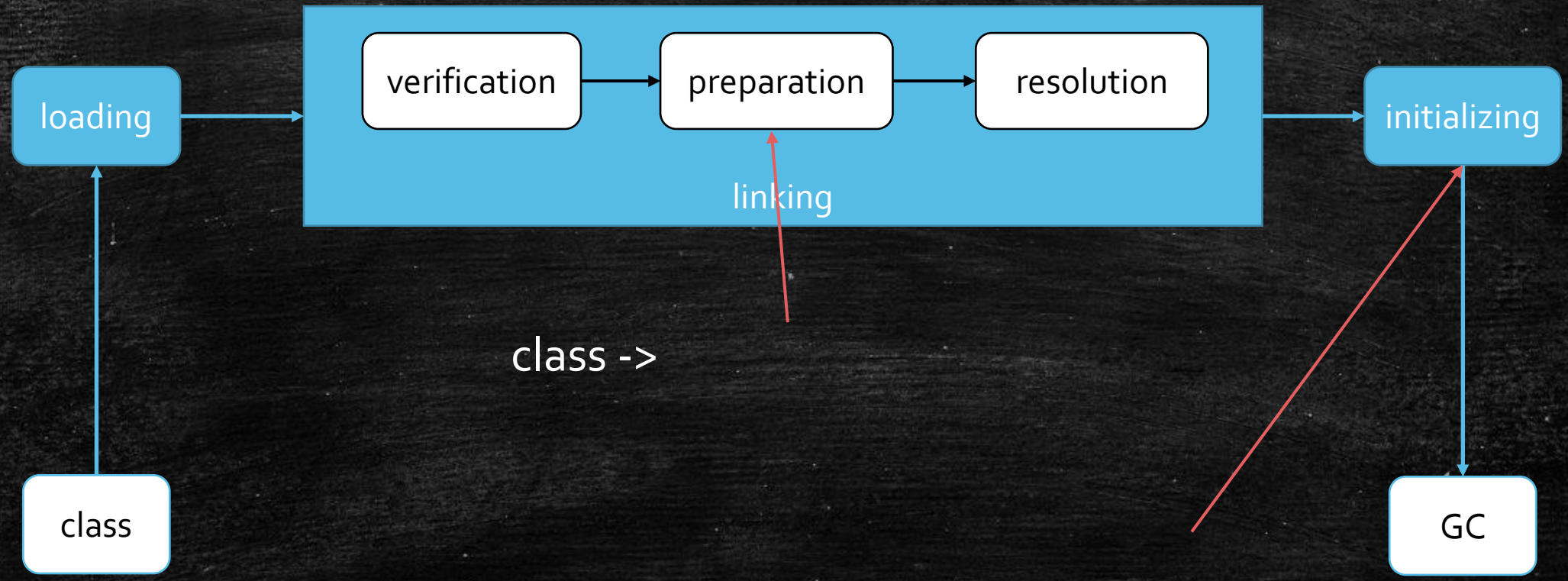
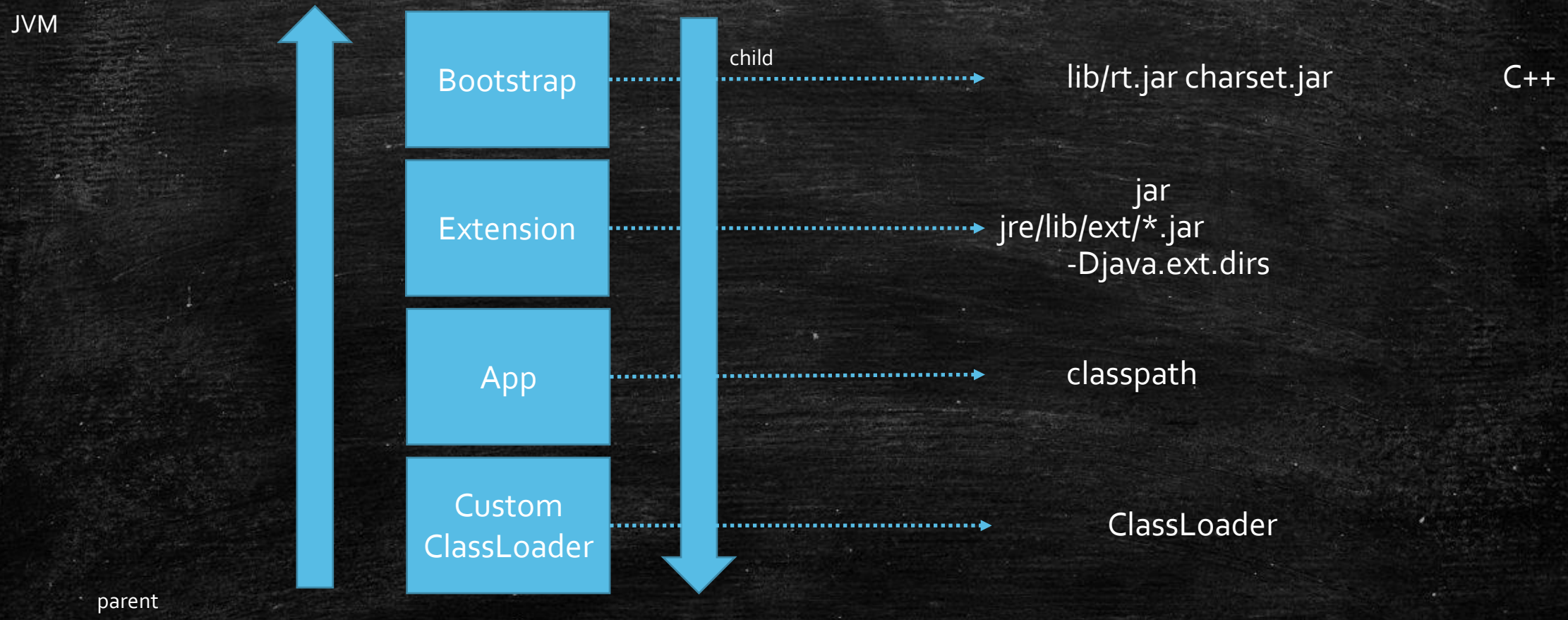
Class Loading Linking Initializing

