

# Java 诊断利器 Arthas 排查问题实践

郭浩 阿里云智能高级开发工程师

# Arthas/阿尔萨斯

- Alibaba 开源的 Java 诊断工具
- 2018年9月开源，Github Star 11,000+
- Github：<https://github.com/alibaba/arthas>
- Wiki：<https://alibaba.github.io/arthas>


**Java** @java · 2018年9月19日  
 Open Source Arthas, helps developers trouble-shoot production issues for #Java applications without modifying code or restating your server.

[github.com/alibaba/arthas...](https://github.com/alibaba/arthas...)

 翻译推文

```

ID      NAME                                GROUP  PRIORITY STATE   NCPU  TIME  INTERRUPTED DAEMON
54      http-bio-8080-Acceptor-0            main   5        RUNNABLE 35    0:1   false      true
662     http-bio-8080-exec-11              main   5        RUNNABLE 8     0:0   false      true
653     http-bio-8080-exec-2               main   5        RUNNABLE 6     0:0   false      true
652     http-bio-8080-exec-1              main   5        RUNNABLE 5     0:0   false      true
654     http-bio-8080-exec-3              main   5        TIMED_WAITING 5  0:0   false      true
655     http-bio-8080-exec-4              main   5        TIMED_WAITING 5  0:0   false      true
669     http-bio-8080-exec-9              main   5        RUNNABLE 5     0:0   false      true
661     http-bio-8080-exec-10             main   5        RUNNABLE 5     0:0   false      true
657     http-bio-8080-exec-6              main   5        TIMED_WAITING 4  0:0   false      true
659     http-bio-8080-exec-8              main   5        TIMED_WAITING 4  0:0   false      true
663     http-bio-8080-exec-12             main   5        RUNNABLE 4     0:0   false      true
656     http-bio-8080-exec-5              main   5        RUNNABLE 2     0:0   false      true
658     http-bio-8080-exec-7              main   5        TIMED_WAITING 2  0:0   false      true
665     Timer-for-arthas-dashboard-1      system 9        RUNNABLE 1     0:0   false      true
48      Pandora.pandora-qos-reporter.Pool main   5        TIMED_WAITING 0  0:0   false      true

Memory
used      total  max  usage  GC
heap      268M  481M  1829M  14.74%  gc.ps.scavenge.count      26
ps_eden_space 236M  341M  648M  36.53%  gc.ps.scavenge.time(ms)   463
ps_survivor_space 8M    14M  14M  57.72%  gc.ps.markswEEP.count     9
ps_old_gen  23M  129M  1369M  1.71%   gc.ps.markswEEP.time(ms)  1451
nonheap   136M  154M  0M    87.98%
code_cache 27M  29M  248M  11.64%
metaspace 99M  109M  0M    87.68%

Runtime
os.name      Mac OS X
os.version   10.10.5
java.version 1.8.0_60
java.home

systemload.average 2.88
processors          4
uptime             11389s

connector    http-bio-8080
qps          146.80
RT(ms)       1.15
error/s      0.00
received/s   00
sent/s       26K
threadpool   http-bio-8080
busy         5
    
```

6    194    486

01

产生背景

02

功能特性

03

实践演示

## 产生背景

- 线上服务抛出异常，怎么获取调用参数？
- 怎样调试线上服务代码？
- 怎样动态修改 logger 级别？
- 服务 RT latency 上升，怎样定位慢调用？
- 服务运行状态和预期不一致，如何确定代码是正确的？

# Arthas 功能特性

- 查看类加载情况
- 反编译类
- 热更新类
- 分析方法调用入参返回值
- 分析慢调用
- 找出阻塞线程
- 支持 JDK6+
- ...

# Arthas Demo

- <https://github.com/guohao/arthas-demo>

```
@RestController
public class UserController {
    private static final Logger LOGGER = LoggerFactory.getLogger(UserController.class);

    @GetMapping("/user/{id}")
    public User findUserById(@PathVariable Integer id) {
        if (LOGGER.isDebugEnabled()) {
            LOGGER.debug("Find user by id: {}", id);
        }
        if (id == null) {
            throw new IllegalArgumentException("Id must not be null");
        }
        if (id < 1) {
            throw new IllegalArgumentException("id < 1");
        }
        return new User(id, name: "name:" + id);
    }
}
```

