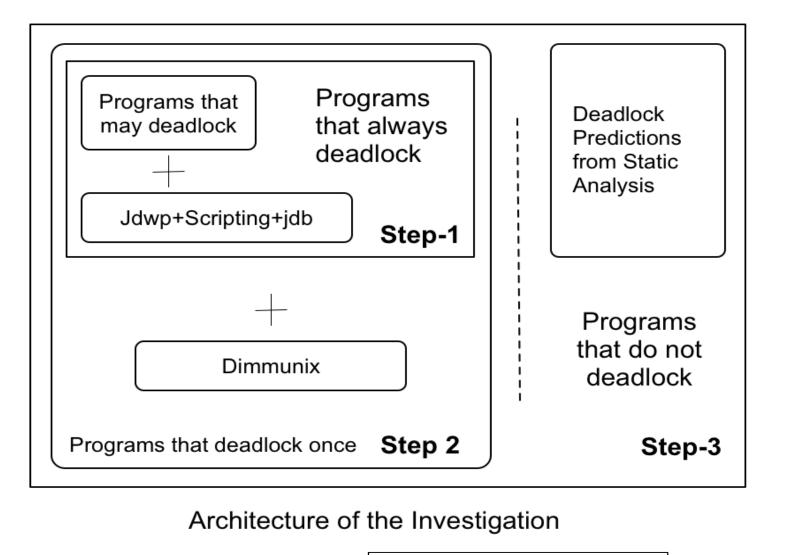
ICSE 2014

Avoiding Deadlocks using Stalemate and Dimmunix





Deadlock Program

Dimmunix

Deadlock Fingerprint

Dimmunix

Deadlocking First Execution

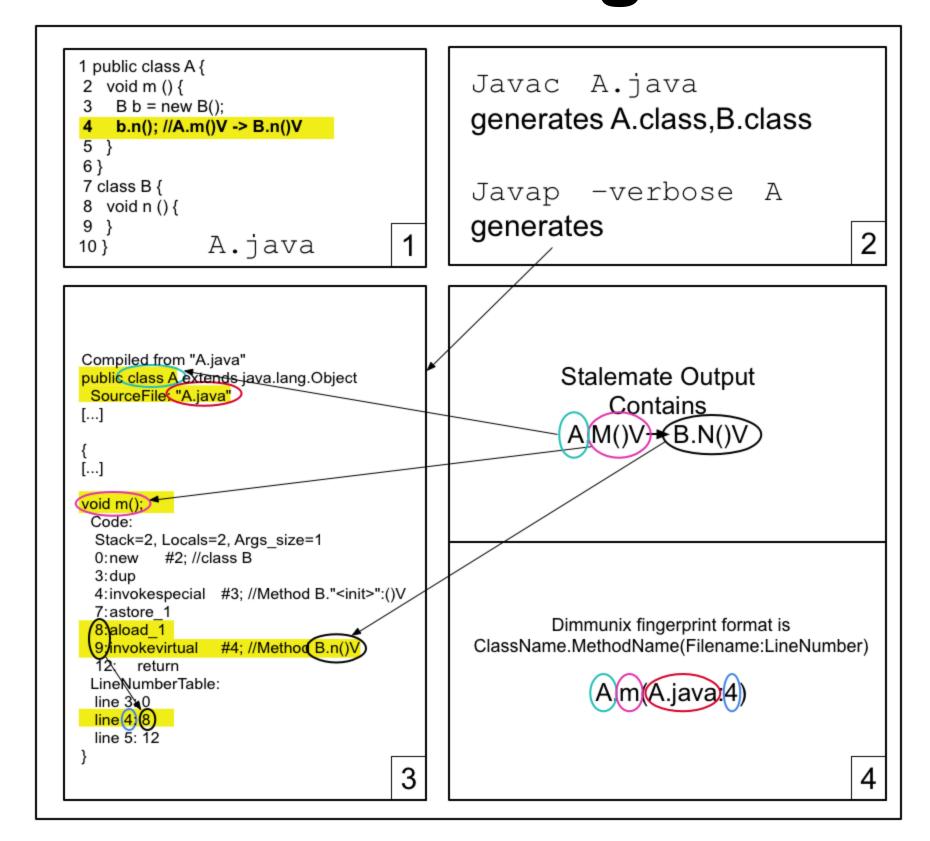
Never Deadlocks

Manual

Step 3

Deadlock Prediction

JRE



Verifying that Stalemate can report Deadlock predictions in the syntax of Dimmunix Fingerprints

Results

API	Program	Bugld	Step1	Step2	Step3
MIDI:	RtsTc	8010771	Pass	Pass	Pass
Musical	TcDp1	8031702	Pass	Pass	Pass
Instrument	TcDp2	8031698	Pass	Pass	Pass
Digital I/f	RtsTcDp	8031699	Pass	Pass	Pass
Corba	TcPdh	8024334	Pass	Pass	Pass
	TcEdh	8036570	Pass	Pass	Pass
Annotation	JlcAt	6588239	Pass	Fail	Fail
Security	RcCt	7118809	Pass	Fail	Fail