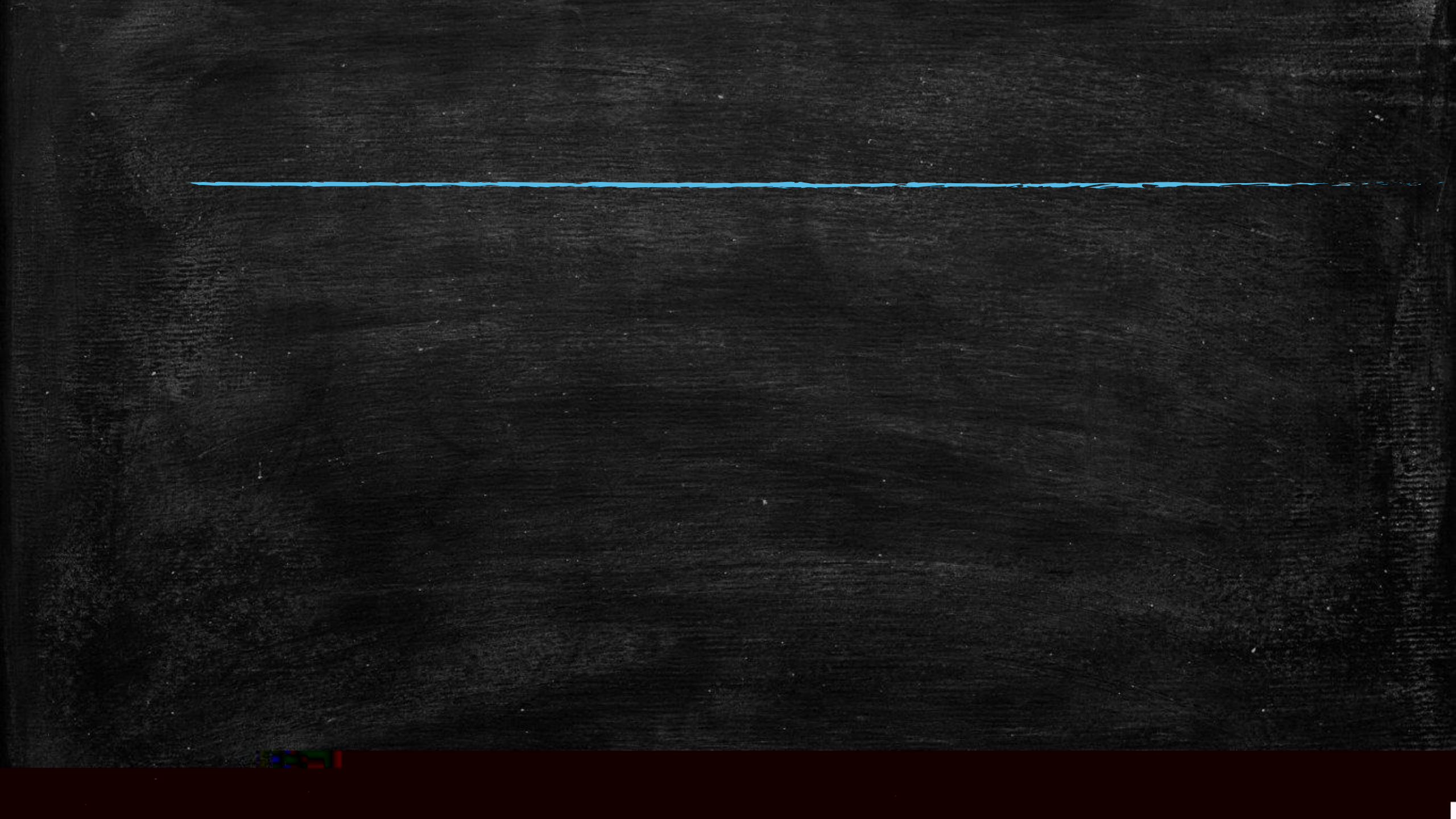
马士兵

class cycle

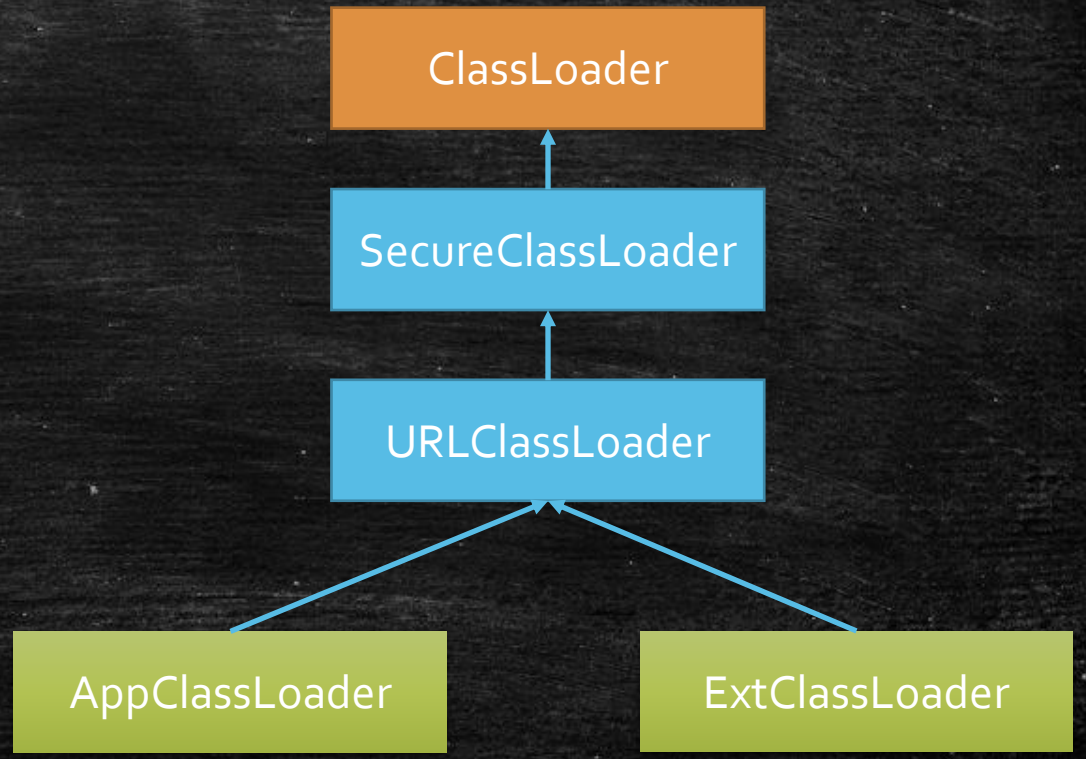

loading
verification
preparation
resolution
linking
initializing
class
GC
class ->
http://mashibing.com

类加载器


JVM
Bootstrap
Extension
App
Custom ClassLoader
child
parent
lib/rt.jar charset.jar
C++
jar
jre/lib/ext/*.jar
-Djava.ext.dirs
classpath
ClassLoader



