B. Software Engineering Standards are developed and promulgated through a consultative process.

C. Software Engineering Standards promote reliable software.

D. Accurate breath test results depend on reliable software.

E. Standards only work when proper management structures are established and adhered to.

F. The “buffer overflow” is an example of source code that was never checked by a quality function within Draeger.

G. Standards make products “testable” and “verifiable”.

H. Standards are mandatory in medical, military, civil aviation, and food and drug environments for reasons of public health and safety.

I. Standards are voluntarily followed in commercial environments because developing software in this way yields a more reliable product.

III. Draeger did not use software engineering standards in the 7110.

A. The simple practice of documenting changes with headers has been abandoned.

B. Pseudo-code and/or written requirements were never developed by Draeger.

C. There was no pseudo-code or written requirements before coding began.

D. No software engineering standards were used to manage the writing of the source code.

E. Many modules, including critical source code modules, violate complexity standards.

F. The source code fails to maintain a reasonable level of design cohesiveness because the source code is customized in each legal jurisdiction and because there is a high velocity of changes attributed to changes in source code requirements.

G. Comments are incomplete, inconsistent and in multiple languages.

H. The Firmware is poorly “built”, with a significant number of unused routines and modules assembled into the final software version.

IV. The 7110 software is overly complex, cannot be tested, and errors inevitably occur on modification of the source code.

A. McCabe complexity metrics are an objective measure of cyclomatic complexity.

B. McCabe established his metrics to identify software that could not be adequately tested because of excessive complexity.

C. Excessive complexity exists because of poor software architecture and failure to adhere to standards.

D. Modules with excessive McCabe metric scores are too complex to test and cannot be demonstrated to be reliable.

V. The 7110 software employs unscientific formulas and algorithms.

A. The use of two technologies (EC and IR) to claim redundant and reliable results is false in that source code EC computations incorrectly and improperly substitute IR measurements, thereby destroying the independence of the two technologies.

B. The EC drift is incorrectly compensated for with information derived from the IR sensors and IR calculations.

C. The software engineer who maintains the source code has no knowledge of the scientific formulas, like Henry’s law, purportedly implemented in the source code.

D. Error conditions are ignored unless they occur a significant number of times, resulting in corrupt calculations with incorrect and invalid data.

E. The Draeger “averaging” algorithm is not an “averaging” algorithm within the accepted mathematics and scientific community.

F. The Draeger “averaging” algorithm produces reports which are wrong.

G. Expansion of the “tolerance” or range of agreement between breath samples, from NJ 3.8 to 3.11, invalidates detection of erroneous samples.

VI. The 7110 software does not properly detect and handle error conditions.

A. Unrepresentative data is utilized in calculations, until consecutive occurrences exceed a significant threshold of invalid data samples.

B. Catastrophic error traps are disabled, to include ”Invalid Instruction” error, “Arithmetic Overflow” error, and “Software Divide by Zero” error.

C. RFI detection is disabled.

D. Excessive use of global variables enables undetectable errors.

E. The source code employed by the State fails to capture summary error data and measurement data for 7110 machines deployed in New Jersey.

VII. The 7110 software relies on a calibration check, with a uniform concentration of alcohol, which cannot detect the flawed formula for computing alcohol in a human breath.

A. The defective “averaging” algorithm appears to work for calibration samples.

B. The defective “averaging” algorithm is relied upon to validate that the machine is working properly.

C. The final measurements from the sensors are given an unscientific and undue weight, producing an unreliable calculation of alcohol for a subject.

D. The algorithm does not treat all breath test measurements the same, thus violating the associative property of all averages.

E. Your Honor’s “4-3-2-1” example demonstrates the invalidity of the Draeger “average.”

F. The error introduced will result in BrAC levels that are wrong, and will wrongfully convict.

VIII. The problems noted in both the SysTest and BaseOne reports are valid problems that make the 7110 scientifically unreliable.

A. Excessive complexity.

B. Excessive use of global variables.

IX. The testimony of SysTest and CMX contradicts SysTest's and CMX's reports, is based upon a lack of experience and knowledge, and is not based on sound scientific principles.

A. Testimony disowned the McCabe complexity problems in SysTest's report.

B. Testimony disavowed the problem with excessive global variables.

C. Neither CMX nor SysTest witnesses had any experience with embedded systems.

D. Neither CMX nor SysTest witnesses had any experience with Software Standards applicable to sensor based embedded systems.

E. The CMX and SysTest witnesses were unfamiliar with fundamental binary arithmetic constructs necessary for evaluating source code.

F. The CMX report did not state assumptions, did not list software tools used, and their work was not documented.

G. The SysTest report was limited in scope, used some inappropriate tools, and dedicated most of their report to tables of data that were not explained.

X. BaseOne's report was based upon appropriate qualifications, experience, and knowledge, and employed sound scientific analysis.

A. Testimony of John Wisniewski to date has supported and complimented the BaseOne report.

B. John Wisniewski was vetted for honesty and ethics by virtue of a "secret" security clearance.

C. John Wisniewski's education and experience are relevant to the evaluation of the 7110.

D. John Wisniewski was quite familiar with fundamental binary arithmetic constructs necessary for evaluating source code.

E. John Wisniewski's use of LINT as a primary static evaluation tool was appropriate and generally accepted in the educational and scientific communities.

F. John Wisniewski's focus on major design defects, which create errors, was objective and a fair assessment of the 7110.

