Investigation Plan

Inv Plan: Win5mem : WinXP memory image triage

Case: 20150124BSK : *Suspicious IE/Java behaviour on workstation*

Investigator: Ben S. Knowles (bsk@dfirnotes.org)

Response Phase: Identification

Refs: Problem reported to Helpdesk in ticket 1202 (https://tickets.dfirnotes.org/HD-1202), Incident case record 20150124BSK (https:ir.dfirnotes.org/INC-20150124BSK)

Date/times of interest: Memory image acquired 2014-04-17 11:00:53 -0400

Evidence location: */cases/win5mem/winxp_java6-meterpreter.vmem*, VMWare memory image

Plan Summary

from 504.5 (2014) p42

1. Which processes are communicating on the network?
2. Which process is likely run by the attacker?
3. Look for signs of pivot and identify the destination system(s)
4. What suspicious process might be root cause?
5. (extra credit) Windows triage commands to find this information from a live system.

Work

Use *Volatility imageinfo* plugin to check which profile to use and verify Vol can read the memory image. Once that's settled we can build a script for a batch run, process the memory image for our first batch of results, and look at the data with *Pandas*.

In [4]:

```
!vol.py --plugins=/home/sosift/f/dfirnotes/ -f /cases/win5mem/winxp_java6-meterpreter.vmem --profile WinXPSP2x86 imageinfo
```

```
Volatility Foundation Volatility Framework 2.4
Determining profile based on KDBG search...

          Suggested Profile(s) : WinXPSP2x86, WinXPSP3x86 (Instantiated with WinXPSP2x86)
                     AS Layer1 : IA32PagedMemoryPae (Kernel AS)
                     AS Layer2 : FileAddressSpace (/cases/win5mem/winxp_java6-meterpreter.vmem)
                      PAE type : PAE
                           DTB : 0x349000L
                          KDBG : 0x80545ce0
          Number of Processors : 1
     Image Type (Service Pack) : 3
                KPCR for CPU 0 : 0xffdff000
             KUSER_SHARED_DATA : 0xffdf0000
           Image date and time : 2014-04-17 15:00:53 UTC+0000
     Image local date and time : 2014-04-17 11:00:53 -0400
```

In [6]:

```
## Get setup to process memory with Volatility, analyse data with Pandas, chart with matplotlib
## Charting tips from https://datasciencelab.wordpress.com/2013/12/21/beautiful-plots-with-pandas-and-matplotlib/
import pandas as pd
%matplotlib inline
import matplotlib as mpl
import matplotlib.pylab as plt

##
case_folder = '/cases/win5mem/'
memimage = '/cases/win5mem/winxp_java6-meterpreter.vmem'
vol_profile = 'WinXPSP2x86' ## use vol.py imageinfo if you don't know this

## Assemble the volatility commands for batch execution in a shell
## start with sift3 volatility + custom modules sample
vol24 = '/usr/bin/vol.py --plugins=/home/sosift/f/dfirnotes/ '
vol_cmd = vol24 + '-f ' + memimage + ' --profile=' + vol_profile

## Configure plugins and output formats, completion flags:
vol_cmd_ps = vol_cmd + ' pscsv --output=csv ' + '> ' + case_folder + 'ps.csv' + ' && echo PS CSV Done!'
vol_cmd_conns = vol_cmd + ' connscan ' + '> ' + case_folder + 'connscan.txt' + ' && echo Connscan Done!'

vol_script = case_folder + 'volscript'

with open(vol_script, 'wb') as f:
            f.write(vol_cmd_ps+'\n')
            f.write(vol_cmd_conns)
```

In [81]:

```
! /bin/sh /cases/win5mem/volscript
```

```
Volatility Foundation Volatility Framework 2.4
PS CSV Done!
Volatility Foundation Volatility Framework 2.4
Connscan Done!
```

Batch processing is complete. Let's pull our results in Pandas DataFrames so we can take a look, starting with the processes CSV file from the demo *pscsv* plugin. We can easily import CSV with Pandas and let it know which column is the date/time data on import, and then set the PID number field as our index. We use the Pandas df.info() function to see a summary of what we imported before continuing.