# Arthas 快速上手

- \$ wget https://alibaba.github.io/arthas/arthas-boot.jar
- \$ java -jar arthas-boot.jar

```
$ java -jar arthas-boot.jar --repo-mirror aliyun
[INFO] arthas-boot version: 3.1.0
[INFO] Found existing java process, please choose one and hit RETURN.
* [1]: 63226
  [2]: 63978 org.jetbrains.jps.cmdline.Launcher
  [3]: 63979 com.taobao.arthas.demo.ArthasDemoApplication
3
[INFO] arthas home: /Users/guohao02/.arthas/lib/3.1.0/arthas
[INFO] Try to attach process 63979
[INFO] Attach process 63979 success.
[INFO] arthas-client connect 127.0.0.1 3658
```

The Arthas logo is displayed in a stylized, multi-colored font. The letters are outlined and filled with various colors like red, green, blue, and purple, giving it a digital or 'matrix' aesthetic.

```
wiki: https://alibaba.github.io/arthas
version: 3.1.0
pid: 63979
time: 2019-03-07 17:52:01
```

# Dashboard

ID	NAME	GROUP	PRIORITY	STATE	%CPU	TIME	INTERRUPT	DAEMON
30	Timer-for-arthas-dashboard-1c	system	10	RUNNABLE	61	0:0	false	true
27	nioEventLoopGroup-2-3	system	10	RUNNABLE	19	0:0	false	false
16	nioEventLoopGroup-3-1	system	10	RUNNABLE	18	0:0	false	false
12	AsyncAppender-Worker-arthas-c	system	9	WAITING	0	0:0	false	true
10	Attach Listener	system	9	RUNNABLE	0	0:0	false	true
3	Finalizer	system	8	WAITING	0	0:0	false	true
5	Monitor Ctrl-Break	main	5	RUNNABLE	0	0:0	false	true
2	Reference Handler	system	10	WAITING	0	0:0	false	true
4	Signal Dispatcher	system	9	RUNNABLE	0	0:0	false	true
20	as-command-execute-daemon	system	10	TIMED_WAI	0	0:0	false	true
14	job-timeout	system	9	TIMED_WAI	0	0:0	false	true
1	main	main	5	TIMED_WAI	0	0:0	false	false

  

Memory	used	total	max	usage	GC
heap	48M	245M	3641M	1.34%	gc.ps_scavenge.count 2
ps_eden_space	37M	64M	1344M	2.79%	gc.ps_scavenge.time(ms) 25
ps_survivor_space	10M	10M	10M	99.70%	gc.ps_marksweep.count 0
ps_old_gen	744K	175104K		0.03%	gc.ps_marksweep.time(ms) 0

  

Runtime	
os.name	Mac OS X
os.version	10.14.3
java.version	1.8.0_181

# Thread (查看线程信息)

```
$ thread -n 3 -i 3000
```

```
"main" Id=1 cpuUsage=37% TIMED_WAITING
  at java.lang.Thread.sleep(Native Method)
  at java.lang.Thread.sleep(Thread.java:340)
  at java.util.concurrent.TimeUnit.sleep(TimeUnit.java:386)
  at demo.MathGame.main(MathGame.java:17)

"nioEventLoopGroup-2-1" Id=15 cpuUsage=13% RUNNABLE (in native)
  at sun.nio.ch.KQueueArrayWrapper.kevent0(Native Method)
  at sun.nio.ch.KQueueArrayWrapper.poll(KQueueArrayWrapper.java:198)
  at sun.nio.ch.KQueueSelectorImpl.doSelect(KQueueSelectorImpl.java:117)
  at sun.nio.ch.SelectorImpl.lockAndDoSelect(SelectorImpl.java:86)
  - locked io.netty.channel.nio.SelectedSelectionKeySet@2a4a735e
  - locked java.util.Collections$UnmodifiableSet@62da8b1d
  - locked sun.nio.ch.KQueueSelectorImpl@6a55648d
  at sun.nio.ch.SelectorImpl.select(SelectorImpl.java:97)
  at io.netty.channel.nio.SelectedSelectionKeySetSelector.select(SelectedSelectionKeySetSelector.java:62)
```

# ClassLoader (查看类加载器信息)

\$ classloader -t

```
$ classloader -t
+-BootstrapClassLoader
+-sun.misc.Launcher$ExtClassLoader@78e03bb5
  +-com.taobao.arthas.agent.ArthasClassLoader@4ac27597
  +-com.taobao.arthas.agent.ArthasClassLoader@5413bb66
  +-sun.misc.Launcher$AppClassLoader@18b4aac2
Affect(row-cnt:5) cost in 3 ms.
```

