



Network Visualization by Semantic Substrates

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UNIVERSITY OF
MARYLAND

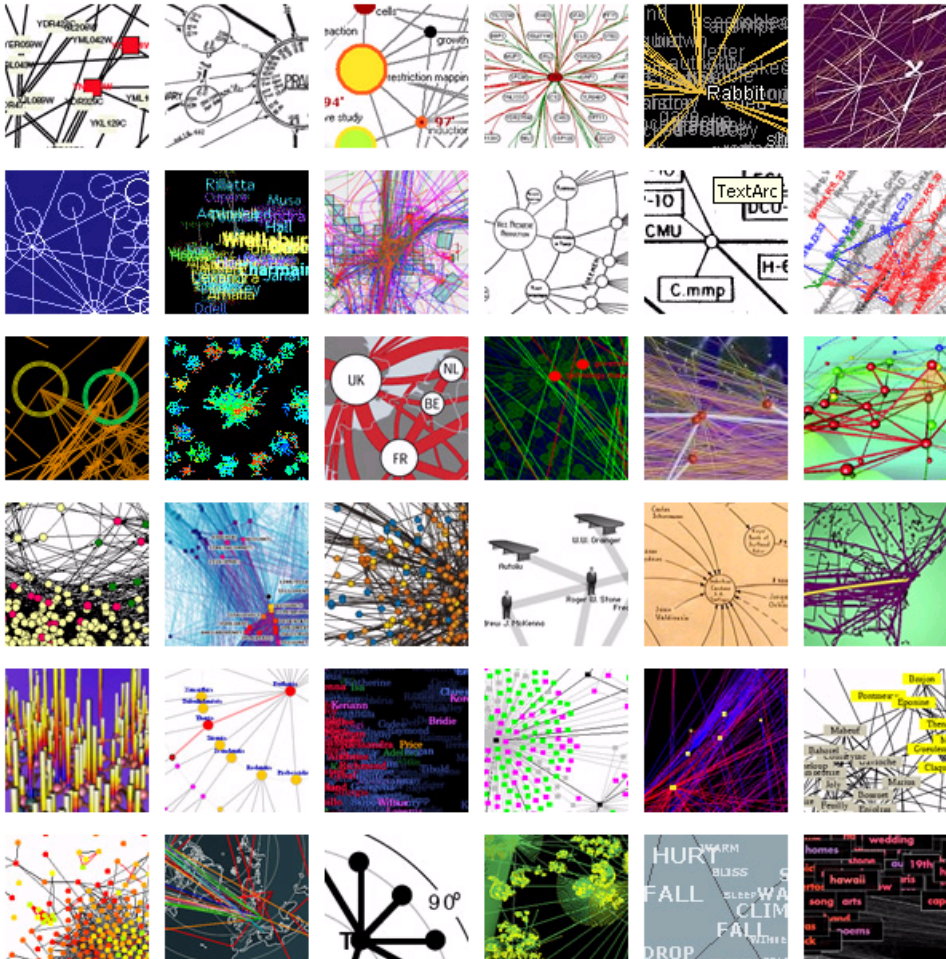


State-of-the-art network visualization

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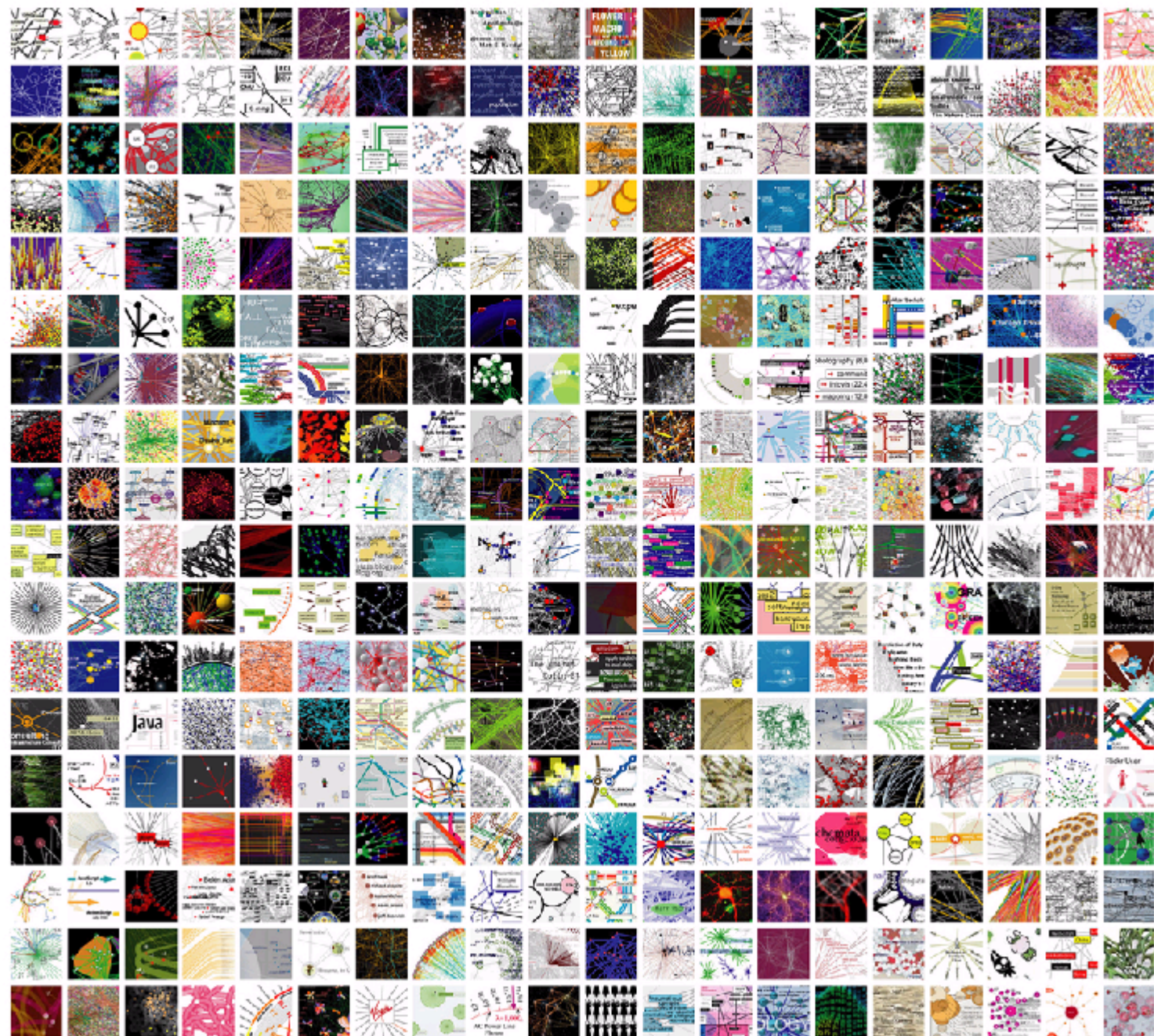
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[Food Webs \(7\)](#)
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[Knowledge Networks \(71\)](#)
[Multi-Domain Representation \(28\)](#)
[Others \(22\)](#)
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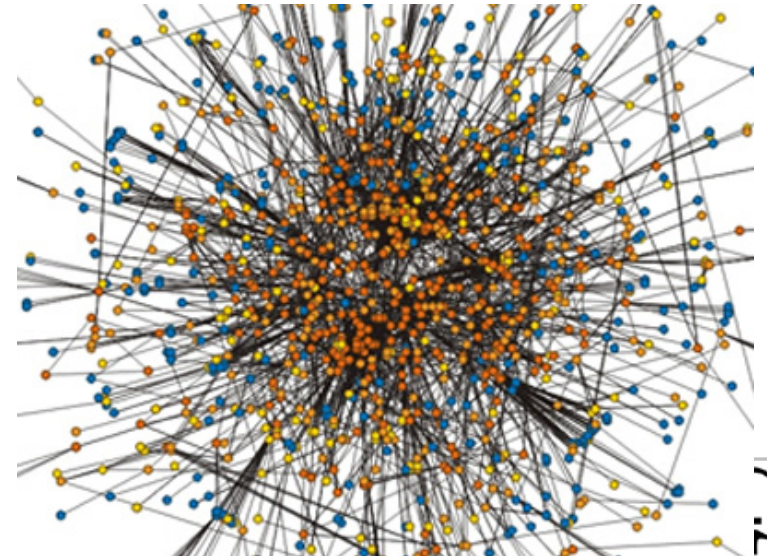
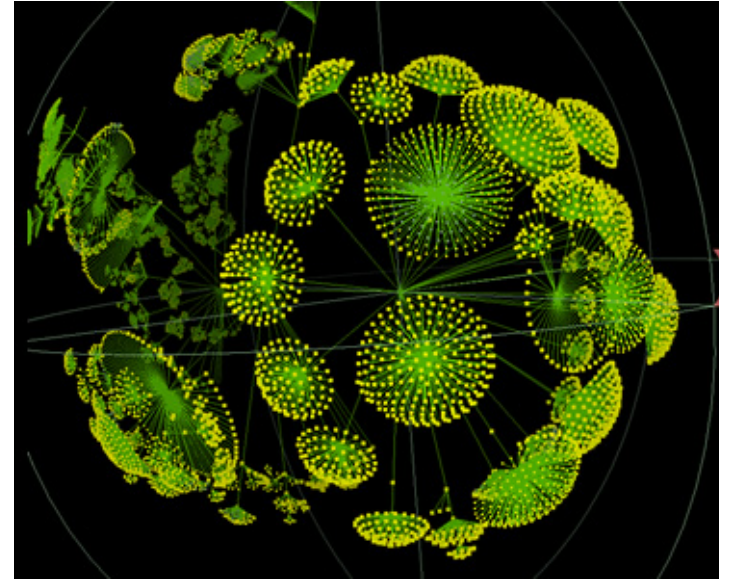


