

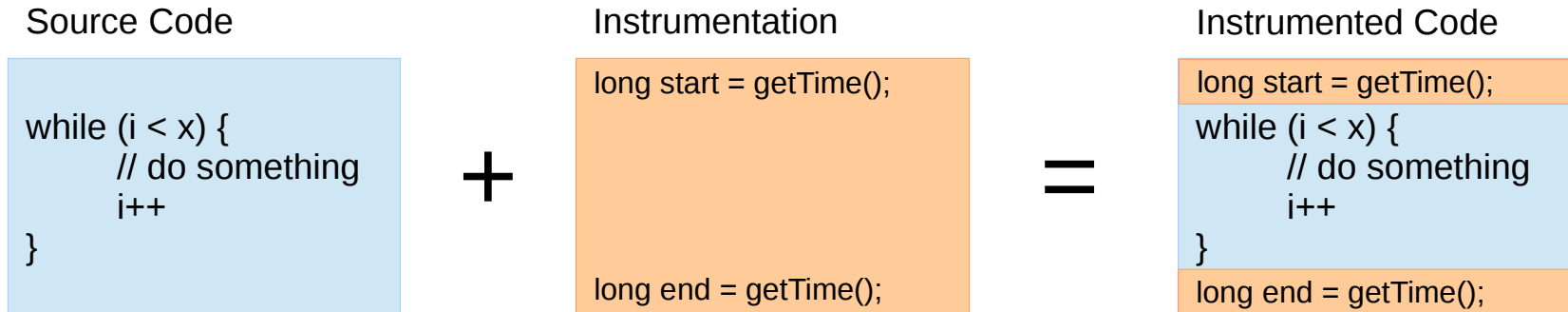


Traditional Monitoring Techniques

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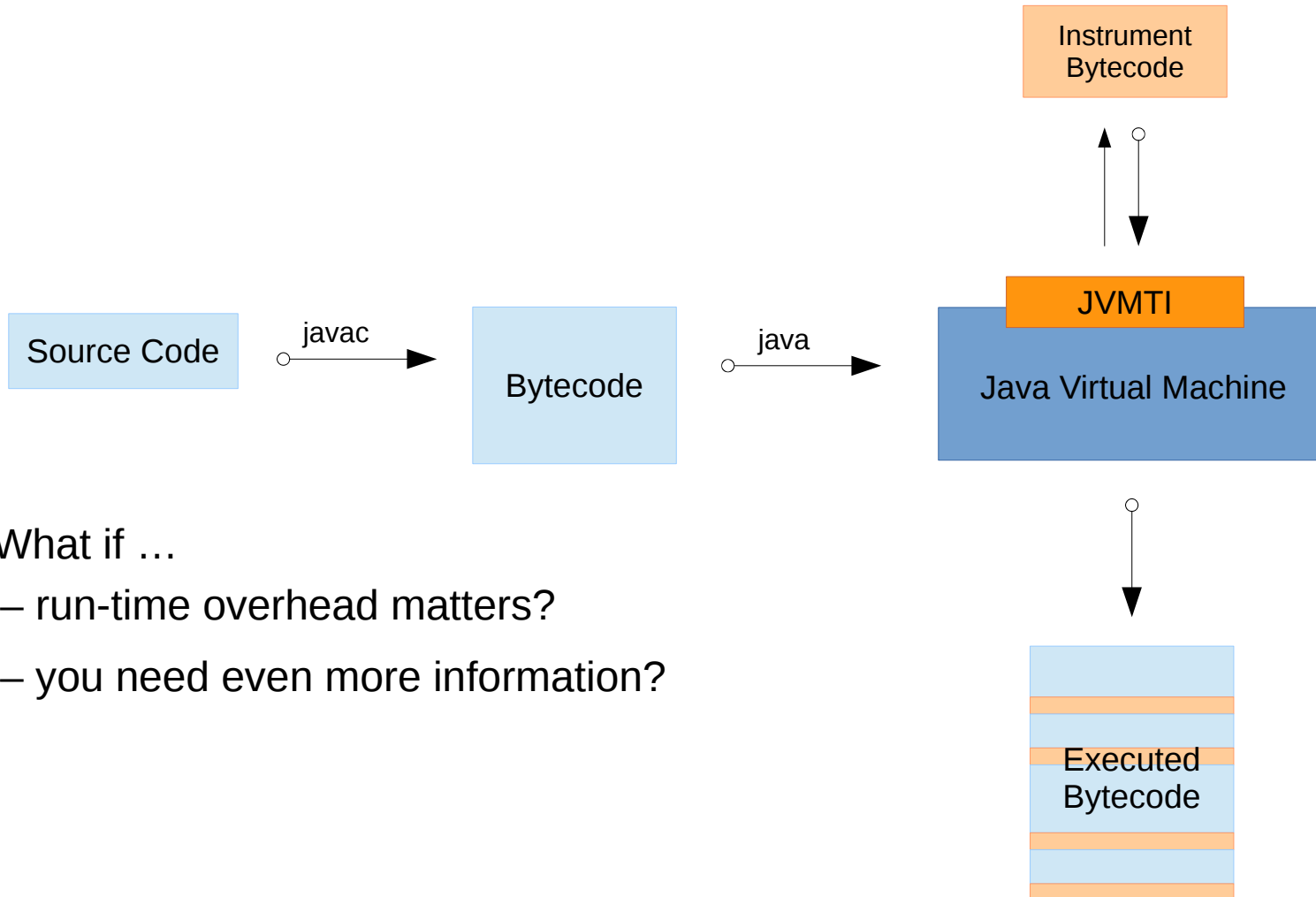
Static Instrumentation



