

The logo for Network Workbench features the word "Network" in a red serif font and "Workbench" in a black sans-serif font. The text is set against a red gradient bar that has a reflection effect below it. The background of the slide is a light gray network diagram with various sized nodes and connecting lines.

# Network Workbench

A Workbench for Network Scientists

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**Goal:** Develop a large-scale network analysis, modeling and visualization toolkit for physics, biomedical, and social science research.

**Amount:** \$1,120,926, NSF IIS-0513650 award

**Duration:** Sept. 2005 - Aug. 2008

**Website:** <http://nwb.slis.indiana.edu>  
<https://nwb.slis.indiana.edu/community>  
<http://cishell.org>

### NWB Advisory Board:

James Hendler (Semantic Web) <http://www.cs.umd.edu/~hendler/>

Jason Leigh (CI) <http://www.evl.uic.edu/spiff/>

Neo Martinez (Biology) <http://online.sfsu.edu/~webhead/>

Michael Macy, Cornell University (Sociology)  
<http://www.soc.cornell.edu/faculty/macy.shtml>

Ulrik Brandes (Graph Theory) <http://www.inf.uni-konstanz.de/~brandes/>

Mark Gerstein, Yale University (Bioinformatics) <http://bioinfo.mbb.yale.edu/>

Stephen North (AT&T) <http://public.research.att.com/viewPage.cfm?PageID=81>

Tom Snijders, University of Groningen <http://stat.gamma.rug.nl/snijders/>



### **Network Workbench (NWB) Tool**

- o A network analysis, modeling, and visualization toolkit for physics, biomedical, and social science research.
- o Can install and run on multiple Operating Systems.
- o Uses Cyberinfrastructure Shell Framework underneath.

### **Cyberinfrastructure Shell (CIShell)**

- o An open source, software framework for the integration and utilization of datasets, algorithms, services, and tools.
- o Uses OSGi and Equinox

### **NWB Community Wiki**

- o A place for users of the NWB Tool, the Cyberinfrastructure Shell (CIShell), or any other CIShell-based program to request, obtain, contribute, and share algorithms and datasets.
- o All algorithms and datasets that are available via the NWB Tool have been well documented in the Community Wiki.

### Main

- [People](#)
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### Datasets

### Algorithms

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### Measurement

#### Local

##### Edge/Node Level




- [Node Degree](#) 
- [Node Indegree](#) 
- [Node Outdegree](#) 
- [Max Flow Edge<sup>2</sup>](#)

##### Degree Distributions

- [Undirected Degree Distribution](#) 
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##### Degree Correlations

- [Undirected K-Nearest Neighbor](#) 
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- [One Point](#) 

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## Analyze Data Algorithms




This section is for algorithms that can analyze data. Examples would be Betweenness Centrality, Attack Tolerance, etc...

### Analyze Data




#### Measurement

#### Local




##### Edge/Node Level

- [Node Degree](#) 
- [Node Indegree](#) 
- [Node Outdegree](#) 
- [Max Flow Edge<sup>2</sup>](#)



##### Degree Distributions

- [Undirected Degree Distribution](#) 
- [Indegree Distribution](#) 
- [Outdegree Distribution](#) 

##### Degree Correlations

- [Undirected K-Nearest Neighbor](#) 
- [Directed K-Nearest Neighbor](#) 
- [One Point Correlations](#) 





##### Clustering Coefficient

- [Watts Strogatz Clustering Coefficient](#) 
- [Watts Strogatz Clustering Coefficient Over k](#) 
- [Newman Clustering Coefficient<sup>2</sup>](#)
- [Newman Clustering Coefficient Over k<sup>2</sup>](#)