Node Placement Methods

- Node-link diagrams
 - Force-directed layout
 - Geographical map
 - Circular layout
 - Temporal layout
 - Clustering
 - *Layouts based on node attributes (later)*
- Matrix-based
- Tabular textual

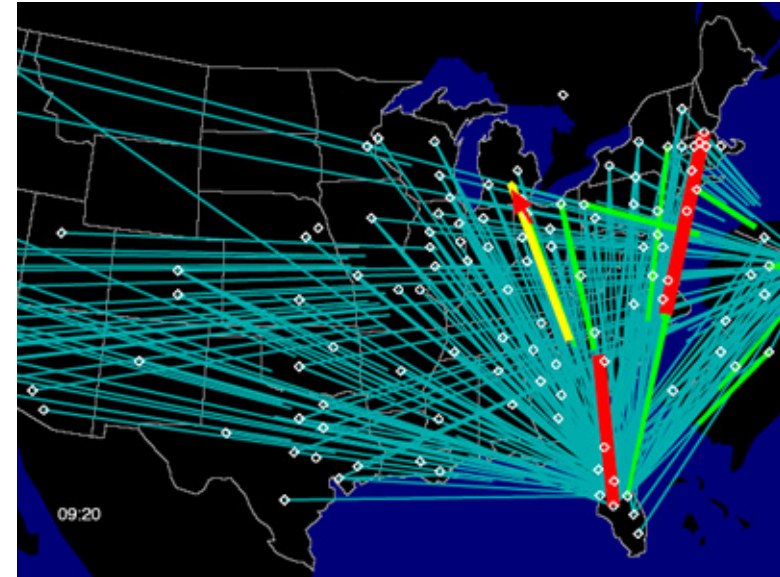
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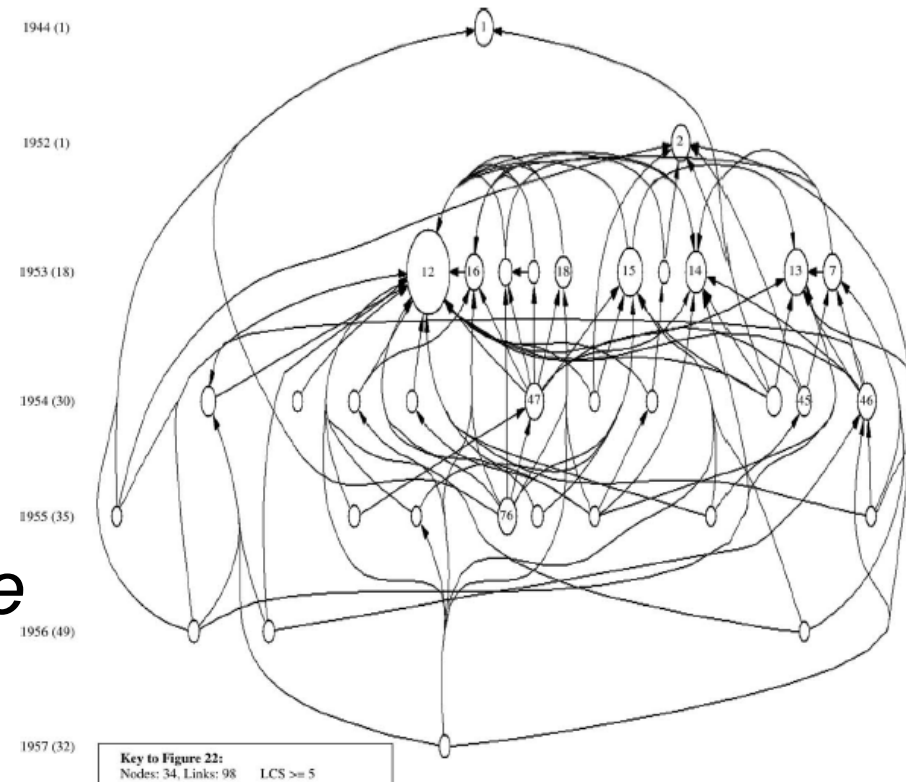
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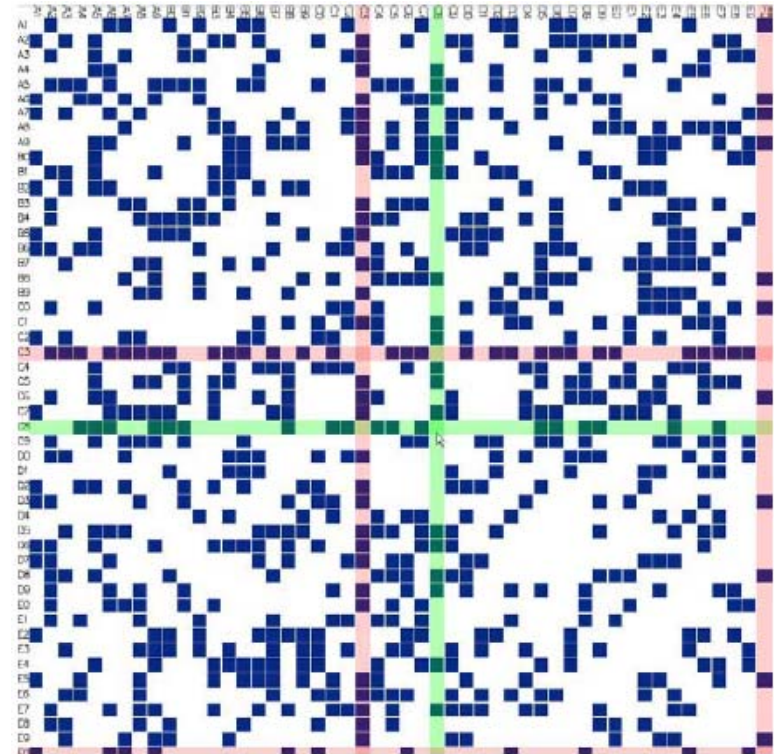
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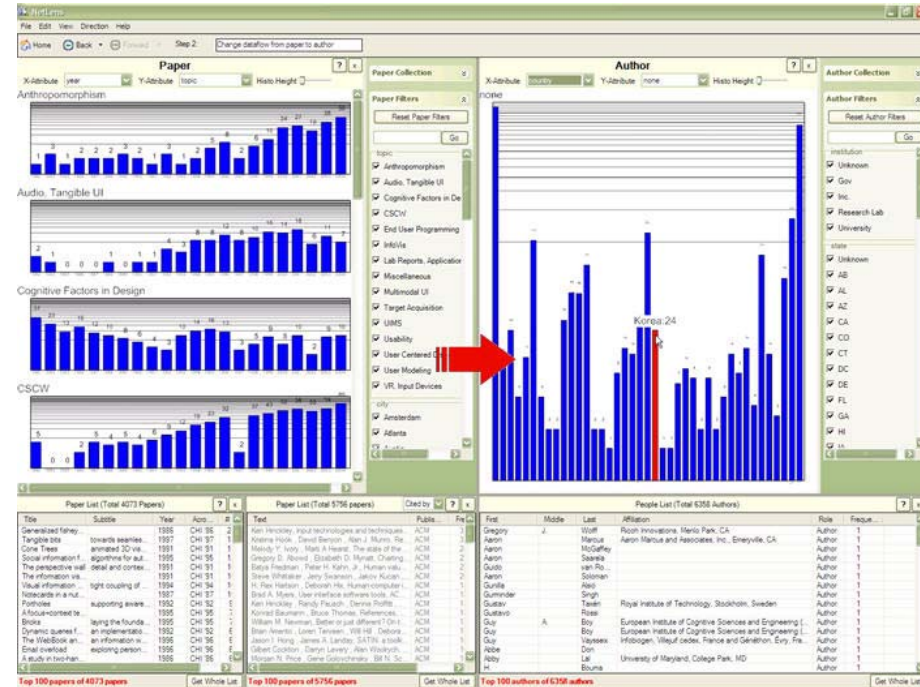
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NetViz Nirvana



