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Cyberinfrastructure for Network Science Center
School of Library and Information Science
Indiana University, Bloomington, IN
## Project Details

**Investigators:** Katy Börner, Albert-Laszlo Barabasi, Santiago Schnell, Alessandro Vespignani, Stanley Wasserman, Eric Wernert

**Software Team:**
- Lead: Weixia (Bonnie) Huang
- Developers: Bruce Herr, Russell Duhon, Santo Fortunato, Ben Markines, Cesar Hidalgo, M Felix Terkhorn, Tim Kelley, Ann McCranie, Soma Sanyal, Ramya Sabbineni, Vivek S. Thakre,

**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](http://nwb.slis.indiana.edu)
- [https://nwb.slis.indiana.edu/community](https://nwb.slis.indiana.edu/community)
- [http://cishell.org](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 Martínez (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/
Tom Snijders, University of Groningen  http://stat.gamma.rug.nl/snijders/
Major Deliverables

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

Cyberinfrastructure Shell (CIShell)
- An open source, software framework for the integration and utilization of datasets, algorithms, services, and tools.
- Uses OSGi and Equinox

NWB Community Wiki
- 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.
- All algorithms and datasets that are available via the NWB Tool have been well documented in the Community Wiki.
Analyze Data Algorithms

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

Edge/Node Level
- Node Degree
- Node Indegree
- Node Outdegree
- Max Flow Edge

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
- Newman Clustering Coefficient Over k

Other Local Measurements
- Distribution of Weights:
- k-Core Count:
- Coherence for Weighted Graphs:
Community Wiki cont.

Custom Fillings

Many scientists use a very specific subset of algorithms and datasets 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.

Physics

Analysis of Large-Scale Networks by Soma Sanyal

Biology

Analysis of Biological Networks by Cesar A. Hidalgo R.

Scientometrics

Modeling the Co-Evolution of Co-Author and Paper-Citation Networks by Soma Sanyal & Katy Börner
Map Your Bibtex File by Bruce Herr & Katy Börner coming soon
Semantic Analysis of Scholarly Data by Katy Börner coming soon

Internet Research

Error and Attack Tolerance of Networks by Katy Börner and Hardik Sheth
Search Performance of P2P Networks by Hardik Sheth and Katy Börner

Others

Data Conversion Service by Weixia (Bonnie) Huang & Bruce Herr
An Abstract Definition of Algorithms, Datasets and Converters

- **Data[]**
- **User-entered parameters**
- **CIShell Context**

**Algorithm**

**Metadata**
- key=value
- key=value
- key=value

**Data[]**
Abstract Algorithm Definition

Modeling Algorithms

Inputs

Output

NetSci 07
Abstract Algorithm Definition

Analysis Algorithms

Inputs

Outputs

NetSci 07
Abstract Algorithm Definition

Visualization Algorithms

Input

Output

NetSci 07
MetaData of an Algorithm

User-entered parameters -> Algorithm -> Data[]

```python
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/nbo
# 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_url=http://lanl.arxiv.org/abs/cond-mat/9910332
docu=https://nwb.slis.indiana.edu/community/?n=ModelData.Barabasi-AlbertScale-
```
GUI Builder and MetaType Service

NetSci 07
Data Converters and Conversion Service

![Diagram showing data conversion relationships]

NetSci 07
NWB tool and CIShell provide

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