Network Analysis

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1 Week 3 - Network Analysis

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We will load data from https://snap.stanford.edu/data/#p2p. Specifically Gnutella peer to peer network from August 8 2002.

```
In [31]: import networkx as nx
         import pandas as pd
         import IPython.display as display
         import matplotlib.pyplot as plt
```

```
In [32]: %matplotlib inline
         %qtconsole
```

Here we're going to use a wikipedia database described as:

Directed graph (each unordered pair of nodes is saved once): Wiki-Vote.txt Wikipedia voting on promotion to administratorship (till January 2008). Directed edge A->B means user A voted on B becoming Wikipedia administrator.
Nodes: 7115 Edges: 103689
FromNodeId ToNodeId
30 1412
30 3352
30 5254
30 5543
30 7478

Let's start by loading the graph with NetworkX

```
In [33]: df = pd.read_csv('Wiki-Vote.txt', sep='\t', skiprows=4, names=['fromN', 'toN'])
         # prune this
         df = df.iloc[:10000, :]
         df.to_csv('Wiki-Vote.csv')
```

```
In [34]: G = nx.Graph()
         G.add_edges_from(zip(df.fromN, df.toN))
         len(G)
```

```
Out[34]: 1825
```

We've pared down the graph to just 1825 nodes. Let's see what the diameter of the graph is. The diameter is the longest node to node distance.

```
In [35]: nx.diameter(G)
```

