Module II - Why do SNA in NetworkX

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NEW YORK UNIVERSITY

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Agenda for Module II

Speed and scalability

- Why speed and scalability matter
- NetworkX is designed for large data sets
- Comparing NetworkX to other SNA tools

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How NetworkX complements Python's scientific computing suite

- SciPy/NumPy
- Matplotlib
- and others...

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How NetworkX complements Python's scientific computing suite

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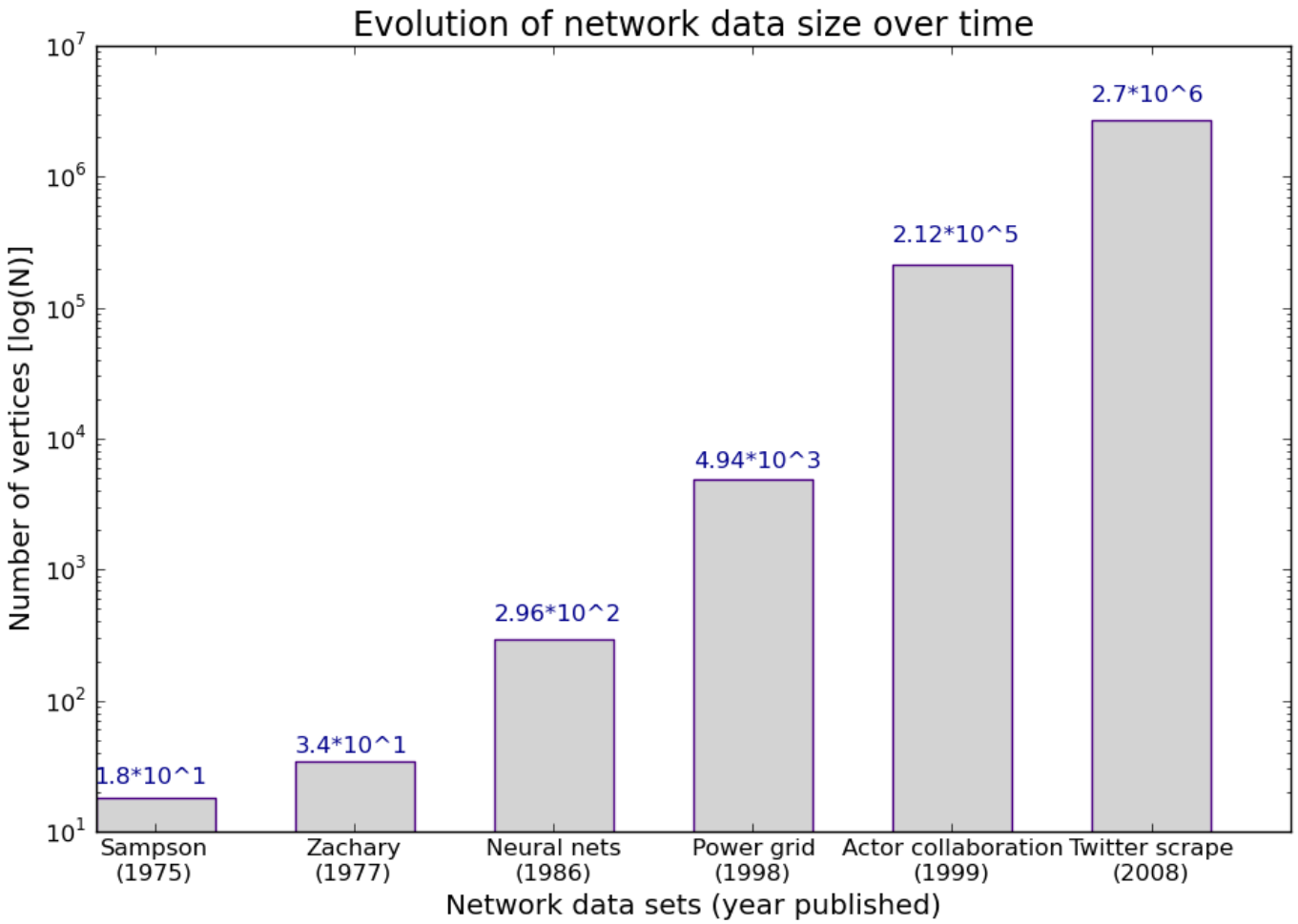
Getting data in and out of NetworkX

- I/O basics
- Pulling non-local data
  - Directly from the web
  - External databases

Why should we worry about scalability?

The size of networks being studying has increased rapidly over the years...