In [2]:

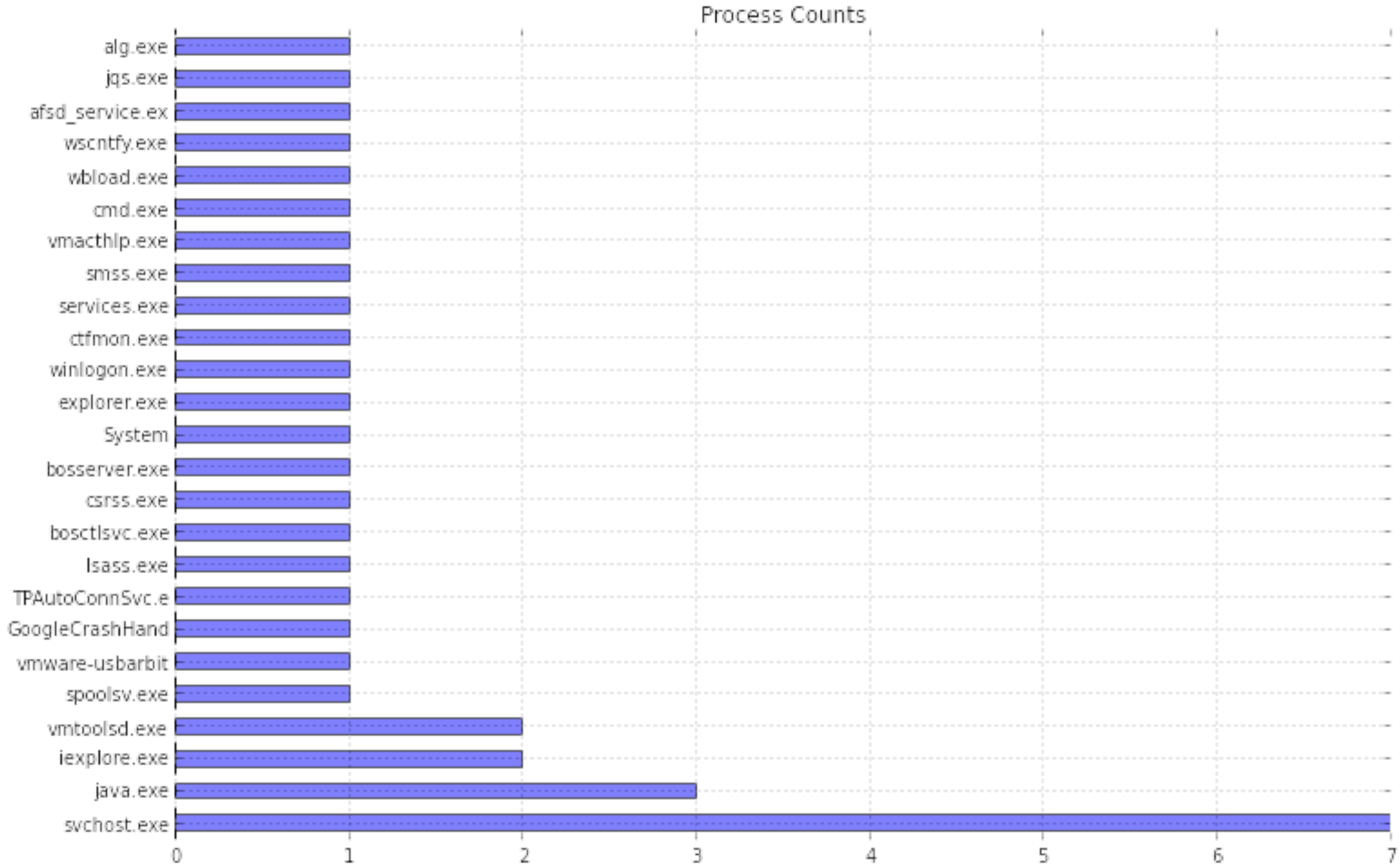
```
procs = pd.read_csv('/cases/win5mem/ps.csv', parse_dates=['Created'])
procs.set_index(['Pid'])
procs.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 35 entries, 0 to 34
Data columns (total 4 columns):
Offset     35 non-null object
Process    35 non-null object
Pid        35 non-null int64
Created    35 non-null datetime64[ns]
dtypes: datetime64[ns](1), int64(1), object(2)
memory usage: 1.4+ KB
```

Here's quick histogram of processes by process name. Only svchost, Java, VmWare, and Internet Explorer have more than one instance.