?? ?? ??

NetViz Nirvana



NetViz Nirvana

- 1) Every node is visible
- 2) For every node
you can count its degree
- 3) For every link
you can follow it
from source to destination
- 4) Clusters and outliers are identifiable



How to attain
NetViz Nirvana?

Semantic Substrates



Semantic Substrates

- Group nodes into regions
 - According to an attribute
 - Categorical, ordinal, or binned numerical

Semantic Substrates

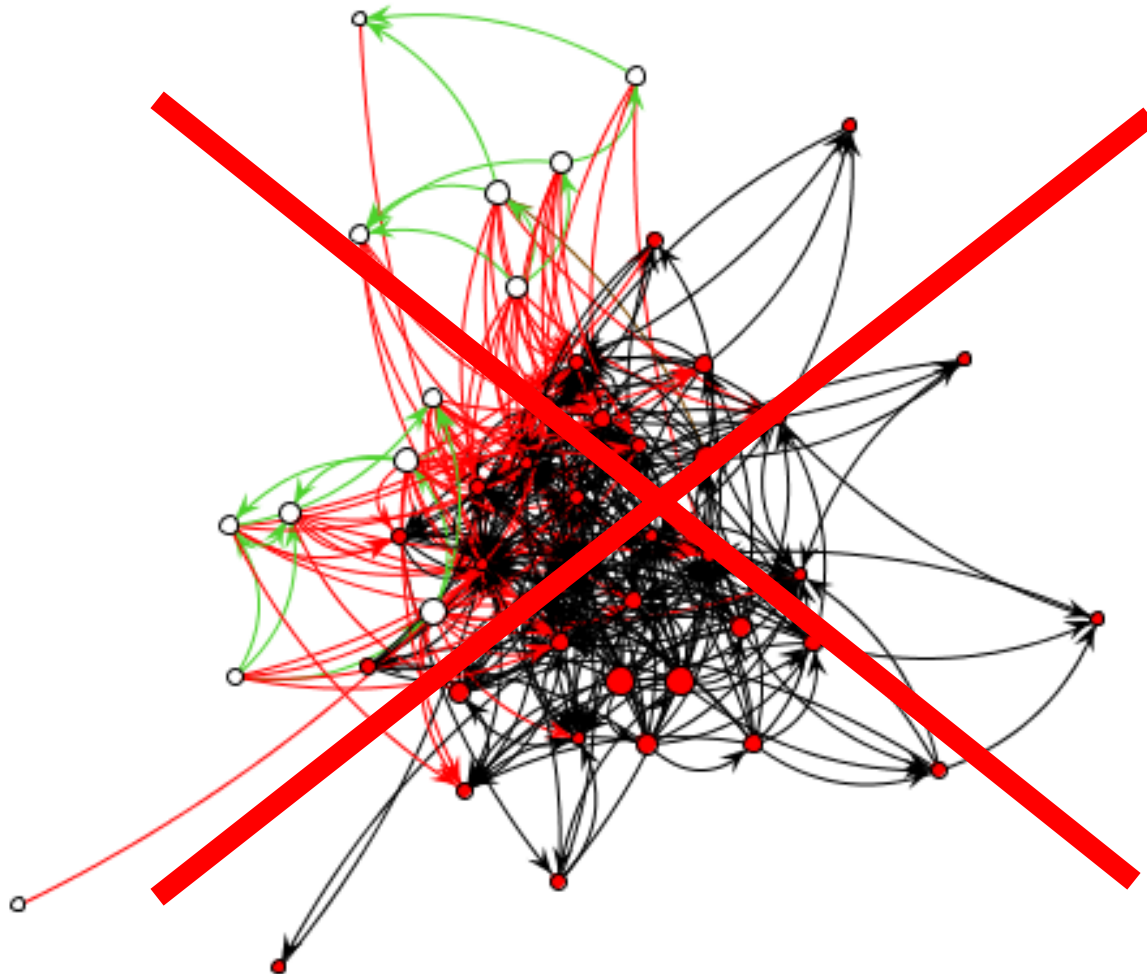
- Group nodes into regions
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- In each region:
 - Place nodes according to other attribute(s)