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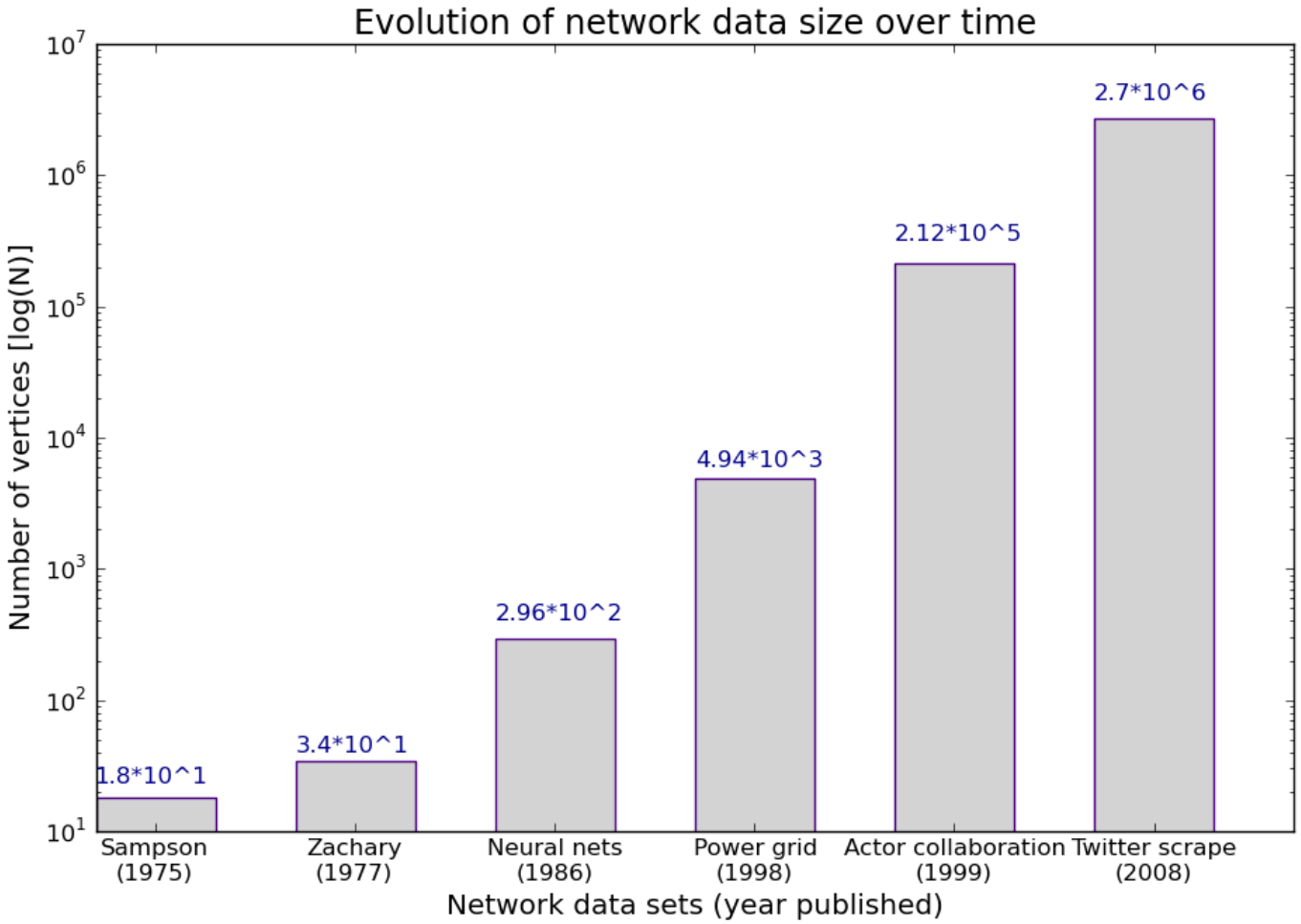

As network data becomes more readily available this trend will continue!

How network size affects tools

While the data continues to scale up, many tools have not kept pace

Standard Tool Limitations

Tool	Node Limit	Platforms
UCINet	$\sim V = 5K$	Windows only
Pajek	$\sim V = 100K$	Windows only
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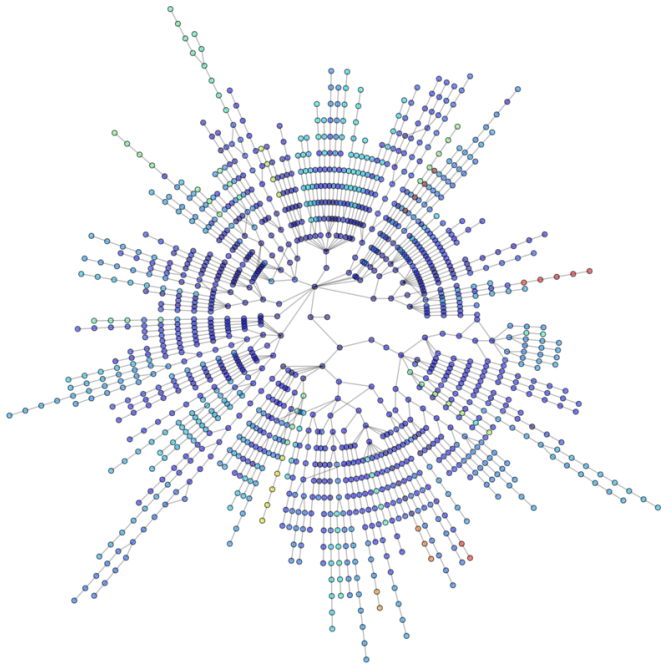
NetworkX is designed to handle data sets of the scale being generated today