类加载器继承关系


ClassLoader
SecureClassLoader
URLClassLoader
AppClassLoader
ExtClassLoader

类加载器范围

（来自Launcher源码）

- sun.boot.class.path
  - Bootstrap ClassLoader加载路径
- java.ext.dirs
  - ExtensionClassLoader加载路径
- java.class.path
  - AppClassLoader加载路径

```
com.mashibing.jvm.classloader.T003_ClassLoaderScope
```

自定义类加载器

继承ClassLoader

重写模板方法findClass

- 调用defineClass

自定义类加载器加载自加密的class

- 防止反编译
- 防止篡改

```
com.mashibing.jvm.classloader.T005_MSBClassLoader
com.mashibing.jvm.classloader.T007_MSBClassLoaderWithEncription
```

Classloader源码解析

loadClass

```
protected Class<?> loadClass(String name, boolean resolve)
    throws ClassNotFoundException
{
    synchronized (getClassLoadingLock(name)) {
        // First, check if the class has already been loaded
        Class<?> c = findLoadedClass(name);
        if (c == null) {
            long t0 = System.nanoTime();
            try {
                if (parent != null) {
                    c = parent.loadClass(name, resolve: false);
                } else {
                    c = findBootstrapClassOrNull(name);
                }
```

```
if (c == null) {
    // If still not found, then invoke findClass in order
    // to find the class.
    long t1 = System.nanoTime();
    c = findClass(name);
```

ClassLoader源码解析

findClass

如果是AppClassLoader首先会执行URLClassLoader的findClass方法

思考这是一个什么设计模式?

```
String path = name.replace( oldChar: '.', newChar: '/').concat(".class");
Resource res = ucp.getResource(path, b: false);
if (res != null) {
    try {
        return defineClass(name, res);
    } catch (IOException e) {
        throw new ClassNotFoundException(name, e);
    }
```

defineClass Class

混合模式

解释器 -Xmixed
- bytecode intepreter

JIT -Xint
- Just In-Time compiler -Xcomp

混合模式
- 混合使用解释器 + 热点代码编译
- 起始阶段采用解释执行
- 热点代码检测
  - 多次被调用的方法（方法计数器：监测方法执行频率）
  - 多次被调用的循环（循环计数器：检测循环执行频率）
  - 进行编译