Semantic Substrates

- Group nodes into regions
 - According to an attribute
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- In each region:
 - Place nodes according to other attribute(s)
- Give users control of link visibility

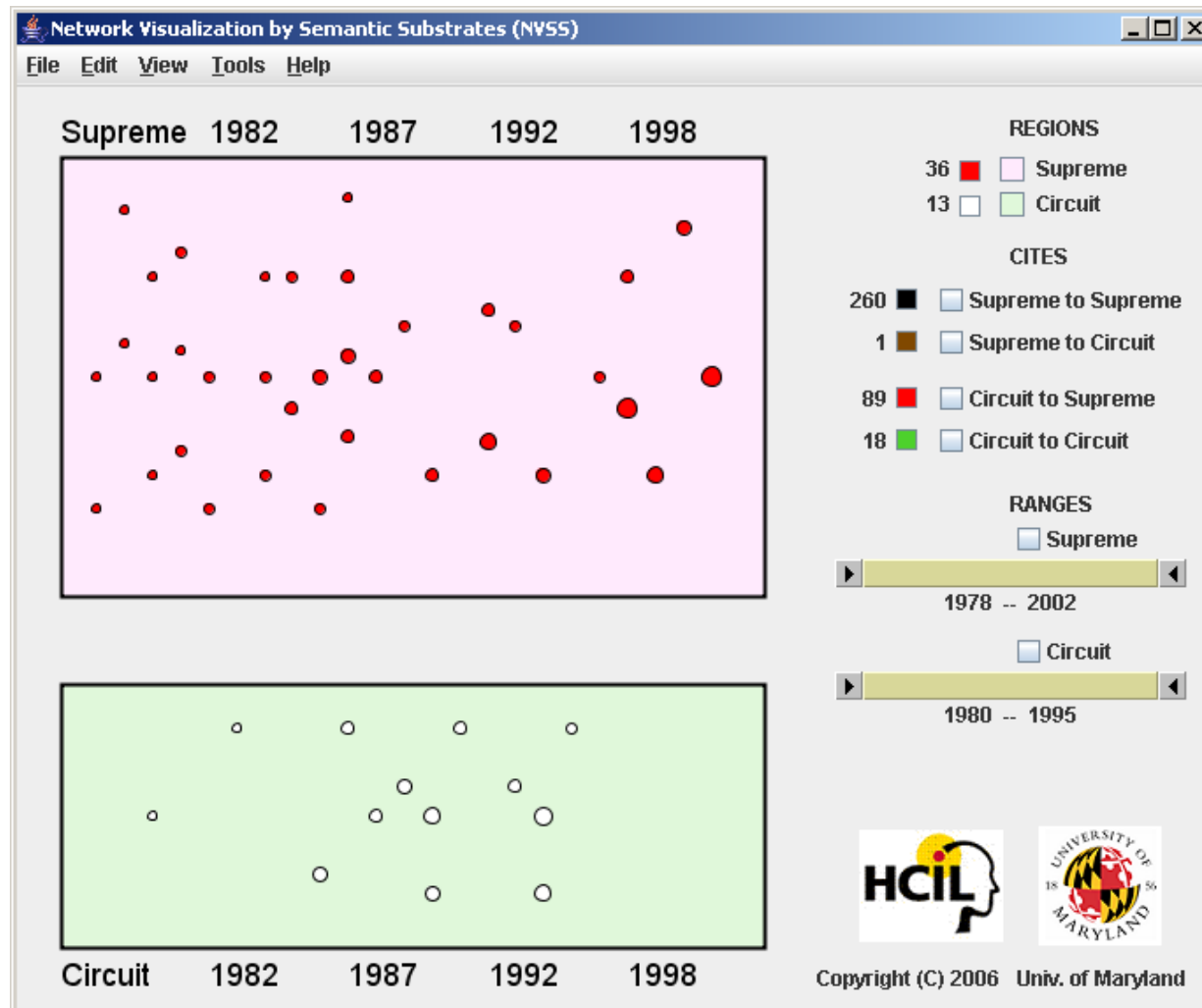
Force Directed Layout

36 ● Supreme & 13 ○ Circuit Court decisions
268 citations on Regulatory Takings 1978-2002