In [28]:

```
# Create a figure of given size
fig = plt.figure(figsize=(12,8))

# Add a subplot
ax = fig.add_subplot(111)
# Remove grid lines (dotted lines inside plot)
ax.grid(False)
# Remove plot frame
ax.set_frame_on(False)
# Pandas trick: remove weird dotted line on axis
#ax.lines[0].set_visible(False)

# Set title
ttl = title='Process Counts'
# Set color transparency (0: transparent; 1: solid)
a = 0.7
# Create a colormap
customcmap = [(x/24.0,  x/48.0, 0.05) for x in range(len(procs))]
## chart the data frame with these params
procs['Process'].sort_index().value_counts().plot(kind='barh', title=ttl, ax=ax, alpha=a)
plt.savefig('Process Counts.png', bbox_inches='tight', dpi=300)
```



Pandas can handle fixed width text tables almost as adroitly as CSV using the read_fwf function. We use it to load in the output of the standard Volatility connscan, set the Pid field as our index, and check import with info().

(FIXME) We need to get rid of one null line that is an import artifact.

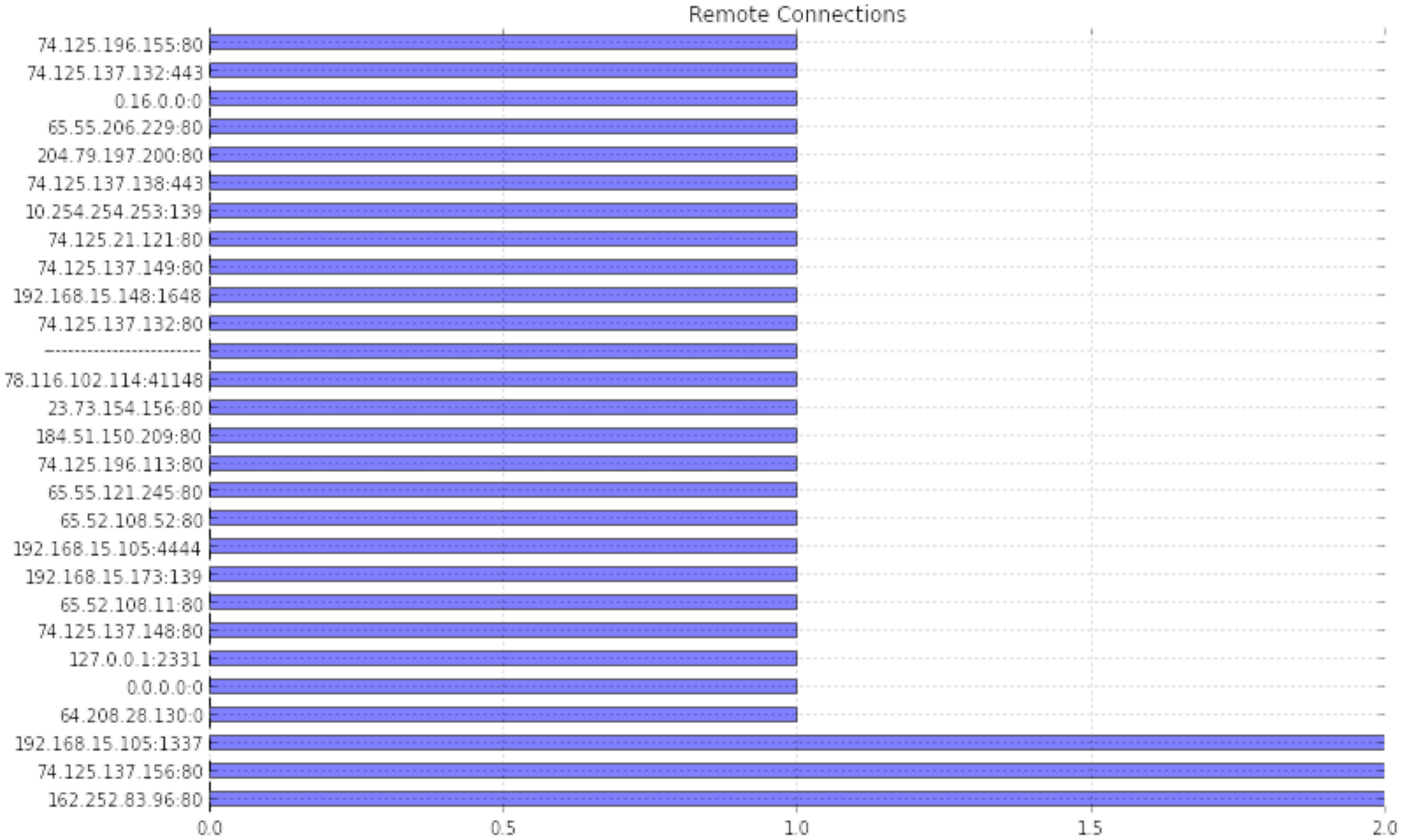
```
In [31]: conns = pd.read_fwf('/cases/win5mem/conns.txt')
         conns.set_index(['Pid'])
         conns.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 31 entries, 0 to 30
Data columns (total 4 columns):
Offset(P)         31 non-null object
Local Address     31 non-null object
Remote Address    31 non-null object
Pid               31 non-null object
dtypes: object(4)
memory usage: 1.2+ KB
```