com.mashibing.jvm.classloader.T009_WayToRun

lazyloading

严格讲应该叫lazyInitializing

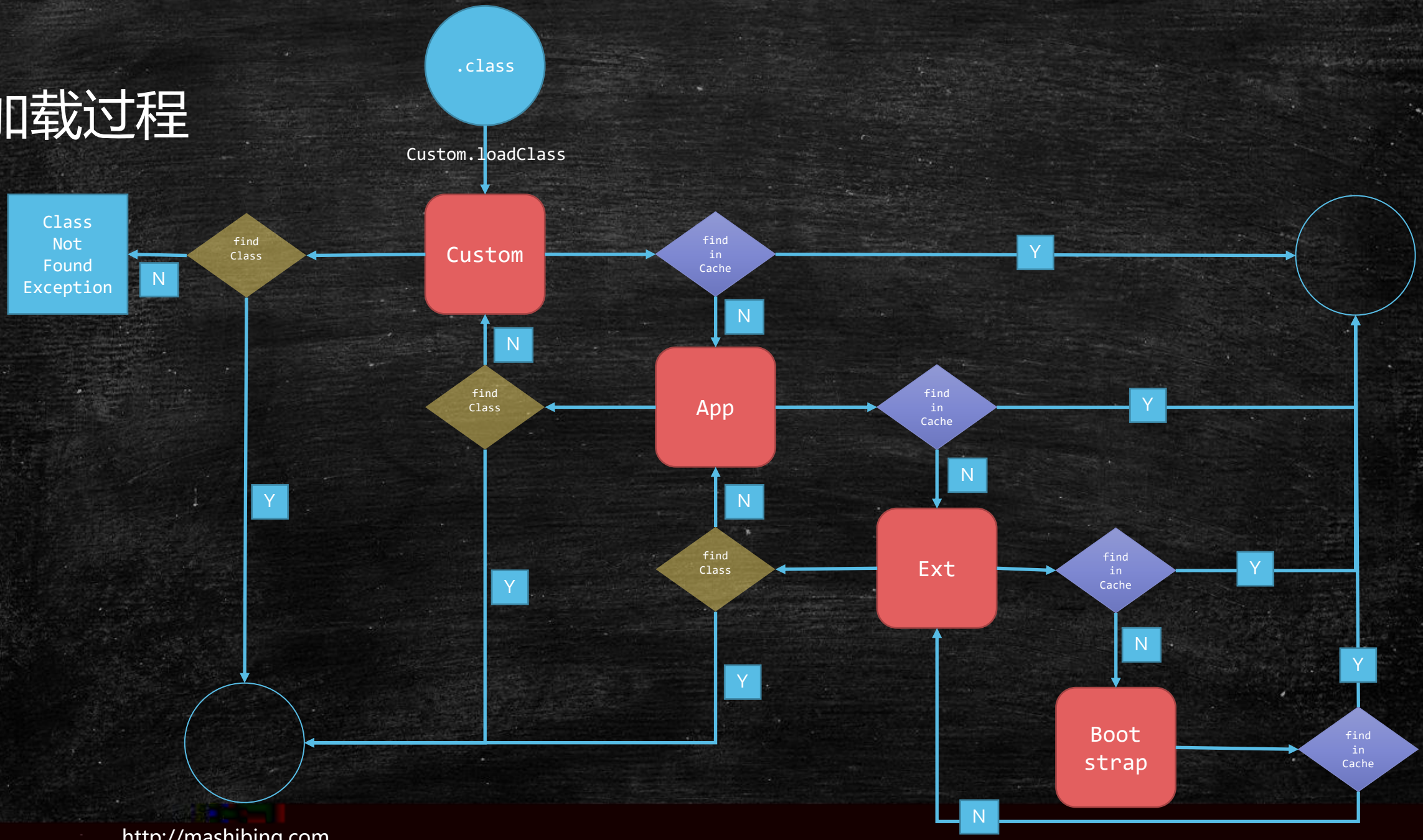
JVM规范并没有规定何时加载

但是严格规定了什么时候必须初始化

- new getstatic putstatic invokestatic指令，访问final变量除外
- java.lang.reflect对类进行反射调用时
- 初始化子类的时候，父类首先初始化
- 虚拟机启动时，被执行的主类必须初始化
- 动态语言支持java.lang.invoke.MethodHandle解析的结果为REF_getstatic REF_putstatic REF_invokestatic的方法句柄时，该类必须初始化

```
com.mashibing.jvm.classloader.T008_LazyLoading
```

类加载过程


.class
Custom.loadClass
Custom
find Class
Class Not Found Exception
N
find in Cache
Y
N
App
find Class
N
find in Cache
Y
N
Ext
find Class
Y
N
find in Cache
Y
N
Boot strap
find in Cache
Y
N
Y
Y
Y

针对小白

- java0基础后端课 SSM

双料架构师

AI

volatile Object o = new Object()

```
1  0 new #2 <java/lang/Object>
2  3 dup
3  4 invokespecial #1 <java/lang/Object.<init>>
4  7 astore_1
5  8 return
```