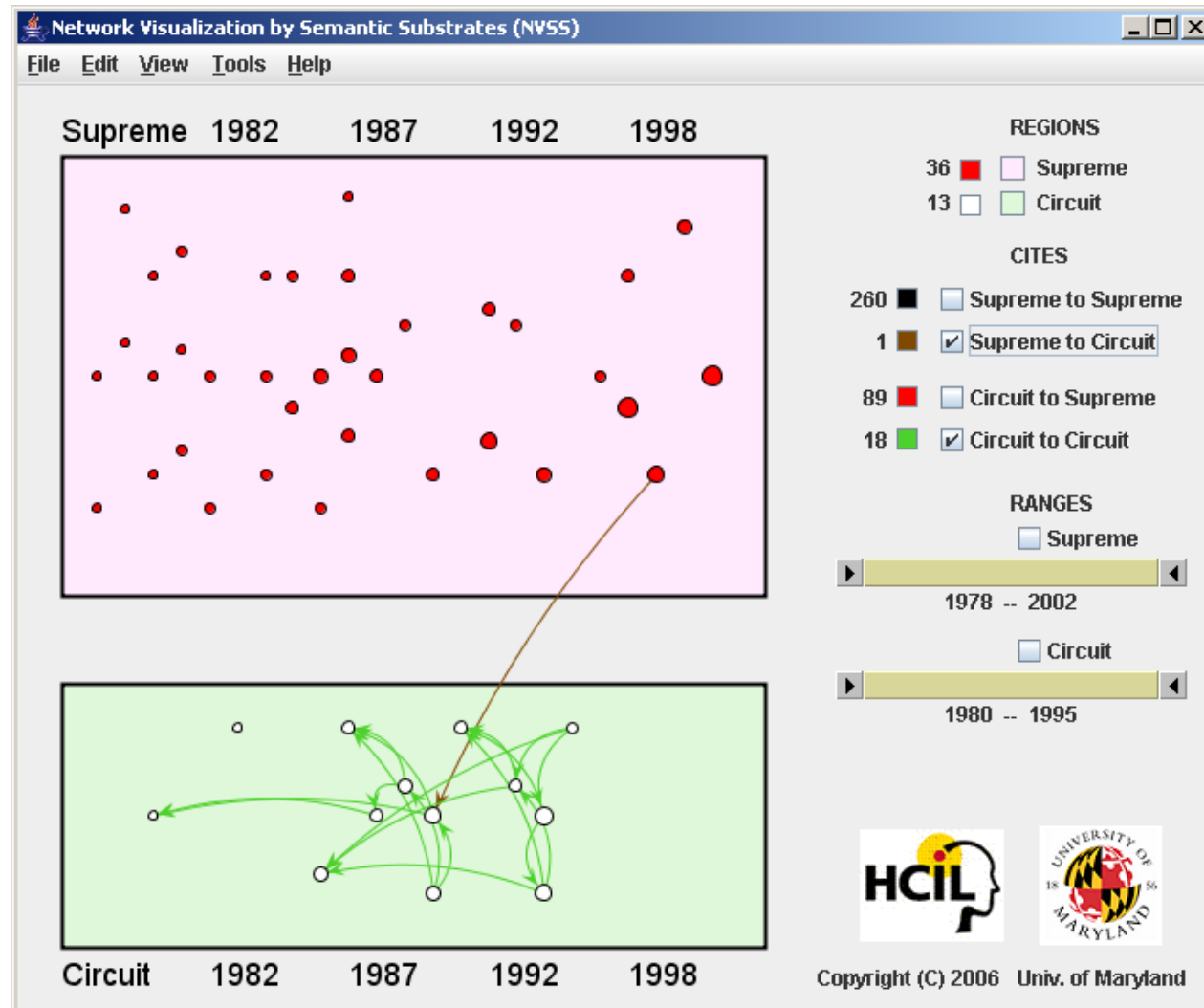


Network Visualization by **Semantic Substrates**

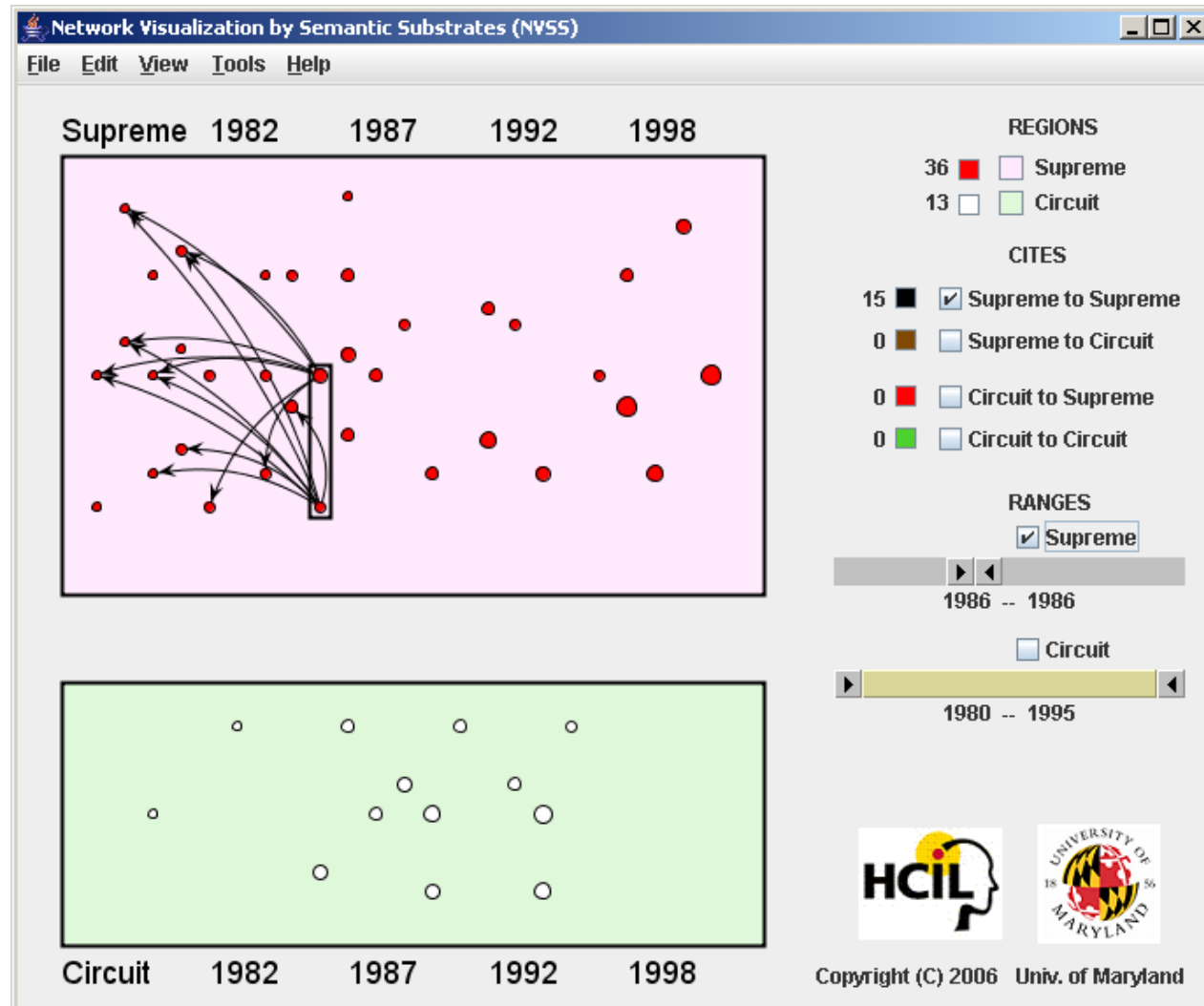
NVSS 1.0



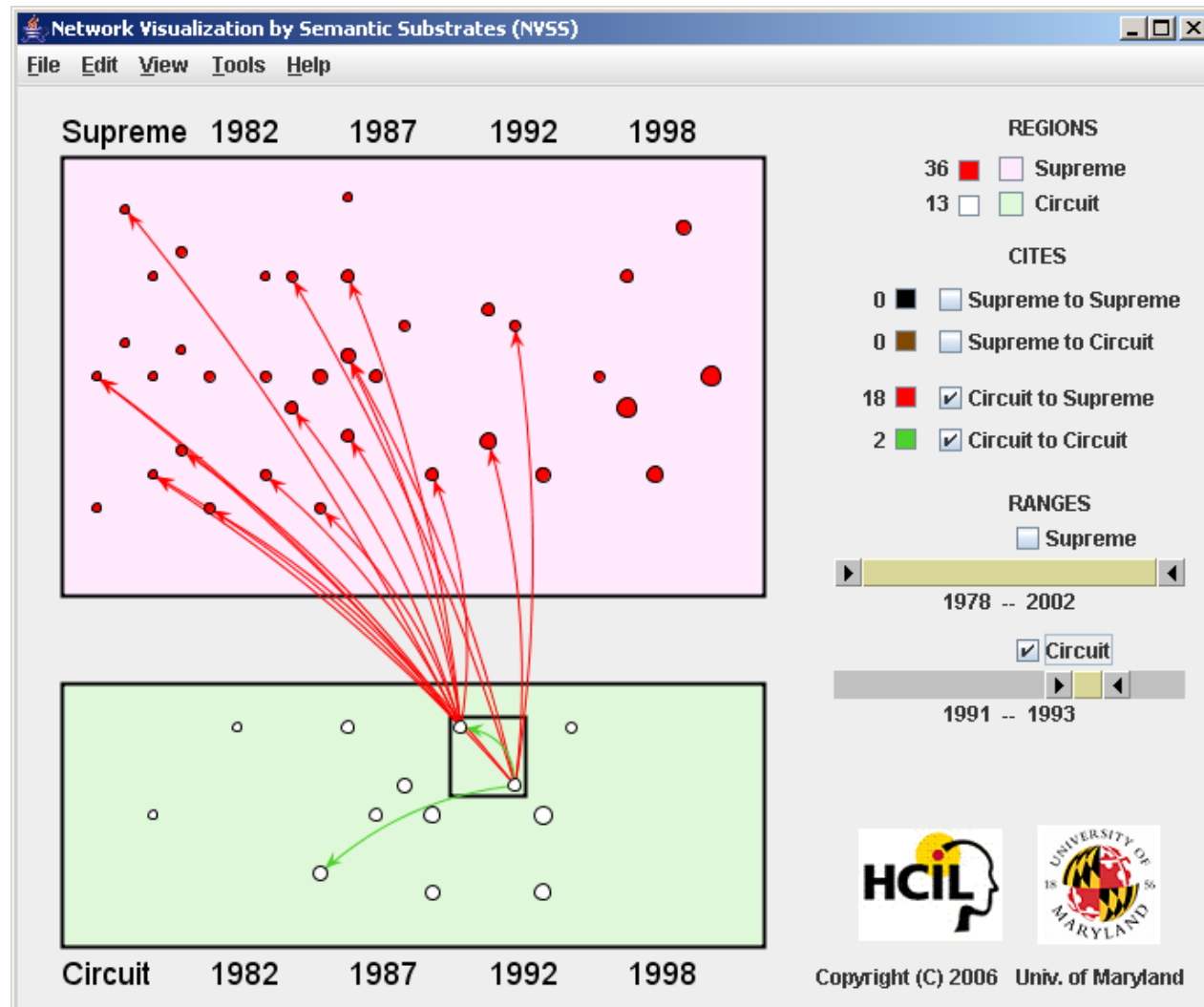