- 10's of millions or nodes and 100's of millions of edges
- Can read network data from local files, or from external sources
  - Internet
  - Relational databases



Moving beyond basic concepts of the "graph"

In a more fundamental way, however, most network tools are limited in their concept of what can be a network

- Networks are collections of nodes and edges
- Nodes are static integers or strings, and edges are binary or continuous values

NetworkX can represent **ANY** relationship supported by Python data types

Suppose we had data, or a data generating process, that was a time-series

- Current tools need kludges or hacks to add this data
- In NetworkX, we simply use the built-in Python `datetime` package to create a network of time-stamps

Simple time-series network

```
G=DiGraph()
# Create datetime object nodes
for v in xrange(num_nodes):
    G.add_node(datetime.now())
time_nodes=G.nodes()
# Add edges with 'time' attribute
for i in xrange(num_nodes):
    draws=random.uniform(0,1,num_nodes)
    for j in xrange(num_nodes):
        if i!=j and draws[j]<=p:
            G.add_edge(time_nodes[i],time_nodes[j],time=datetime.now())
...
# target source datetime_created
2010-05-25 13:38:42.515323 2010-05-25 13:38:42.515492
    {'time': datetime.datetime(2010, 5, 25, 13, 38, 42, 515752)}
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- Numeric optimization
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- Provides many functions for working on arrays and matrices
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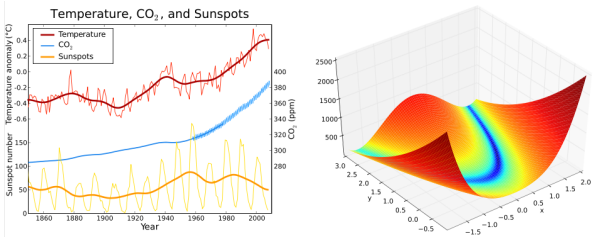

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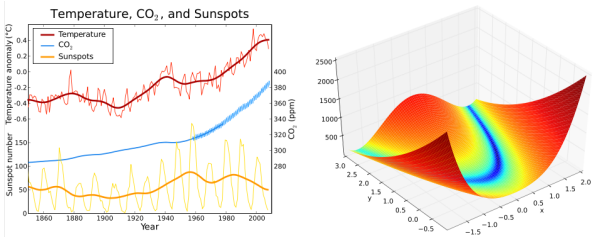

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SciPy.org Sponsored By ENTHOUGHT

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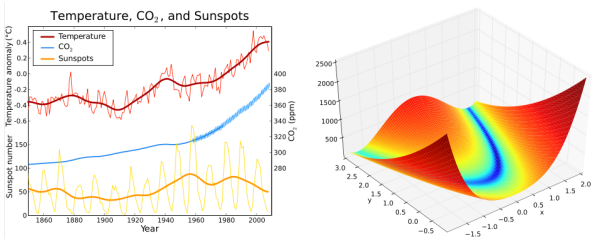

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NetworkX uses this entire suite to store, analyze and visualize networks

Exporting to GraphViz in NetworkX

NetworkX is designed to be an open-source all-purpose network manipulation and analysis tool

- Historically, the focus has not been on visualization

While there are several options for visualization in NetworkX, perhaps the best is its ability to read and write `GraphViz` files

- GraphViz is an open-source tool designed specifically for drawing graphs from the DOT language
- NetworkX works directly with GV using the `pygraphviz` package

Load Sampson data and visualize with graphviz

```
# Load Sampson monastery data from edglist
>>> g2=read_edgelist("samp_like_el.txt",delimiter="\ t",create_using=DiGraph())
>>> info(g2)
Name:
Type:                   DiGraph
Number of nodes:        18
Number of edges:        55
Average in degree:      3.0556
Average out degree:     3.0556
# Convert to pygraphviz type
>>> g2_gv=to_agraph(g2)
# Output DOT file and draw using dot layout
>>> g2_gv.write("samp_like_dot.dot")
>>> g2_gv.draw('samp_like.png',prog='dot')
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