##### Other Local Measurements

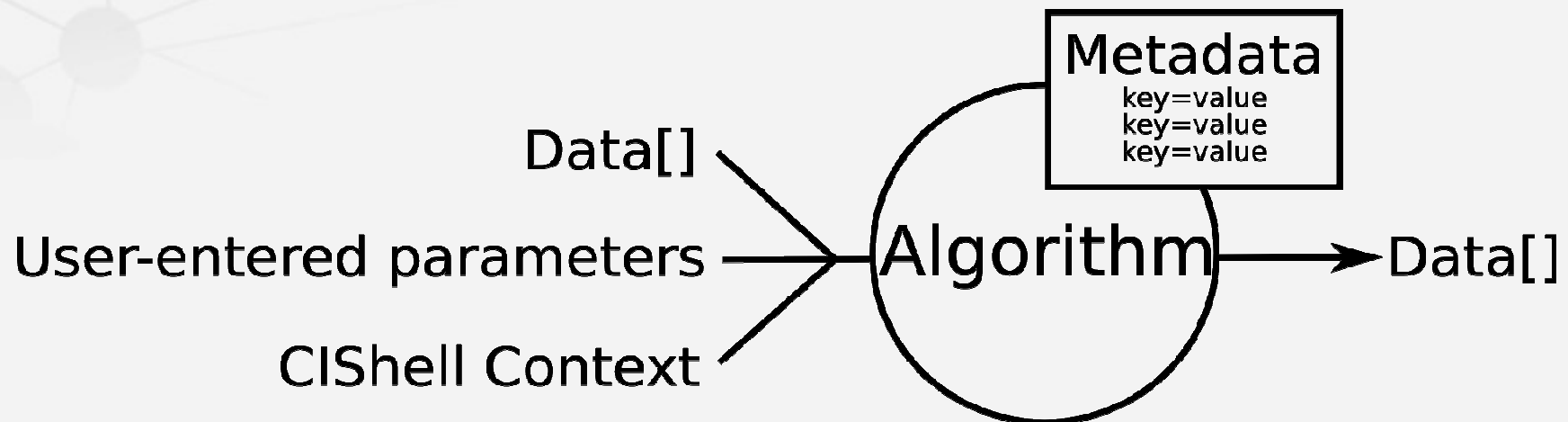
- [Distribution of Weights<sup>2</sup>](#)
- [k-Core Count<sup>2</sup>](#)
- [Coherence for Weighted Graphs<sup>2</sup>](#)

A Workbench for Network Scientists
Custom Fillings / Home Page

<p><b>Main</b></p> <p><a href="#">People</a></p> <p><a href="#">NWB Tool</a></p> <p><a href="#">Update Sites</a></p> <p><a href="#">Custom Fillings</a></p> <p><b>Datasets</b></p> <p><b>Algorithms</b></p> <p><a href="#">Related Work</a></p> <p><a href="#">FAQ</a></p> <p><a href="#">Statistics</a></p> <p> DIGG IT!</p> <p> <b>reddit</b> SUBMIT</p> <p> DEL.ICIO.US</p> <p> <b>RSS</b></p>	<p><b>Custom Fillings</b></p> <p>Many scientists use a very specific subset of <a href="#">algorithms</a> and <a href="#">datasets</a> in their work. Here, we link to custom fillings designed by different researchers. Descriptions of custom fillings frequently resemble learning modules providing an easy introduction into the working styles of different sciences.</p> <p><b>Physics</b></p> <p style="padding-left: 20px;"><a href="#">Analysis of Large-Scale Networks</a> by Soma Sanyal</p> <p><b>Biology</b></p> <p style="padding-left: 20px;"><a href="#">Analysis of Biological Networks</a> by Cesar A. Hidalgo R.</p> <p><b>Scientometrics</b></p> <p style="padding-left: 20px;"><a href="#">Modeling the Co-Evolution of Co-Author and Paper-Citation Networks</a> by Soma Sanyal &amp; Katy Börner</p> <p style="padding-left: 20px;"><a href="#">Map Your Bibtex File<sup>2</sup></a> by Bruce Herr &amp; Katy Börner <b>coming soon</b></p> <p style="padding-left: 20px;"><a href="#">Semantic Analysis of Scholarly Data<sup>2</sup></a> by Katy Börner <b>coming soon</b></p> <p><b>Internet Research</b></p> <p style="padding-left: 20px;"><a href="#">Error and Attack Tolerance of Networks</a> by Katy Börner and Hardik Sheth</p> <p style="padding-left: 20px;"><a href="#">Search Performance of P2P Networks</a> by Hardik Sheth and Katy Börner</p> <p><b>Others</b></p> <p style="padding-left: 20px;"><a href="#">Data Conversion Service</a> by Weixia (Bonnie) Huang &amp; Bruce Herr</p>
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## An Abstract Definition of Algorithms, Datasets and Converters



## Modeling Algorithms

Inputs

The screenshot displays the Network Workbench Tool interface. A dialog box titled "Barabasi-Albert" is open, showing input parameters: "Number of nodes" (1000), "Links set by new node" (2), and "Seed of random number generator" (1). An arrow labeled "Inputs" points to this dialog box. In the background, the "Console" window shows the execution of the "Barabási-Albert Scale-Free" algorithm, including author information and input parameters. The "Data Manager" window on the right shows the output: "List of edges of network created through the Barabasi-Albert algorithm". An arrow labeled "Output" points to this text. The "Scheduler" window at the bottom contains buttons for "Remove From List", "Remove completed automatically", and "Remove all completed".