\$ classloader -l

```
$ classloader -l
```

name	loadedCount	hash	parent
BootstrapClassLoader	2586	null	null
com.taobao.arthas.agent.ArthasClassLoader@4ac27597	1051	4ac27597	sun.misc.Launcher\$ExtClassLoader@78e03bb5
com.taobao.arthas.agent.ArthasClassLoader@5413bb66	1093	5413bb66	sun.misc.Launcher\$ExtClassLoader@78e03bb5
sun.misc.Launcher\$AppClassLoader@18b4aac2	4193	18b4aac2	sun.misc.Launcher\$ExtClassLoader@78e03bb5
sun.misc.Launcher\$ExtClassLoader@78e03bb5	7	78e03bb5	null

```
Affect(row-cnt:5) cost in 4 ms.
```

## Sc (展示已加载类详情)

- `$ sc -d java.lang.String`

```
class-info      java.lang.String
code-source
name           java.lang.String
isInterface    false
isAnnotation   false
isEnum        false
isAnonymousClass false
isArray       false
isLocalClass  false
isMemberClass false
isPrimitive   false
isSynthetic   false
simple-name    String
modifier      final,public
annotation
interfaces     java.io.Serializable,java.lang.Comparable,java.lang.CharSequence
super-class    +-java.lang.Object
class-loader
classLoaderHash null
```

## Watch (监控方法入参返回值)

- watch 查看入参/异常/返回值
- <http://localhost:8080/user/0> 500
- `$ watch com.taobao.arthas.demo.web.UserController * '{params[0], throwExp}'`

```
$ watch com.taobao.arthas.demo.web.UserController * '{params[0],throwExp}' 'true'
Press Q or Ctrl+C to abort.
Affect(class-cnt:1 , method-cnt:2) cost in 28 ms.
ts=2019-03-12 22:25:22; [cost=0.116596ms] result=@ArrayList[
  @Integer[2],
  null,
]
ts=2019-03-12 22:25:23; [cost=0.182827ms] result=@ArrayList[
  @Integer[2],
  null,
]
ts=2019-03-12 22:25:23; [cost=0.143261ms] result=@ArrayList[
  @Integer[2],
  null,
]
```

## Trace (监控方法调用栈)

- trace 监控方法调用路径，并输出每个节点耗时
- <http://localhost:8080/a.txt> 404
- trace com.taobao.arthas.demo.web.UserController \* > trace.log

## Jad (实时反编译)

- \$ jad com.taobao.arthas.demo.web.UserController

### ClassLoader:

```
+sun.misc.Launcher$AppClassLoader@2a139a55  
+-sun.misc.Launcher$ExtClassLoader@5fa7e7ff
```

### Location:

```
/Users/guohao02/code/github/fork/arthas-demo/target/classes/
```

```
/*  
 * Decompiled with CFR 0_132.  
 */  
package com.taobao.arthas.demo.web;  
  
import com.taobao.arthas.demo.vo.User;  
import org.slf4j.Logger;  
import org.slf4j.LoggerFactory;
```

## Redefine (热更新类)

- \$ redefine UserController.class

```
public User findUserById(@PathVariable Integer id) {  
    if (LOGGER.isDebugEnabled()) {  
        LOGGER.debug("Find user by id: {}", id);  
    }  
    if (id == null) {  
        throw new IllegalArgumentException("Id must not be null");  
    }  
    if (id < 1) {  
        return new User(id, name: "name:" + id);  
        throw new IllegalArgumentException("id < 1");  
    }  
    return new User(id, name: "name:" + id);  
}
```

# Ognl

- ognl 获取日志实现
  - ognl '@com.taobao.arthas.demo.web.UserController@LOGGER'
- ognl 动态修改日志打印级别
  - ognl '@com.taobao.arthas.demo.web.UserController@LOGGER.setLevel(@ch.qos.logback.classic.Level@DEBUG)'
- ognl 查看日志配置文件加载位置
  - ognl '#map1=@org.slf4j.LoggerFactory@getLogger("root").loggerContext.objectMap, #map1.get("CONFIGURATION\_WATCH\_LIST)'

# 成为 Arthas 的 Contributor

- 登记用户 /issues/395
- 修正错别字/改进文档
- 完善翻译/翻译 user case
- 补充单元测试
- 补充代码注释
- 新的 command



A screenshot of a GitHub issues page for the Arthas project. It displays four open issues, each with a 'help wanted' label. The issues are:

- 最快速度成为Arthas Contributor** help wanted  
#395 opened 6 hours ago by hengyunabc
- Arthas源码分析** help wanted  
#393 opened 23 hours ago by hengyunabc
- Need a new LOGO/需要一个新的LOGO** help wanted  
#371 opened 7 days ago by hengyunabc
- Add jmx command** help wanted  
#367 opened 8 days ago by hengyunabc

# Thanks!

Q&A

欢迎钉钉扫码进群



10 YEARS 十年再出发 RELOADED