References

- [1] K. Arnold, J. Gosling and D. Holmes, "The Java Programming Language, Third Edition", Pearson-Education Pte Ltd, Delhi 110-092, India, 2000.
- [2] Vivek. K. Shanbhag, "Deadlock-Detection in Java-Library using Static-Analysis", 15th APSEC-2008.
- [3]. D. T. Horatiu Jula, C. Zamfir, and G. Candea.Deadlock immunity:enabling systems to defend against deadlocks. In USENIX OSDI, December 2008
- 4] https://code.google.com/p/dimmunix/
- [5] https://github.com/vivekShanbhag/Stalemate

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Inherited from Stalemate Static Analysis Sometime Deadlocking Programs **Deadlock Predictions E.x. 1: TcPdh** namespace: com.sun.org.omg.CORBA <Cycle-2 locks="ParameterDescriptionHelper.class" public class TcPdh TypeCode.class"> public static void main(String[] args) { <Thread-1> new Thread() { ParameterDescriptionHelper.type() public void run() { ParameterDescriptionHelper.type(); }; ParameterDescriptionHelper.type: }.start(); ()LTypeCode;#LTypeCode.class;#0 new Thread() { </Thread-1> public void run() { OperationDescriptionHelper.type(); }; <Thread-2> }.start(); OperationDescriptionHelper.type() OperationDescriptionHelper.type:()LTypeCode;# TypeCode.class;#0 ParameterDescriptionHelper.type:()LTypeCode; </Thread-2> public class KTest2 { </Cycle-2> public static void main(String [] a) throws Exception{ final CacheTable ct = new CacheTable(); final long time = System.currentTimeMillis(); E.x. 2: RcCt namespace: sun.security.krb5.internal.rcache ct.put("TheOnlyOne", new AuthTime(time - 300000L, 0), time); <Cycle-2 locks="ReplayCache CacheTable"> final ReplayCache rc = (ReplayCache) ct.get("TheOnlyOne"); <Thread-1> new Thread() { ReplayCache.put()LAuthTime; · · · | · · · · · · · · | · · · · **>** public void run() { CacheTable.remove()Ljava/lang/Object; rc.put(new AuthTime(time - 300000L, 0), time + 300000); </Thread-1> <Thread-2> }.start(); CacheTable.put()LAuthTime; ct.put("TheOnlyOne", new AuthTime(time - 300000L, 0), time); ReplayCache.put()LAuthTime; </Thread-2> <Cycle-2>

Step 1 : Always Deadlocking Program (jdwp+scriptlet+jdb) "Thread-1": "Thread-2": at com.sun.org.omg.CORBA.ParameterDescription at com.sun.org.omg.CORBA.ParameterDescriptionHelper. Helper.type(ParameterDescriptionHelper.java:62) type(ParameterDescriptionHelper.java) - waiting to lock <0xb0899c78> (a java.lang.Class for - waiting to lock <0xb08a5a18> (a java.lang.Class for org.omg.CORBA.TypeCode) com.sun.org.omg.CORBA.ParameterDescriptionHelper) - locked <0xb0899c78> (a java.lang.Class for at com.sun.org.omg.CORBA.OperationDescriptionHelper. type(OperationDescriptionHelper.java:116) com.sun.org.omg.CORBA.ParameterDescription - locked <0xb08a5a18> (a java.lang.Class for org.omg.CORBA.TypeCode) at dimmunixTests.CorbaDeadlock\$1.run (CorbaDeadlock.java:22) - locked <0xb08a4100> (a java.lang.Class for com.sun.org.omg.CORBA.OperationDescriptionHelper) at dimmunixTests.CorbaDeadlock\$2.run(CorbaDeadlock.java:25) "Thread-0": "main": at java.util.Hashtable.remove(Hashtable.java:435) at sun.security.krb5.internal.rcache.ReplayCache. - waiting to lock <0xa5621b80> put(ReplayCache.java:62) - waiting to lock <0xa5622fb8> (a sun.security.krb5.internal.rcache.CacheTable) at sun.security.krb5.internal.rcache.ReplayCache. (a sun.security.krb5.internal.rcache.ReplayCache) at sun.security.krb5.internal.rcache.CacheTable. put(ReplayCache.java:123) put(CacheTable.java:59) locked <0xa5622fb8> - locked <0xa5621b80> (a sun.security.krb5.internal.rcache.ReplayCache) at KTest2\$1.run(KTest2.java:13) (a sun.security.krb5.internal.rcache.CacheTable) at KTest2.main(KTest2.java:16)

Dimmunix observes the deadlock to generate corresponding fingerprints

Deadlock Fingerprints generated in Step 2 deadlock_template = 1# com.sun.org.omg.CORBA.OperationDescriptionHelper .type(OperationDescriptionHelper.java:62), dimmunixTests.CorbaDeadlock\$2.run (CorbaDeadlock.java:25); 1# dimmunixTests.CorbaDeadlock\$1.run (CorbaDeadlock.java:22) deadlock_template = 1# dimmunixTests.KTest2\$1.run(KTest2.java:22), java.lang.Thread.run(Thread.java:679); 1# dimmunixTests.KTest2\$2.run(KTest2.java:28), java.lang.Thread.run(Thread.java:679)