Filtering links by source-target



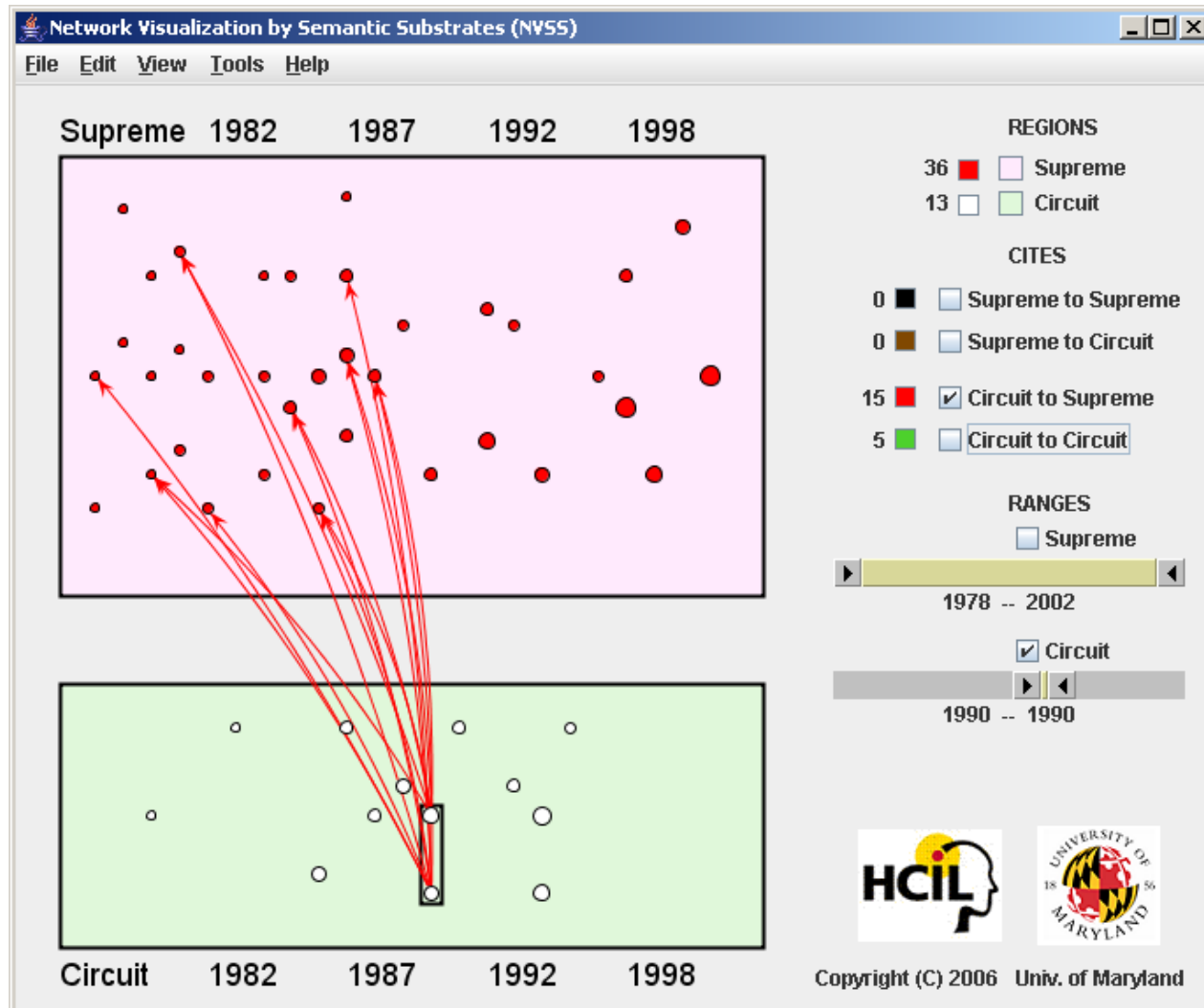
Filtering links by time attribute (1)



Filtering links by time attribute (2)