Here is a quick histogram of the remote IP addresses in use, including the port numbers. Reviewing the x-axis we see common web service ports (80 and 443), Windows service ports (139), and some less obvious ones. High ports 1337, 4444, and 1648 may all be worth followup as they are less expected on a Windows XP system than the first set.

In [32]:

```
# Create a figure of given size
fig = plt.figure(figsize=(12,8))

# Add a subplot
ax = fig.add_subplot(111)
# Remove grid lines (dotted lines inside plot)
ax.grid(False)
# Remove plot frame
ax.set_frame_on(False)
# Pandas trick: remove weird dotted line on axis
#ax.lines[0].set_visible(False)

# Set title
ttl = title='Remote Connections'
# Set color transparency (0: transparent; 1: solid)
a = 0.7
# Create a colormap
customcmap = [(x/24.0,  x/48.0, 0.05) for x in range(len(procs))]
## chart the data frame with these params

conns['Remote Address'].sort_index().value_counts().plot(kind='barh', title=ttl, ax=ax, alpha=a)

plt.savefig('Remote Connections.png', bbox_inches='tight', dpi=300)
```



Let's slice out just those IE processes and see who they were talking to. We pull the process IDs from the process data and use it to look for processes with connection in the connection data from *connscan*.

```
In [92]: procs[procs.Process=="iexplore.exe"]
```

Out[92]:

