Strings_Extraction

July 24, 2020

1 Introduction

When analysing malware, string extraction is one of the first things to do to briefly extract useful information such as IP address, domains, functions, data, or any other information that has not been removed by the developer. This short notebook will leverage strings extraction coupled with graph theory to understand and show strings similarity between a set of malware.

2 Import

[10]:
```
import os
import itertools
import graphviz
import networkx
from networkx.drawing.nx_pydot import write_dot
from IPython.display import Image
```

3 Directory of your Samples

[11]:
```
# Path of your samples directory
MAL_DIR_VAR = '/Users/fr0gger/tracker_dtrack/'
MAL_DIR = os.listdir('/Users/fr0gger/tracker_dtrack/')

# Distance threshold
jaccard_threshold = 0.4 # Similarity threshold where 0 means identical and 1␣
 ↪means totally different (default = 0.2).
```

4 Create list

[12]:
```
# Create empty list
sample_exe = []

# Extract PE file from the directory
for sample in MAL_DIR:
    sample_exe.append(MAL_DIR_VAR + sample)
```

```
# Print the list of your sample that will be processed
for i in sample_exe:
    print(i)
```

```
/Users/fr0gger/tracker_dtrack/ADK0719-5c688d235f057c7b0f6ea0a5ba1d9829
/Users/fr0gger/tracker_dtrack/UK1118-8d4aed9a4f0e1317cdb30c6297e1df6c
/Users/fr0gger/tracker_dtrack/UK0705-b7c3039203278bc289fd3756571bd468
/Users/fr0gger/tracker_dtrack/DK0719-8765888a825223f427756dce79956720
/Users/fr0gger/tracker_dtrack/ADK0519-69d43c9e9160a25d7a16851d565b170a.
/Users/fr0gger/tracker_dtrack/ADK0719-8a6dd4ae2380474773038845ebb00bb0
/Users/fr0gger/tracker_dtrack/DK0719-9c542be96bf5e099445ce103d05d4b69
/Users/fr0gger/tracker_dtrack/ADK1016-2ebb3e170dfeda090c6f94ea81bdc155
/Users/fr0gger/tracker_dtrack/ADK0219-1143d9d8c4d77825054a835dc118ae81
/Users/fr0gger/tracker_dtrack/DK0719-4f8091a5513659b2980cb53578d3f798
/Users/fr0gger/tracker_dtrack/TD0719-d8da33fae924b991b776797ba8cde24c
/Users/fr0gger/tracker_dtrack/ADK0519-59a4fbfdb3dec67cff7ba053577c74e5
/Users/fr0gger/tracker_dtrack/TD0719-file-out-6efbf8ab97f740f07de6e9c8cc189852
/Users/fr0gger/tracker_dtrack/ADK0618-8fa49304e4de43c4b36f3e584752ffa9
/Users/fr0gger/tracker_dtrack/UK0519-d10781f6b0a420ba0a9addfa5411fd97
/Users/fr0gger/tracker_dtrack/ADK0219-80c98421cb53136f6f1bcde66c6a37e6
/Users/fr0gger/tracker_dtrack/UK0317-a45ec61bbdcfe7cd02b64b4529eb3f89
/Users/fr0gger/tracker_dtrack/ADK0519-c78ef5493a26071736d7dc6ae385e1ae
/Users/fr0gger/tracker_dtrack/DK0519-a1d103ae93c8b7cba0ea5b03d0bd2d9d
/Users/fr0gger/tracker_dtrack/DK1017-f5e0dda8403ea35b57bab955f4a1549a
/Users/fr0gger/tracker_dtrack/UK0519-ebb52f45ff1483e82ff3258b7f086571
/Users/fr0gger/tracker_dtrack/ADK0719-62bb6f0b235e338565bec2675c5895c8
/Users/fr0gger/tracker_dtrack/DK0719-bef2d3c2b058dbb36033f4639fb47f9e
/Users/fr0gger/tracker_dtrack/ADK0919-f8cb18b2a3d797c9ccd51b343b3c54c8.
/Users/fr0gger/tracker_dtrack/ADK1018-3a3bad366916aa3198fd1f76f3c29f24
/Users/fr0gger/tracker_dtrack/DK0319-b5ab935d750be8b5b7c9cf3b87c772ca
```

5 Strings Comparison

String similarity functions measure how similar two strings are. The unit that measures string similarity is the distance between strings. By setting distance thresholds it is possible to use string metrics to identify similar but different strings. This is a useful property for spotting patterns in binaries.