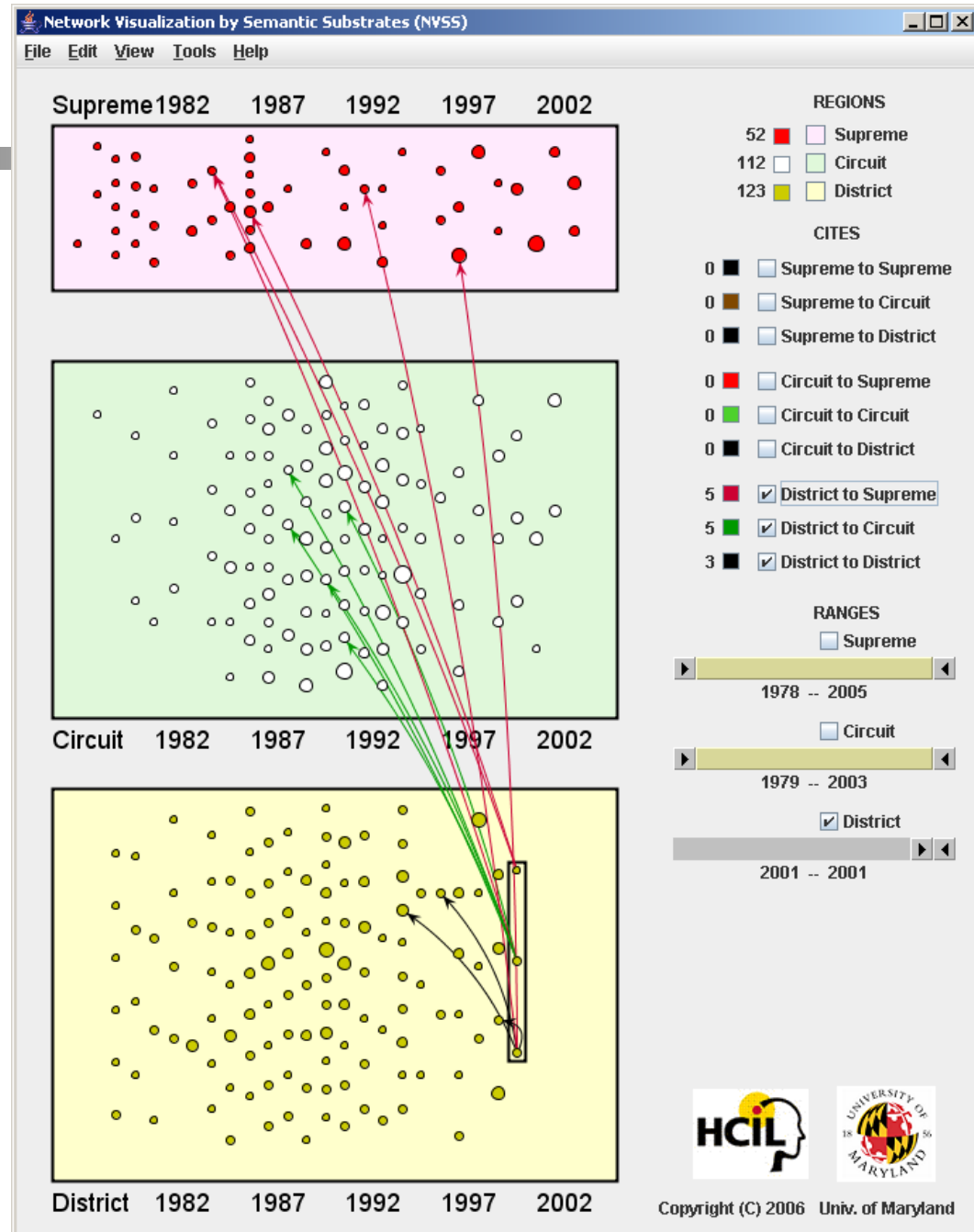


Overlapped Links



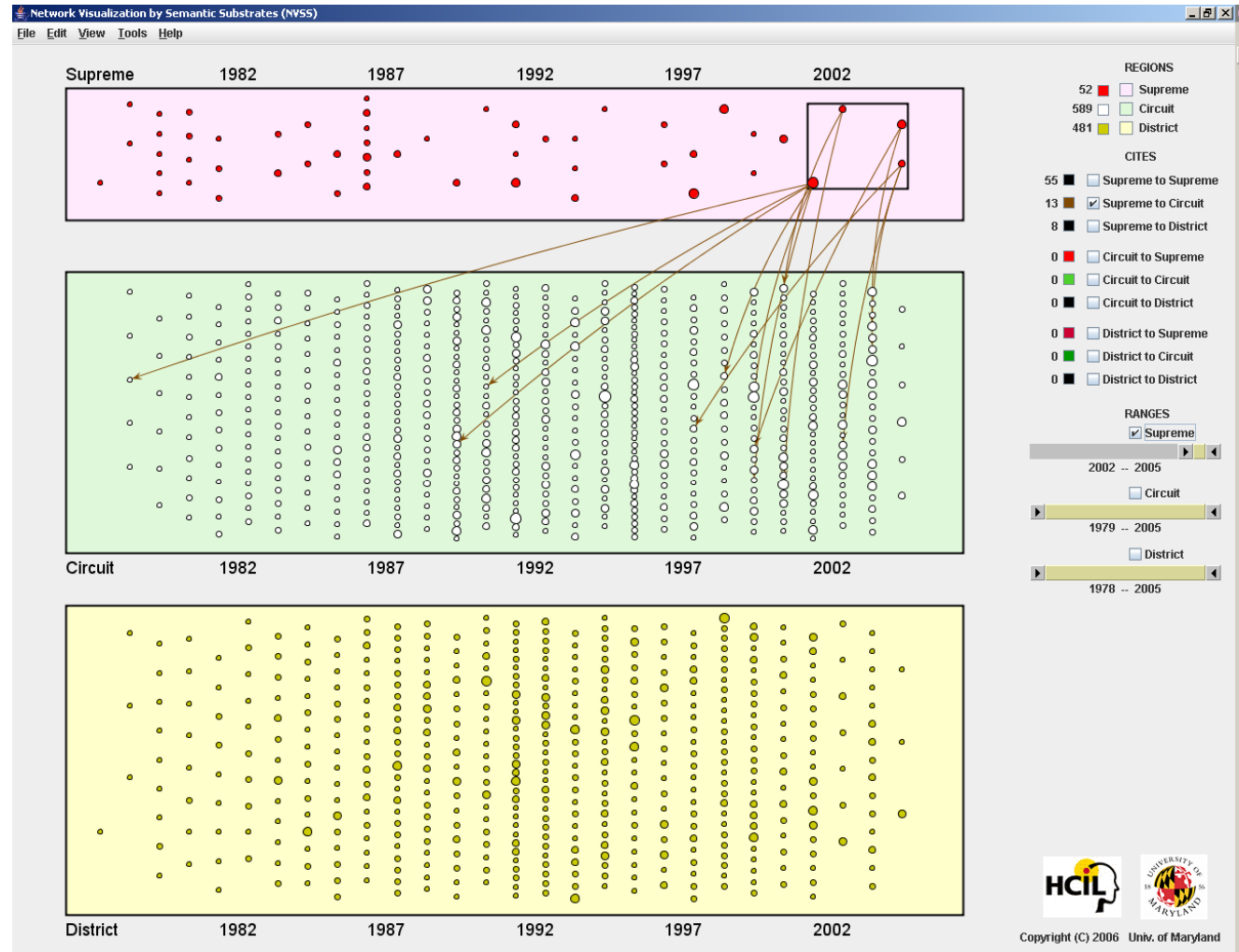
Three Regions

- Links from District Courts
- Indicates longevity of cases (short to long)
 - District
 - Circuit
 - Supreme