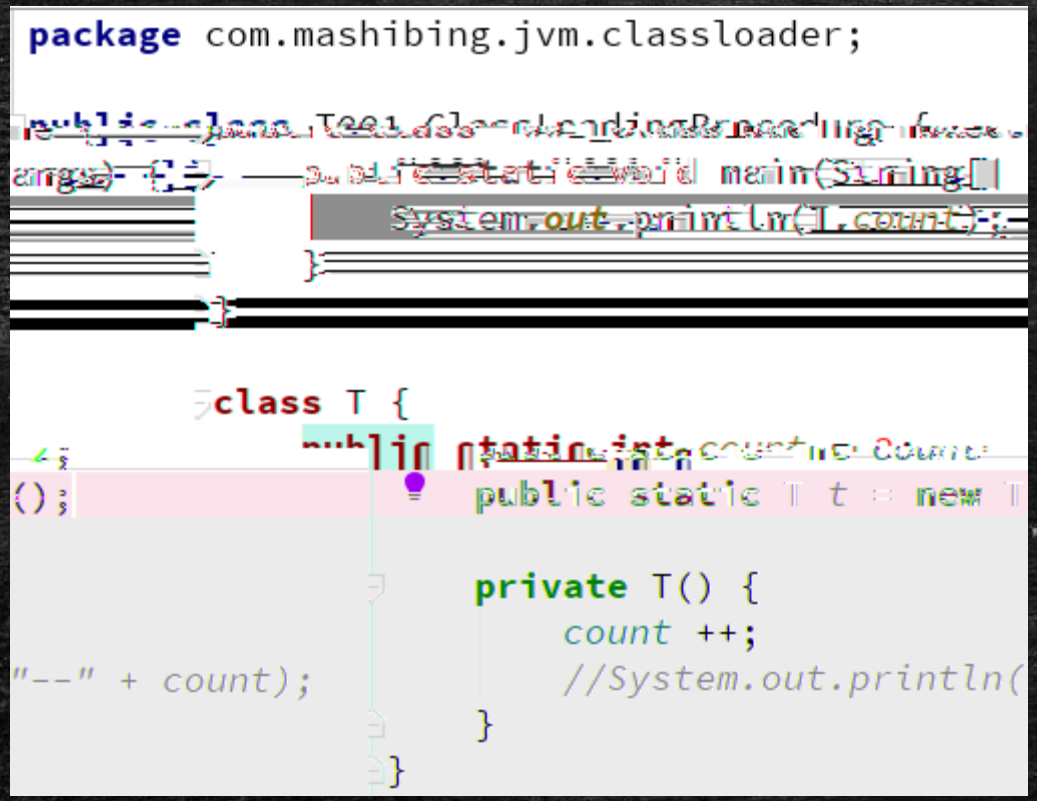
點點點

已经有原子性了，重排也会执行完所有的代码，也并不会读到半初始化状态啊

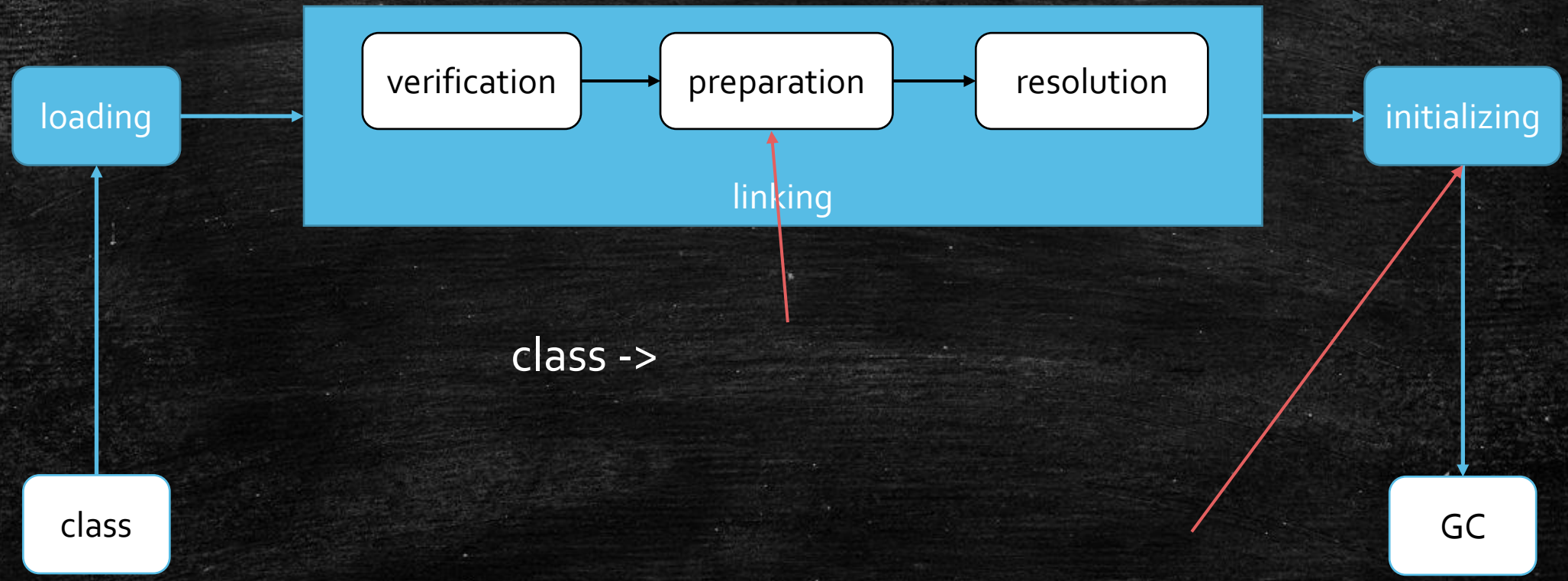
一道面试题

```
package com.mashibing.jvm.classloader;

public class T001_ClassLoadingProcedure {
    public static void main(String[] args) {
        System.out.println(T.count);
    }
}

class T {
    public static T t = new T();
    public static int count = 2;

    private T() {
        count ++;
    }
}
```