5.1 Full Strings Correlation

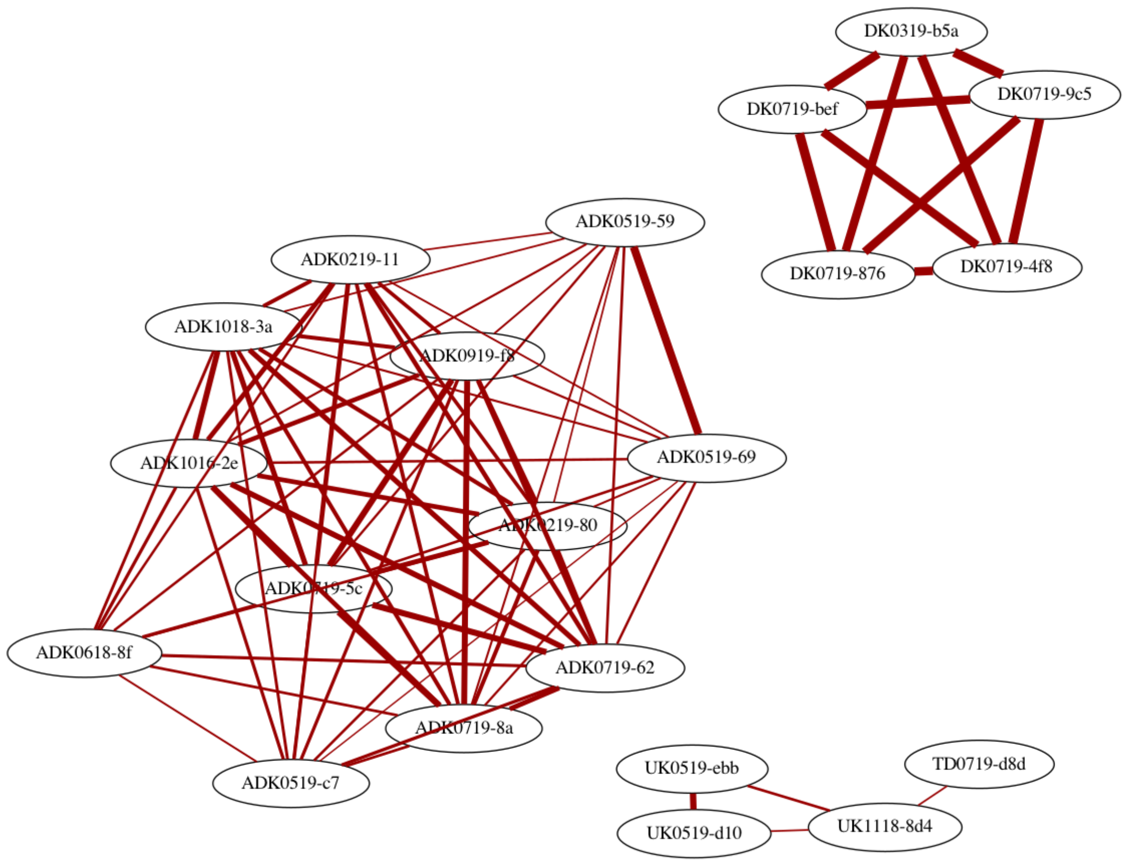
This section will extract all the strings from your list of samples and compare them using the jacquard distance.

[4]:
```
graph = networkx.Graph()
malware_attributes = dict()

# Extract strings
```

```
def getstrings(fullpath):
    strings = os.popen("strings -e l '{0}'".format(fullpath)).read()
    strings = set(strings.split("\n"))
    return strings

def jaccard(set1,set2):
    intersection = set1.intersection(set2)
    intersection_length = float(len(intersection))
    union = set1.union(set2)
    union_length = float(len(union))
    return intersection_length / union_length

directo = os.listdir(MAL_DIR_VAR)

for file in directo:
    strings = getstrings(MAL_DIR_VAR + file)
    malware_attributes[file] = strings
    #graph.add_node(file, label=file[:10])

# Calculate the jaccard distance for the strings extracted
for malware1, malware2 in itertools.combinations(directo, 2):
    jaccard_index = jaccard(malware_attributes[malware1],␣
 ↪malware_attributes[malware2])

    if jaccard_index > jaccard_threshold:
        graph.add_node(malware1, label=malware1[:10],  color='#000000')
        graph.add_node(malware2, label=malware2[:10],  color='#000000')
        graph.add_edge(malware1, malware2, penwidth=1 + (jaccard_index -␣
 ↪jaccard_threshold) * 10, color="#990000")

write_dot(graph, 'img/full_strings.dot')
```

[5]:
```
# This part will generate the graph correlation
os.system('fdp -Tpng -o img/full_strings.png img/full_strings.dot')
Image("img/full_strings.png")
```

[5]:



5.2 Specific Strings Correlation

In this section we will extract specific strings from the binaries and compare them. The first thing to do is to modify the following variables. In the following example, we are looking for strings related to the C2 connexion.