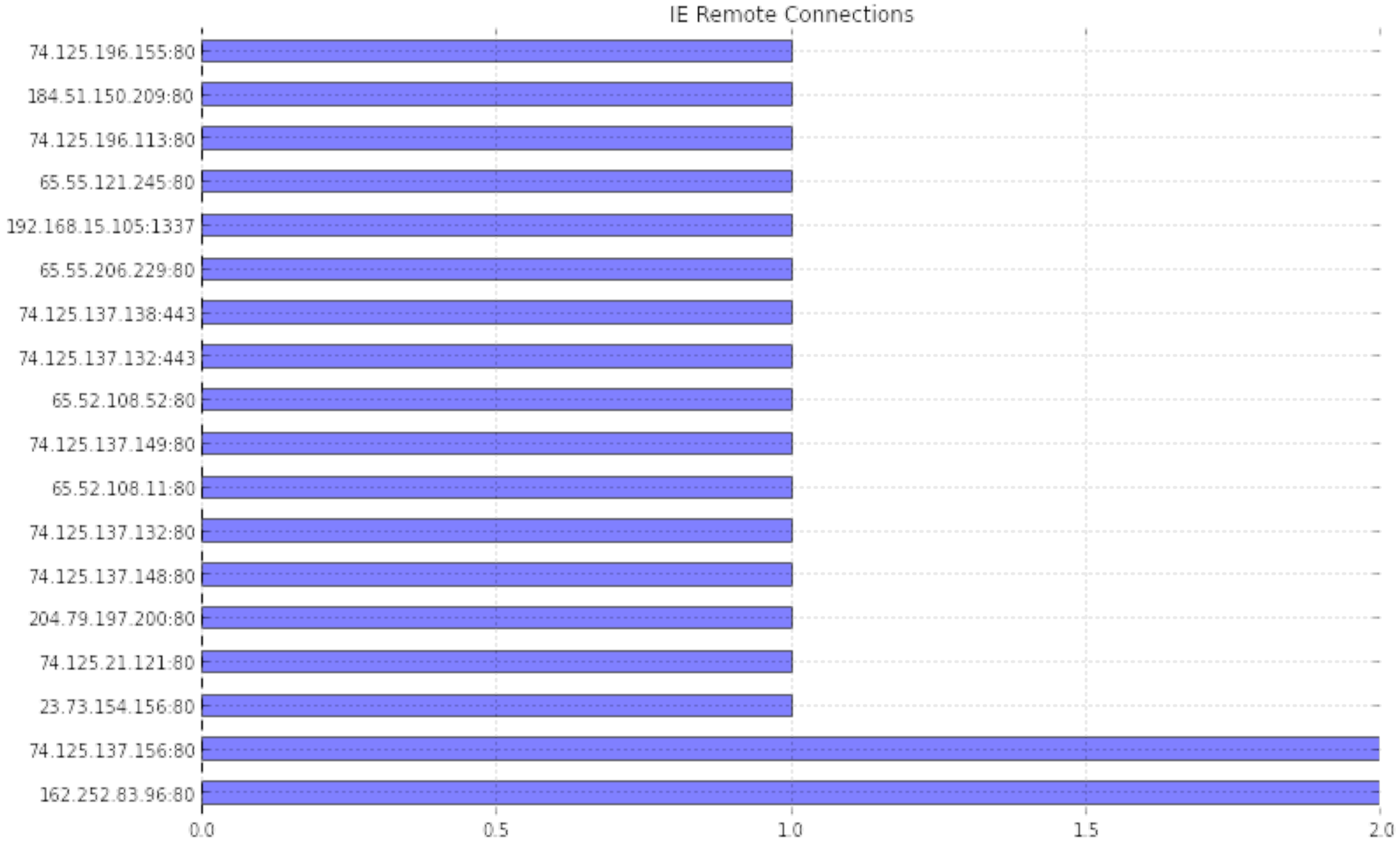
	Offset	Process	Created
Pid			
308	0x82033020	iexplore.exe	2014-04-17 14:41:31
2576	0x82100020	iexplore.exe	2014-04-17 14:41:37

In [34]:

```
## not all processes have connections, but this one does
ie_conns = conns[conns.Pid == '2576']
```