G. BaseOne reported their assumptions, the tools they used, and documented their work.

XI. The 7110 is not consistently capable of measuring and accurately reporting the concentration of alcohol in a human subject's breath, and does not reliably report results.

A. The hardware is not designed so that the software can verify that the hardware has properly carried out the software's commands.

B. Some hardware errors that can be detected by the source code are ignored.

C. New Jersey has failed to purchase options that would enable the 7110 to self detect errors that create wrong test results, whether from RFI, temperature, or some other source.

Conclusion

The Draeger 7110 MK III Alcotest with 3.11 New Jersey firmware is not scientifically reliable for testing the breath of human subjects for alcohol.

Bibliography

-----, ***Second Software Engineering Standards Application Workshop***, San Francisco, California, IEEE Computer Society Press (1983)

-----, ***Software Engineering Standards***, IEEE (1987)

-----, ***Total Systems Reliability Symposium***, National Bureau of Standards, Gaithersburg, Maryland, IEEE Computer Society Press (1983)

-----, ***Tutorial on LINT***, Center for Parallel Computers, Cornell Theory Center, Center for Advanced Computing, Cornell University (2007)

Darwin, Ian F., ***Checking C Programs with Lint***, O'Reilly & Associates (1991)

Dunn, Robert H., and Ullman, Richard S., ***TQM for Computer Software*** 2d, McGraw-Hill (1994)

Evans, David, and Larochelle, David, ***Splint Manual***, ver. 3.1.1-1, Secure Programming Group, Dept. of Computer Science, School of Engineering, University of Virginia (2003), http://www.splint.org/downloads/manual.pdf

Gabow, H.N., Maheshwari, S.N., Osterweil, L.J., ***On Two Problems in the Generation of Program Test Paths***, IEEE Transactions on Software Engineering, vol. SE-2, no. 3, p.227 (Sept. 1976)

Gorman, Robert A., and Ginsburg, Jane C., ***Copyright for the Nineties: Cases and Materials*** 4th, Michie (1993)

Grady, Robert B., ***Practical Software Metrics for Project Management and Process Improvement***, Prentice-Hall (1992)

Grady, Robert B., and Caswell, Deborah L., ***Software Metrics: Establishing a Company-Wide Program***, Prentice-Hall (1987)

Head, William C., and Workman, Thomas E., Jr., ***An Analysis of 'Source Code' Litigation in the United States: What Challenges Have Been Asserted, and Where is this Litigation Heading***, International Council on Alcohol, Drugs, and Traffic Safety, Seattle, Washington (2007)

Henn, Harry G., ***Henn on Copyright Law: A Practitioner's Guide*** 3d, Practising Law Institute (1991)

Jones, Capers, ***Software Assessments, Benchmarks, and Best Practices***, Addison-Wesley (2000)

McCabe, Thomas J., ***A Complexity Measure***, IEEE Transactions on Software Engineering, vol. SE-2, no. 4, p.308 (Dec. 1976)

McConnell, Steve, ***Software Project Survival Guide: How to Be Sure Your First Important Project Isn't Your Last***, Microsoft Press (1998)

McConnell, Steve, ***Code Complete: A Practical Handbook of Software Construction***, Microsoft Press (1993)

Moller, K.H., and Paulish, D.J., ***Software Metrics: A Practitioner's Guide to Improved Product Development***, IEEE Computer Society Press (1993)

Moore, James W., ***Software Engineering Standards: A User's Road Map***, IEEE Computer Society Press (1998)

Musa, John D., ***A Theory of Software Reliability and Its Application,*** IEEE Transactions on Software Engineering, vol. SE-1, no. 3, p.312 (Sept. 1975)

Pappas, Chris H., and Murray, William H., III, ***Debugging C++: Troubleshooting for Programmers***, McGraw-Hill (2000)

Ramamoorthy, C.V., ***Computer Science and Engineering Education***, IEEE Transactions on Computers, vol. C-25, no. 12, p.1200 (Dec. 1976)

Roetzheim, William H., ***Developing Software to Government Standards***, Prentice-Hall (1991)

Skoudis, Ed, ***Malware: Fighting Malicious Code***, Prentice-Hall (2004)

Spinellis, Diomidis, ***Code Reading: The Open Source Perspective***, Addison-Wesley (2003)

Sutter, Herb, and Alexandrescu, ***C++ Coding Standards: 101 Rules, Guidelines, and Best Practices***, Addison-Wesley (2005)

Szor, Peter, ***The Art of Computer Virus Research and Defense***, Addison-Wesley (2005)

Telles, Matt, and Hseih, Yuan, ***The Science of Debugging***, Coriolis Group (2001)

U.S. Patent and Trademark Office, ***General Requirements Bulletin for Admission to the Examination for Registration to Practice in Patent Cases*** (2007)

Wikipedia, Lint (2007)

Wikipedia, Mean (2007)

Wikipedia, Tools for Static Code Analysis (2007)

Workman, Thomas E., Jr., ***Source Code Primer: The Inside Scoop on All Breath Instrument Computers and Electronics***, National Association for DUI Defense and Texas Criminal Defense Lawyers Association, Dallas, Texas (2007)

Wulf, William A., ***Reliable Hardware/Software Architecture***, IEEE Transactions on Software Engineering, vol. SE-1, no. 2, p.233 (June 1975)