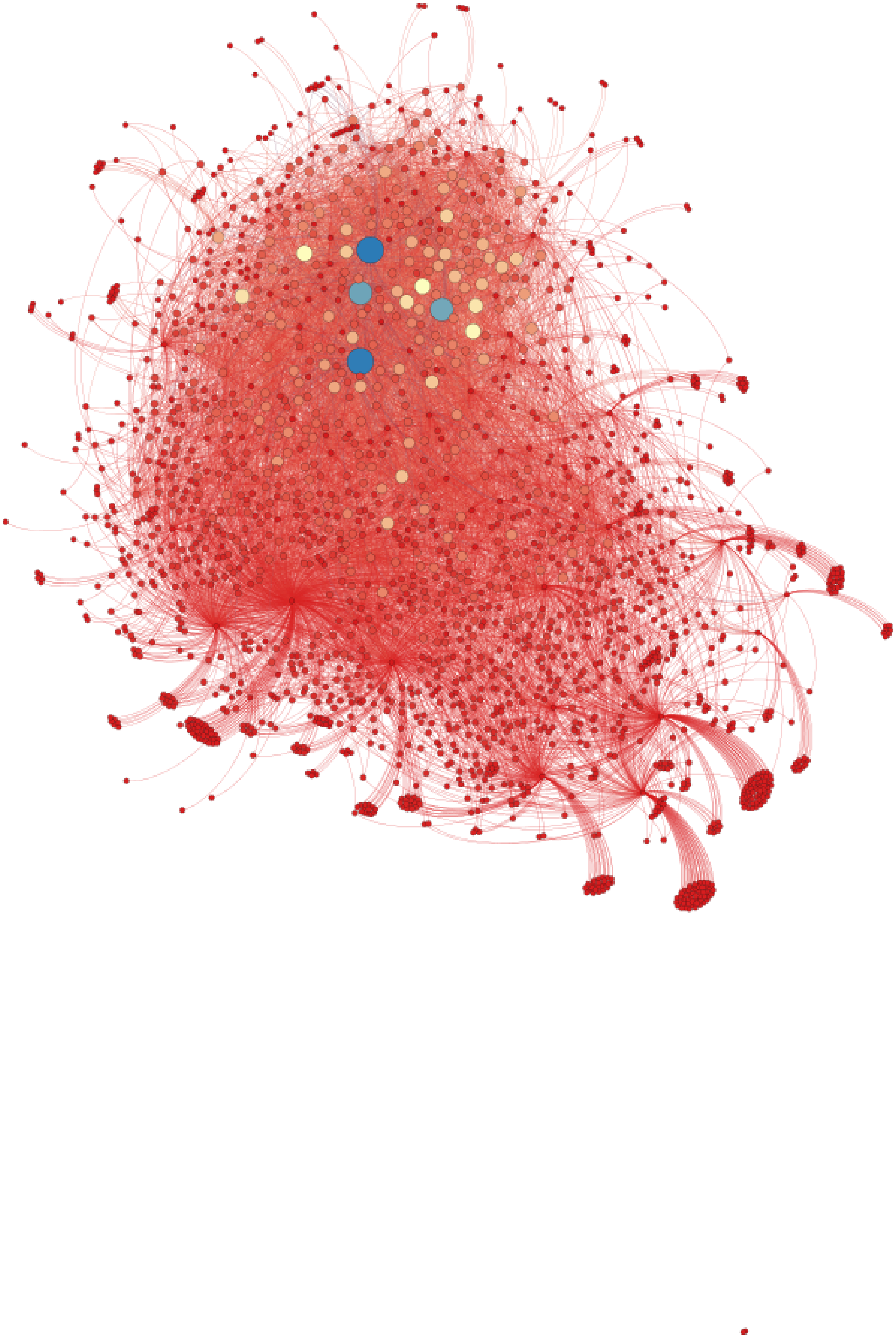
```
Out[35]: 6
```

Six seems a little surprising, given we have 1825 nodes. I wonder if Kevin Bacon is part of this …

I loaded the 1825 nodes into Gephi to look into this. Here is a plot of the network colored by InDegree.

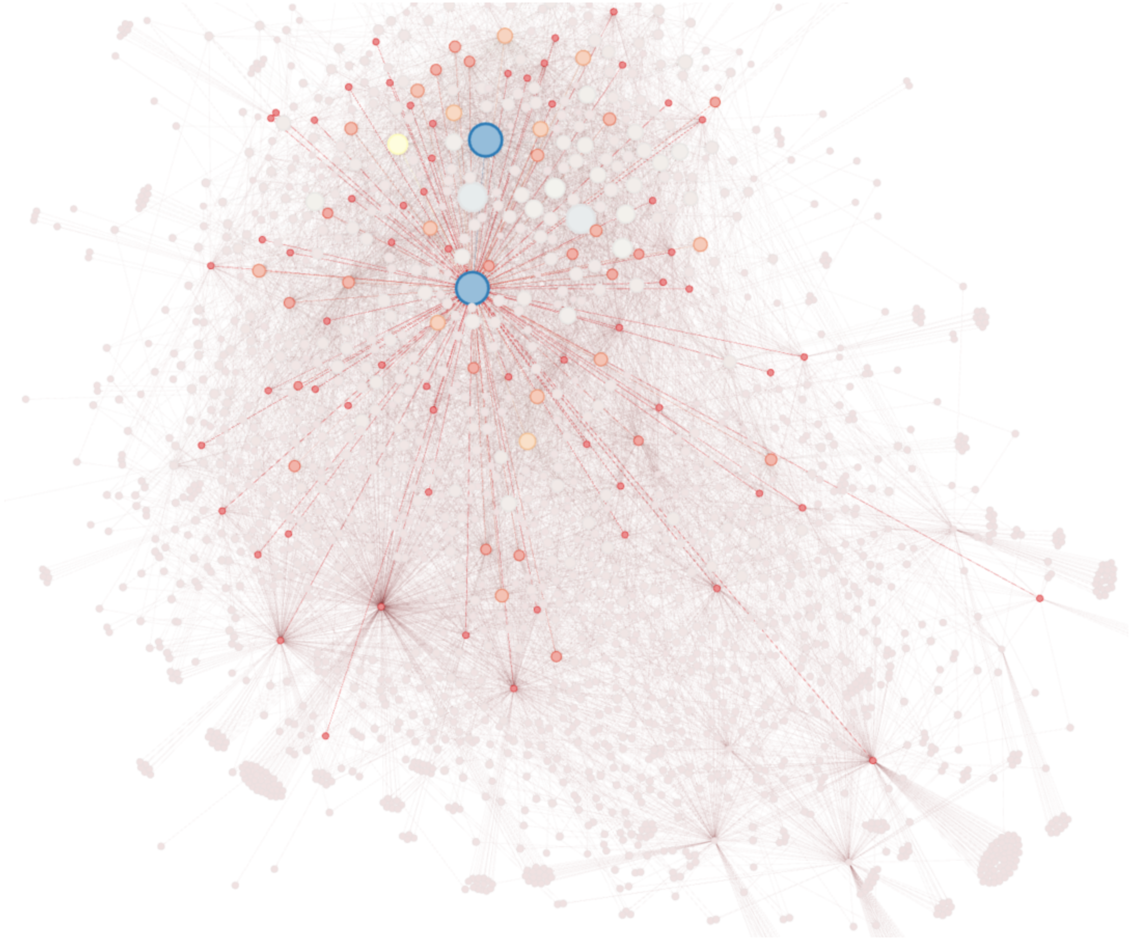
```
In [ ]: display.Image('visual.png')
```

```
Out[None]:
```



```
In [37]: display.Image('reach.png')
```

```
Out[37]:
```