## Analysis Algorithms

## Inputs

The screenshot displays the Network Workbench Tool interface. A 'Clustering' dialog box is open, showing input parameters: 'Number of bins: 10' and 'The average clustering coefficient: 10'. The 'Clustering coefficient' label is circled in red, with an arrow pointing to the 'Inputs' label above. The 'Data Manager' window on the right shows a list of outputs, with 'Sequence of clustering coefficients for network' and 'Distribution of clustering coefficients for network' circled in red, with an arrow pointing to the 'Outputs' label below. The main console area contains text for two algorithms: 'Undirected K-Nearest Neighbor' and 'Watts-Strogatz Clustering Coefficient', including their authors, implementers, integrators, references, and documentation links.

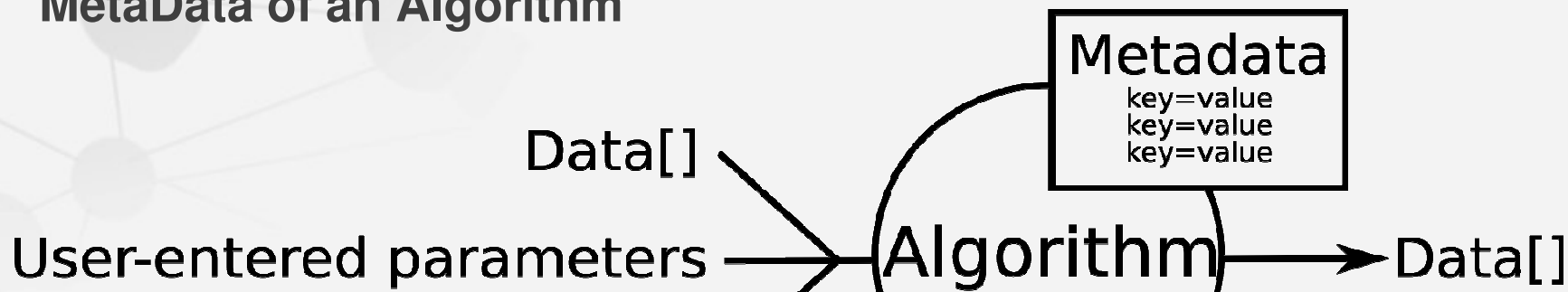
## Visualization Algorithms

## Input

The screenshot shows the Network Workbench Tool interface. The 'Visualization' menu is open, listing various algorithms such as 'Circular Specified', 'Radial Tree/Graph', 'Tree Map', 'Force Directed', 'Kamada-Kawai', 'Fruchterman-Reingold', 'Spring', 'Small World', and 'Parallel Coordinates (demo)'. The 'Radial Tree/Graph' option is selected. The 'Data Manager' window shows the input file path: 'Pajek .net file: C:\apps\nwb-0.5.0\sampladata\Ne...'. The 'Radial Graph Visualization' window displays a complex network graph with nodes labeled by names and academic fields, such as 'Computer Sciences (41)', 'Psychology (30)', 'Medicine (2)', 'Ecology (9)', 'Physics (45)', 'Management (32)', and 'Information Technology (47)'. The graph is a dense, radial structure with many connections between nodes.

## Output

## MetaData of an Algorithm



```
nwb.product  edu.iu.iv.algorit...  validation.proper...  service.properties x
menu_path=Modeling/additions
label=Barabási-Albert Scale-Free
description=Barabasi-Albert algorithm implementation
# each input file will be mapped to inFile[x] (zero based)
in_data=null
# for all input files, 'null' if no input data needed
out_data=file:text/nwb
# for all output files
# each output file will correspond to outFile[x] (zero based)
service.pid=edu.iu.nwb.modeling.barabasiAlbert
remoteable=true
authors=A.-L. Barabási and R. Albert.
implementers=Santo Fortunato
integrators=Santo Fortunato, Weixia Huang
reference=Barabási, A-L. & Albert, R. (1999). Emergence of Scaling in Random
reference_url=http://lanl.arxiv.org/abs/cond-mat/9910332
docu=https://nwb.slis.indiana.edu/community/?n=ModelData.BarabSi-AlbertScale
```

## GUI Builder and MetaType Service

The screenshot displays the Network Workbench Tool interface. The main window shows a console window with the following text:

```

.....
Barabási-Albert Scale-Free was selected.

Author(s): A.-L. Barabási and R. Albert.
Implementer(s): Santo Fortunato
Integrator(s): Santo Fortunato, Weixia Huang
    
```