What if ...

- the source code is not available?
- classes are loaded dynamically?
- run-time information are required?

Dynamic Instrumentation (Java)



What if ...

- run-time overhead matters?
- you need even more information?

Dynamic Instrumentation – Native Agent (JVM TI)

```
JNICALL callbackVMObjectAlloc(...,  
    jthread thread, jobject obj, jclass klass, ...) {  
  
    char* kName;  
    (*jvmti)→GetClassSignature(jvmti, klass, &kName, NULL);  
    // error check  
  
    jvmtiFrameInfo frame[10];  
    jint count;  
    (*jvmti)→GetStackTrace(jvmti, NULL, 0, 10, &frame, &count);  
    // error check  
  
    char* mName;  
    for (i = 0; i < count; i++) {  
        (*jvmti)→GetMethodName(jvmti, frame[i].method, &mName, ...);  
        // error check  
        // get method signature  
    }  
}
```

Dynamic Instrumentation – Java Agent

```
import java.lang.instrument.Instrumentation;

public class Agent {
    public static void premain(String args, Instrumentation inst) {
        inst.addTransformer(new AllocationSiteTracker());
    }
}
```

Dynamic Instrumentation – Java Agent

```
import org.objectweb.asm.*;

class AllocationSiteTracker implements ClassFileTransformer {

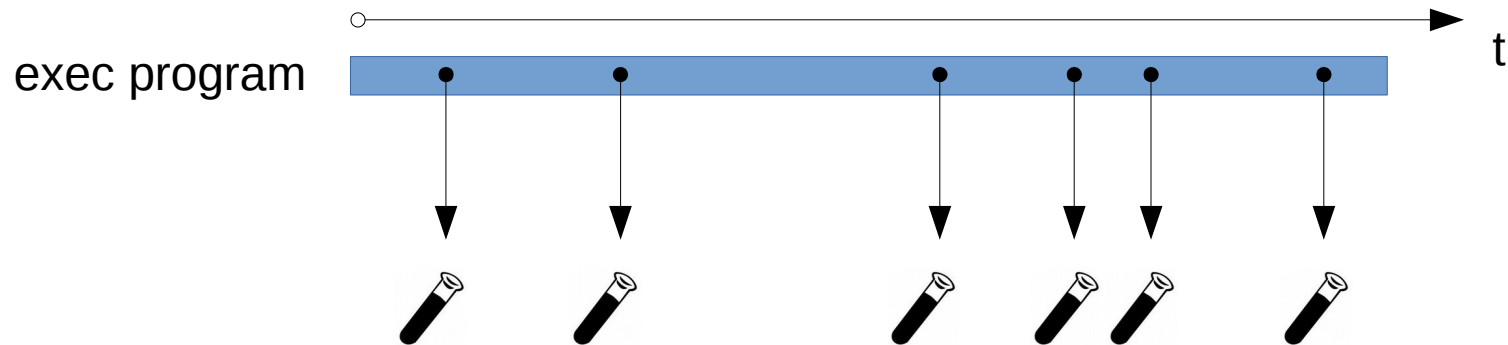
    @Override
    public byte[] transform(ClassLoader loader, String className,
                           ..., byte[] classfileBuffer) {

        ClassReader classReader = new ClassReader(classfileBuffer);
        ClassWriter classWriter = new ClassWriter(classReader, 0);

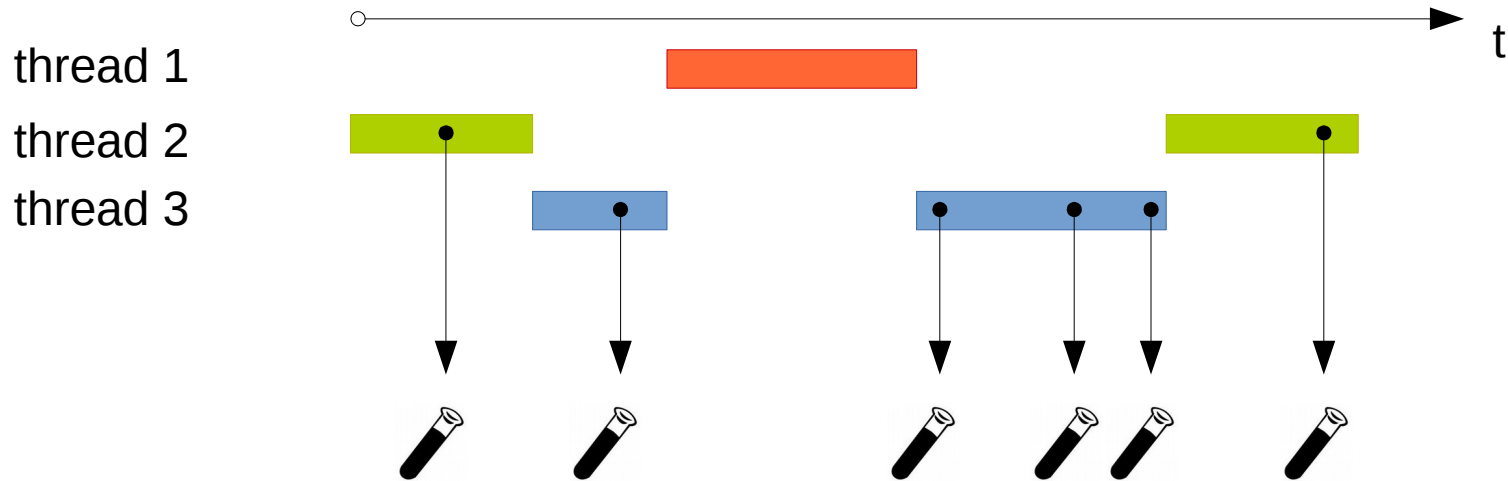
        ClassVisitor classVisitor = new ClassVisitor(Opcodes.ASM5, classWriter){
            @Override
            public MethodVisitor visitMethod(..., String mName, String sig, ...) {
                MethodVisitor methodVisitor = super.visitMethod(..., mName, sig, ...);
                if (methodName.equals("<init>")) // do something
                    return methodVisitor;
            }
        };

        classReader.accept(classVisitor, 0);
        return classWriter.toByteArray();
    }
}
```

Sampling



Sampling



What if ...

– you need precise information?