In the next plot we see what is fairly typical in the graph, the nodes seem to have a lot of reach. This explains why the diameter is only six.

Since we're talking about distance, let's calculate a centrality measure. Before we do we need to pare down the graph

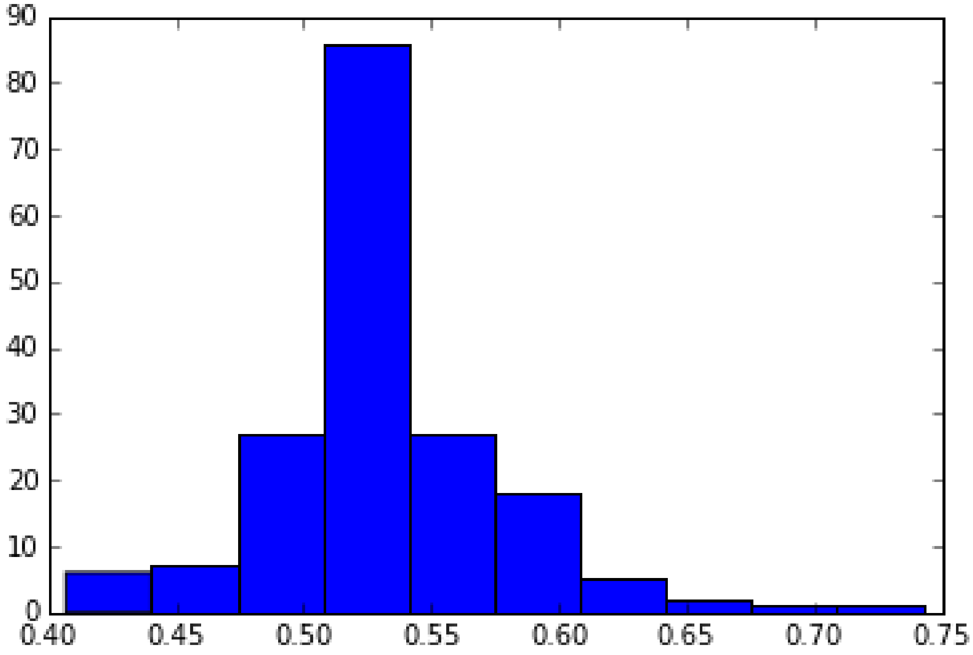
```
In [38]: # we are following an example from Chapter 3 of Social Network Analysis for Startups
         def trim_degrees(g, degree=1):
             g2=g.copy()
             d = nx.degree(g2)
             for n in g2.nodes():
                 if d[n] <= degree: g2.remove_node(n)
             return g2

         core5 = trim_degrees(G, degree=20)
         len(core5)
```

```
Out[38]: 180
```

We now have only 648 nodes. Let's try our centrality measure:

```
In [39]: c = nx.closeness_centrality(core5)
         plt.hist(c.values())
```

```
Out[39]: (array([  6.,   7.,  27.,  86.,  27.,  18.,   5.,   2.,   1.,   1.]),
          array([ 0.40681818,  0.44041022,  0.47400226,  0.5075943 ,  0.54118634,
                  0.57477839,  0.60837043,  0.64196247,  0.67555451,  0.70914655,
                  0.74273859]),
          <a list of 10 Patch objects>)
```



I don't have a good intuition on what the means, but it looks interesting. ;)