The main editor window displays the XML configuration for the Barabasi-Albert GUI:

```

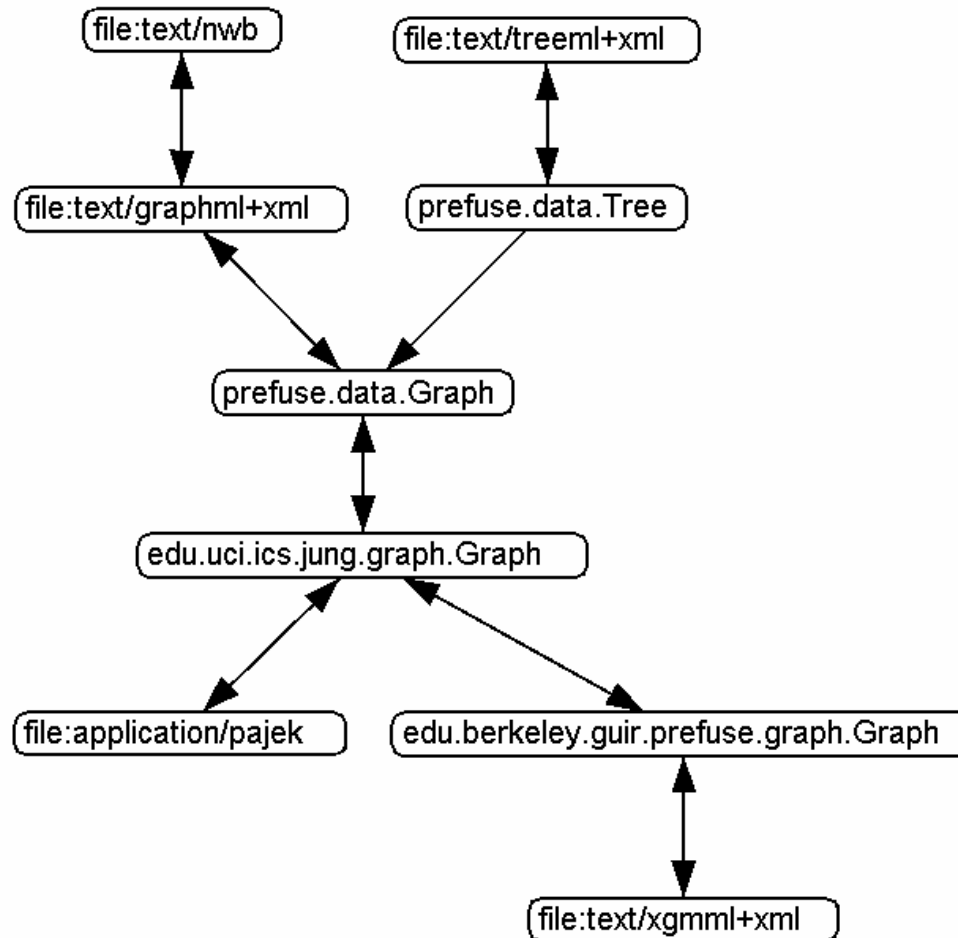
<?xml version="1.0" encoding="UTF-8"?>
<metatype:MetaData xmlns:metatype="http://www.osgi.org/xmlns/metatype/v1.0.0">
  <OCD name="Barabasi-Albert" id="edu.iu.nwb.modeling.barabasiAlbert.gui"
    description="Barabasi-Albert">
    <AD name="Number of nodes" id="NumNodes"
      type="Integer" default="1000" min="0"
      description="Number of nodes of the network"/>
    <!-- Put extremes of range, if unknown leave blank -->
    <!-- Can be required from users for information -->
    <AD name="Links set by new node" id="NewLinks"
      type="Integer" default="2" min="2"
      description="Number of links set by new node, must be at least 2"/>
    <AD name="Seed of random number generator" id="RandomSeed"
      type="Integer" default="1" min="1"
      description="Seed of random number generator, must be at least 1"/>
  </OCD>
  <Designate pid="edu.iu.nwb.modeling.barabasiAlbert">
    <Object ocdref="edu.iu.nwb.modeling.barabasiAlbert.gui" />
  </Designate>
</metatype:MetaData>
    
```

Overlaid on the right is the "Barabasi-Albert" dialog box, which contains the following settings:

- Number of nodes: 1000
- Links set by new node: 2
- Seed of random number generator: 1

The dialog box has "OK" and "Cancel" buttons at the bottom.

## Data Converters and Conversion Service



### **NWB tool and CShell provide**

- o A testing bed for diverse algorithm implementations
- o A mechanism to quickly integrate an algorithm and disseminate through the NWB tool and community wiki.
- o A bridge between what algorithm developers can provide and what application users need.

Thank you