[6]:
```
# VARIABLE TO MODIFY
STRINGS_1 = "dkwero38oerA^t@#"
```

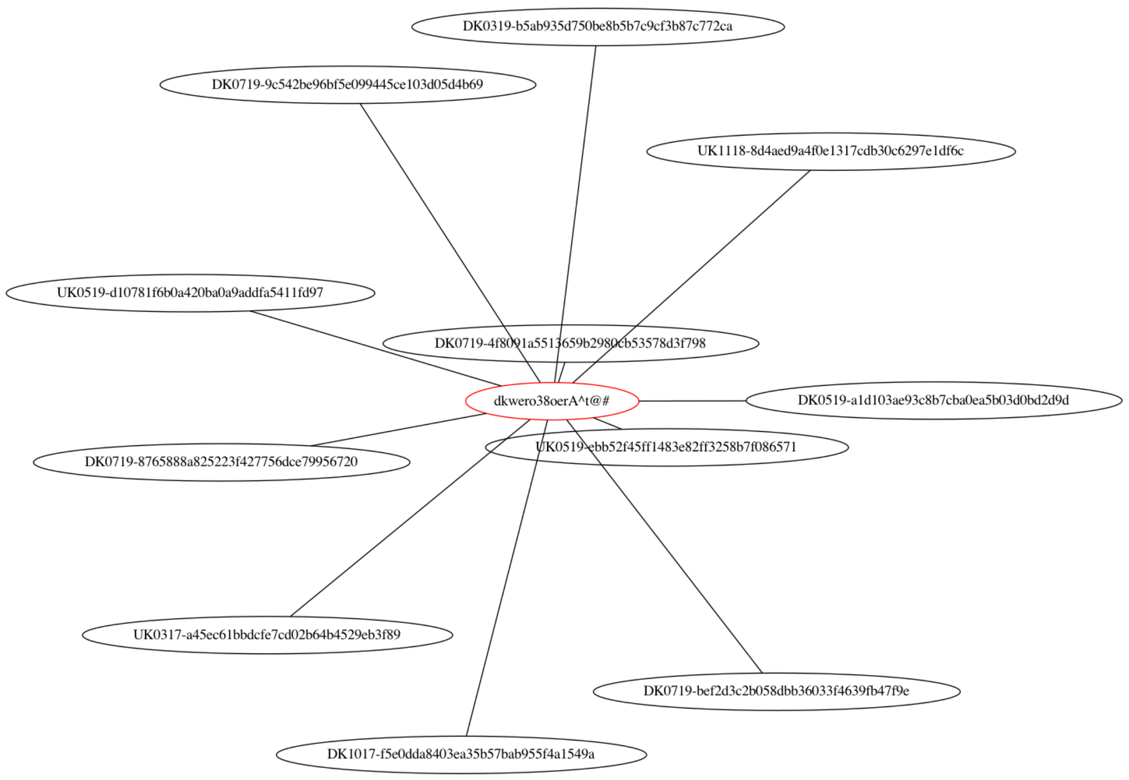
[7]:
```
graph = networkx.Graph()
malware_attributes = dict()

# Get the strings / You can change the default tool "strings" by other such as␣
 ↪"Flarestrings" or "floss"
def getstrings(fullpath):
    strings = os.popen("flarestrings '{0}'".format(fullpath)).read()
    strings = set(strings.split("\n"))
    return strings

directo = os.listdir(MAL_DIR_VAR)
```

```
# Extract strings from every sample in the directory
for file in directo:
    strings = getstrings(MAL_DIR_VAR + file)
    malware_attributes[file] = strings
    #graph.add_node(file, label=file[:10])

# Compare the STRINGS_1 between samples
for malware1, malware2 in itertools.combinations(directo,2):

    graph.add_node(STRINGS_1, size=4, color='red')

    for i in malware_attributes[malware1]:
        if STRINGS_1 in i:
            graph.add_edge(malware1, STRINGS_1, penwidth=1)

    for i in malware_attributes[malware2]:
        if STRINGS_1 in i:
            graph.add_edge(malware2, STRINGS_1, penwidth=1)

write_dot(graph, 'img/specific_strings.dot')
```

[8]:
```
with open("img/specific_strings.dot") as f:
    dot_graph = f.read()
```

[9]:
```
# This part will generate the graph image
os.system('fdp -Tpng -o img/specific_strings.png img/specific_strings.dot')
Image("img/specific_strings.png")
```

[9]:


DK0319-b5ab935d750be8b5b7c9cf3b87c772ca
DK0719-9c542be96bf5e099445ce103d05d4b69
UK1118-8d4aed9a4f0e1317cdb30c6297e1df6c
UK0519-d10781f6b0a420ba0a9addfa5411fd97
DK0719-4f8091a5513659b2980cb53578d3f798
dkwero38oerA^t@#
DK0519-a1d103ae93c8b7cba0ea5b03d0bd2d9d
DK0719-8765888a825223f427756dce79956720
UK0519-ebb52f45ff1483e82ff3258b7f086571
UK0317-a45ec61bbdcfe7cd02b64b4529eb3f89
DK0719-bef2d3c2b058dbb36033f4639fb47f9e
DK1017-f5e0dda8403ea35b57bab955f4a1549a

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