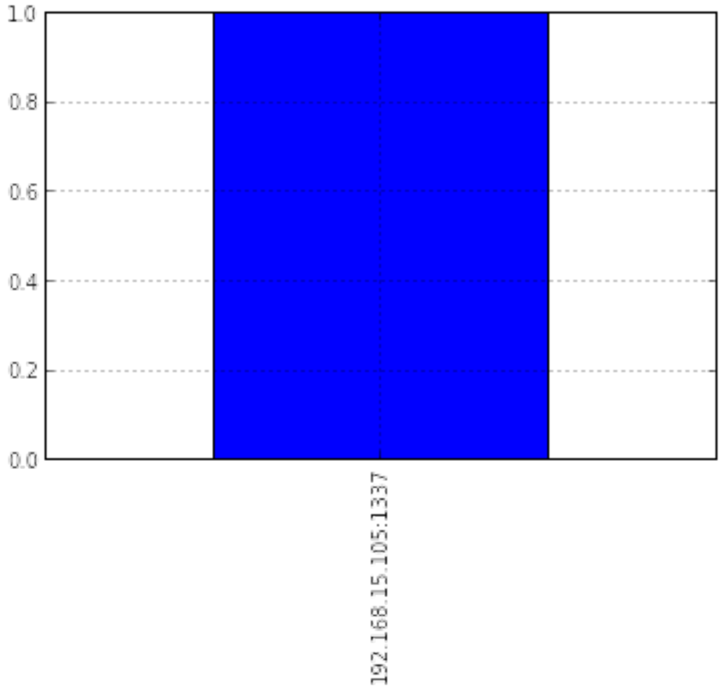
In [36]:

```
# Create a figure of given size
fig = plt.figure(figsize=(12,8))

# Add a subplot
ax = fig.add_subplot(111)
# Remove grid lines (dotted lines inside plot)
ax.grid(False)
# Remove plot frame
ax.set_frame_on(False)
# Pandas trick: remove weird dotted line on axis
#ax.lines[0].set_visible(False)

# Set title
ttl = title='IE Remote Connections'
# Set color transparency (0: transparent; 1: solid)
a = 0.7
# Create a colormap
customcmap = [(x/24.0,  x/48.0, 0.05) for x in range(len(procs))]
## chart the data frame with these params

conns['Remote Address'].sort_index().value_counts()
ie_conns['Remote Address'].sort_index().value_counts().plot(kind='barh', title=ttl, ax=ax, alpha=a)

plt.savefig('IE Remote Connections.png', bbox_inches='tight', dpi=300)
```



We can see that IE was talking to several Internet addresses on web service ports and one local (RFC1918) address on 1337. And Java?

```
In [100]: ## not all processes have connections, this one does
          java_conns = conns[conns.Pid=='3156']
          java_conns['Remote Address'].sort_index().value_counts().plot(kind='bar')

Out[100]: <matplotlib.axes.AxesSubplot at 0x369df90>
```



One Java process was also communicating with the unknown 1337 service on the local network.

Results

Complete Process List and Connection List:

In [69]:

```
procs
```

Out[69]:

	Offset	Process	Pid	Created
0	0x825c8660	System	4	1970-01-01 00:00:00
1	0x82208020	smss.exe	384	2014-04-09 07:47:06
2	0x821be3b8	csrss.exe	620	2014-04-09 07:47:12
3	0x82444da0	winlogon.exe	700	2014-04-09 07:47:13
4	0x821bcda0	services.exe	744	2014-04-09 07:47:14
5	0x824ee4b0	lsass.exe	756	2014-04-09 07:47:14
6	0x8208aa78	vmacthlp.exe	912	2014-04-09 07:47:14
7	0x821fd6b8	svchost.exe	936	2014-04-09 07:47:15
8	0x82240320	svchost.exe	1004	2014-04-09 07:47:15
9	0x820f6da0	svchost.exe	1320	2014-04-09 07:47:16
10	0x821ea8e0	svchost.exe	1388	2014-04-09 07:47:17
11	0x82377020	svchost.exe	1612	2014-04-09 07:47:18
12	0x82348980	wbload.exe	1772	2014-04-09 07:47:21
13	0x8208cc10	spoolsv.exe	1832	2014-04-09 07:47:21
14	0x822d8020	explorer.exe	184	2014-04-09 07:47:25
15	0x82056c10	vmtoolsd.exe	432	2014-04-09 07:47:27
16	0x824d9da0	ctfmon.exe	440	2014-04-09 07:47:28
17	0x824f8a28	GoogleCrashHand	492	2014-04-09 07:47:28
18	0x82207670	svchost.exe	560	2014-04-09 07:47:30
19	0x82048460	svchost.exe	596	2014-04-09 07:47:31
20	0x821789a0	afsd_service.ex	1108	2014-04-09 07:47:31
21	0x824f9590	bosctlsvc.exe	1200	2014-04-09 07:47:31
22	0x82180020	vmtoolsd.exe	1252	2014-04-09 07:47:31
23	0x82224970	vmware-usbarbit	1444	2014-04-09 07:47:31
24	0x823509a0	TPAutoConnSvc.e	1560	2014-04-09 07:47:39
25	0x81ef1628	alg.exe	2440	2014-04-09 07:47:40

```
In [37]: conns
```