A. 2
B. 3
C. 0
D. 1


package com.mashibing.jvm.classloader;
class T {
public static T t = new T
private T() {
count ++;
//System.out.println(
}
}

class cycle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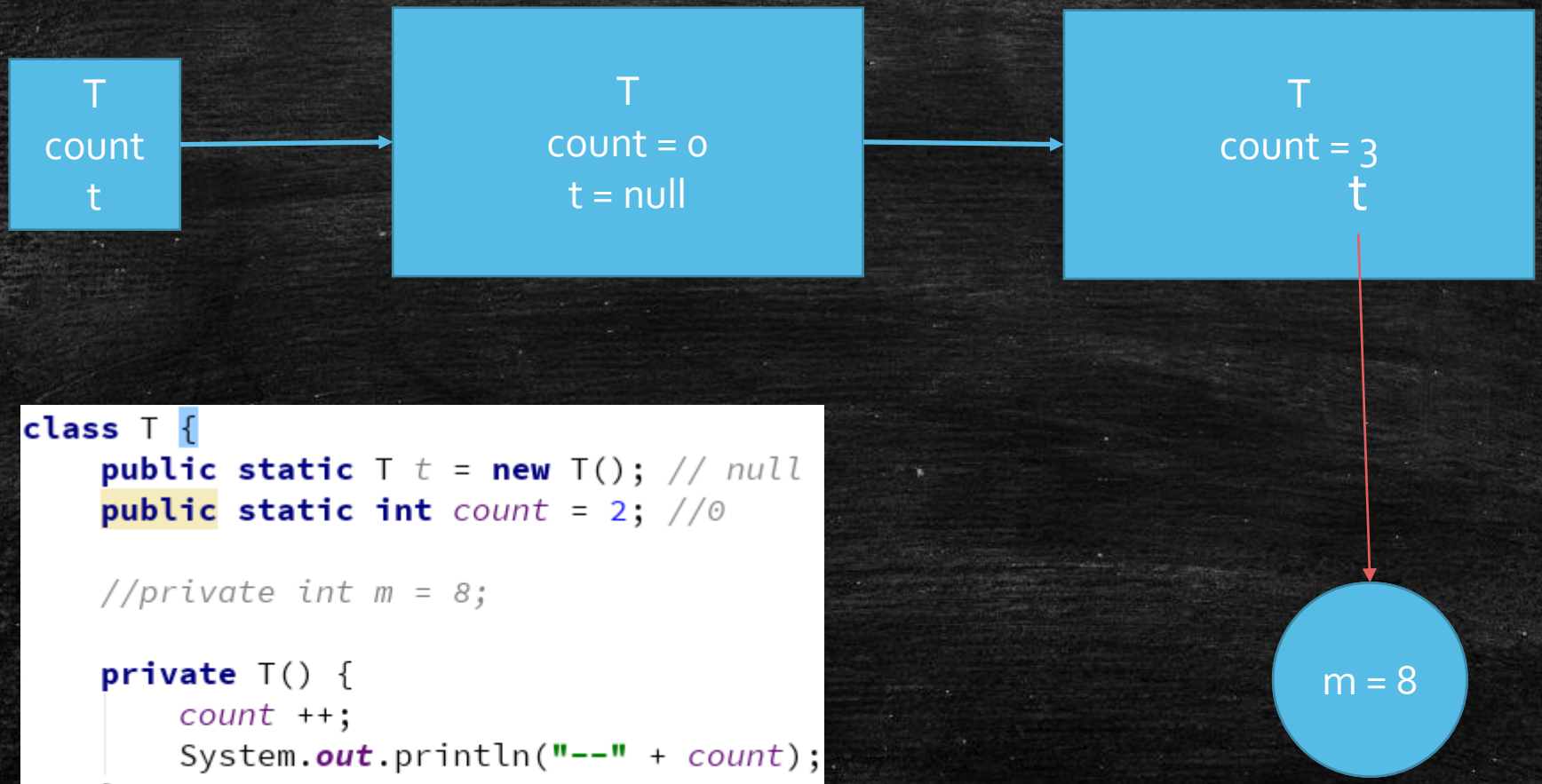
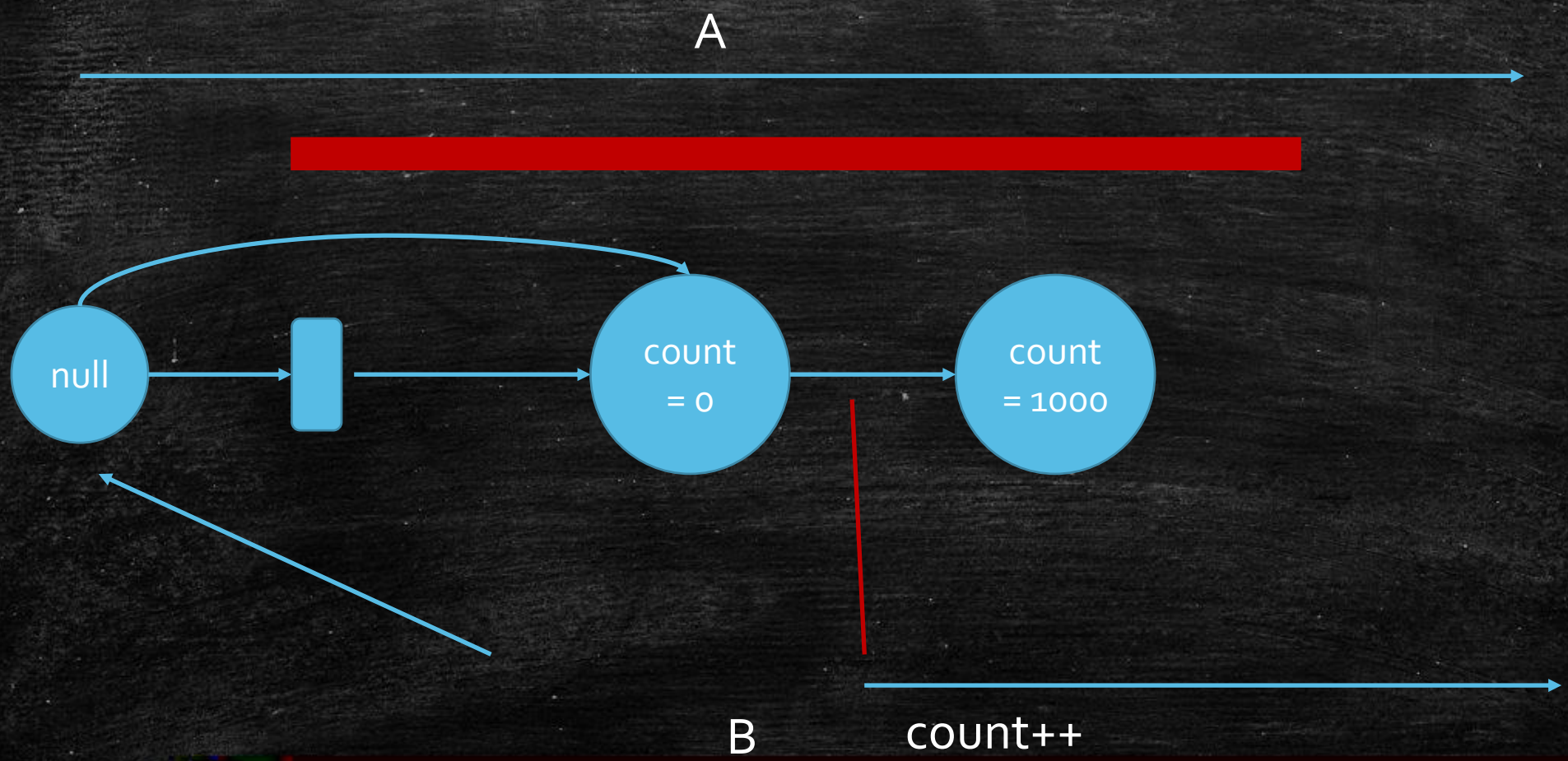



```java
class T {
    public static T t = new T(); // null
    public static int count = 2; //0

    //private int m = 8;

    private T() {
        count ++;
        System.out.println("--" + count);
    }
}
```

double check singleton



指令重排序

```java
public class T {
    public static void main(String[] args) {
        T t = new T();
    }
}
```

```
0 new #2 <T>
3 dup
4 invokespecial #3 <T.<init>>
7 astore_1
8 return
```

volatile

线程间可见性

防止指令重排序

preparation - initialization

preparation
- 静态变量设定为默认值

initialization
- <clinit>
- 设定为人工指定值

添加幻灯片标题 - 4

添加幻灯片标题 - 5