Out[37]:

	Offset(P)	Local Address	Remote Address	Pid
0	----------	------------------------	-------------------------	---
1	0x01e61bf8	192.168.15.148:2358	162.252.83.96:80	2576
2	0x01e7ec18	192.168.15.148:2345	23.73.154.156:80	2576
3	0x01ecb8e0	0.0.0.0:0	0.0.0.0:0	2179774712
4	0x01edebc0	10.254.254.253:139	192.168.15.148:1648	4
5	0x01eef9d0	127.0.0.1:5152	127.0.0.1:2331	640
6	0x01f08e68	192.168.15.148:2366	192.168.15.173:139	0
7	0x01f0be68	192.168.15.148:2352	74.125.137.132:443	2576
8	0x01f0e3a0	192.168.15.148:2353	74.125.137.156:80	2576
9	0x020845d0	8.44.65.130:61057	78.116.102.114:41148	0
10	0x020bf328	67.0.0.0:0	64.208.28.130:0	2181821248
11	0x020d95b8	192.168.15.148:2360	74.125.137.132:80	2576
12	0x02101210	192.168.15.148:2365	192.168.15.105:4444	3472
13	0x0210ca98	192.168.15.148:2349	74.125.21.121:80	2576
14	0x0213cd00	192.168.15.148:2350	74.125.196.113:80	2576
15	0x02140e68	192.168.15.148:2333	65.55.206.229:80	2576
16	0x02152c10	192.168.15.148:2359	162.252.83.96:80	2576
17	0x0216cbd0	192.168.15.148:2336	65.55.121.245:80	2576
18	0x02170298	0.224.90.3:0	0.16.0.0:0	2183416352
19	0x0218b400	192.168.15.148:2347	184.51.150.209:80	2576
20	0x021b18c0	192.168.15.148:2351	74.125.137.156:80	2576
21	0x021d6858	192.168.15.148:2346	74.125.137.149:80	2576
22	0x021f2678	192.168.15.148:2362	192.168.15.105:1337	2576
23	0x022126a0	192.168.15.148:2341	65.52.108.11:80	2576
24	0x02255638	192.168.15.148:2348	74.125.137.148:80	2576
25	0x02341948	192.168.15.148:2340	65.52.108.52:80	2576

Suspicious Processes

Internet Explorer and Java processes were communicating with an unidentified services on a local network host. Those processes and the host they were communicating with are worth further investigation to get to the bottom of the supicious activity in the evidence presented.

In [102]:

```
procs[procs.Process=="iexplore.exe"]
```

Out[102]:

	Offset	Process	Created
Pid			
308	0x82033020	iexplore.exe	2014-04-17 14:41:31
2576	0x82100020	iexplore.exe	2014-04-17 14:41:37

In [104]:

```
procs[procs.Process=="java.exe"]
```

Out[104]:

	Offset	Process	Created
Pid			
3156	0x81ee8990	java.exe	2014-04-17 14:42:15
476	0x81ec1020	java.exe	2014-04-17 14:42:20
3472	0x81ec06a8	java.exe	2014-04-17 14:42:20

Conclusion

There are definite signs of supicious activity in the evidence gathered so far. Recommend proceding with response efforts in accordance with the IRP: **Contain** the desktop system and gather more evidence from other sources.