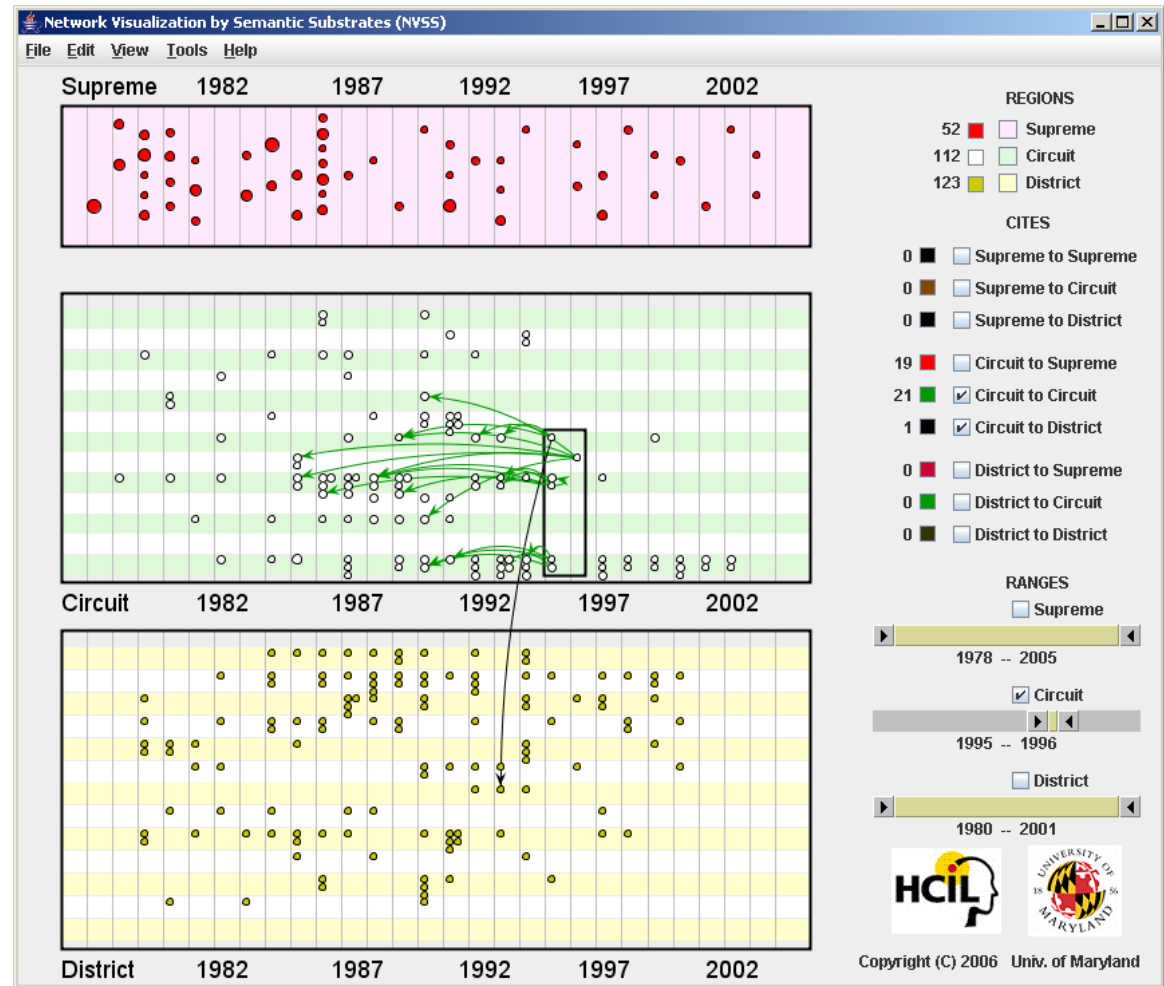
Scalability

- 1280x1024
- 1,122 nodes
- 7,645 links



Using a third attribute in regions

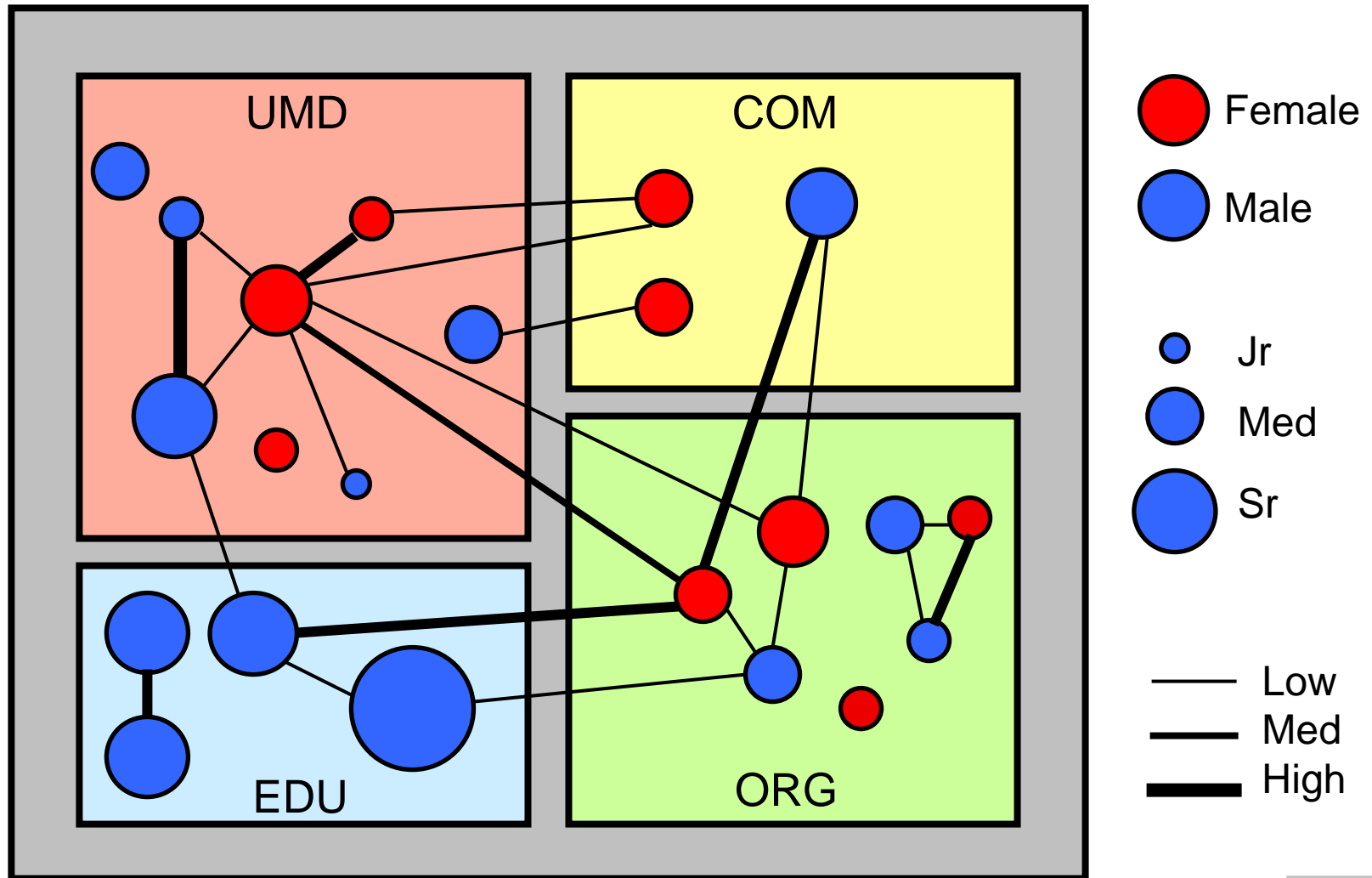
- 13 circuits for both Circuit and District Courts
- Horizontally separated
- Reveals that links remain mostly within a circuit although there are some across (lateral citations)



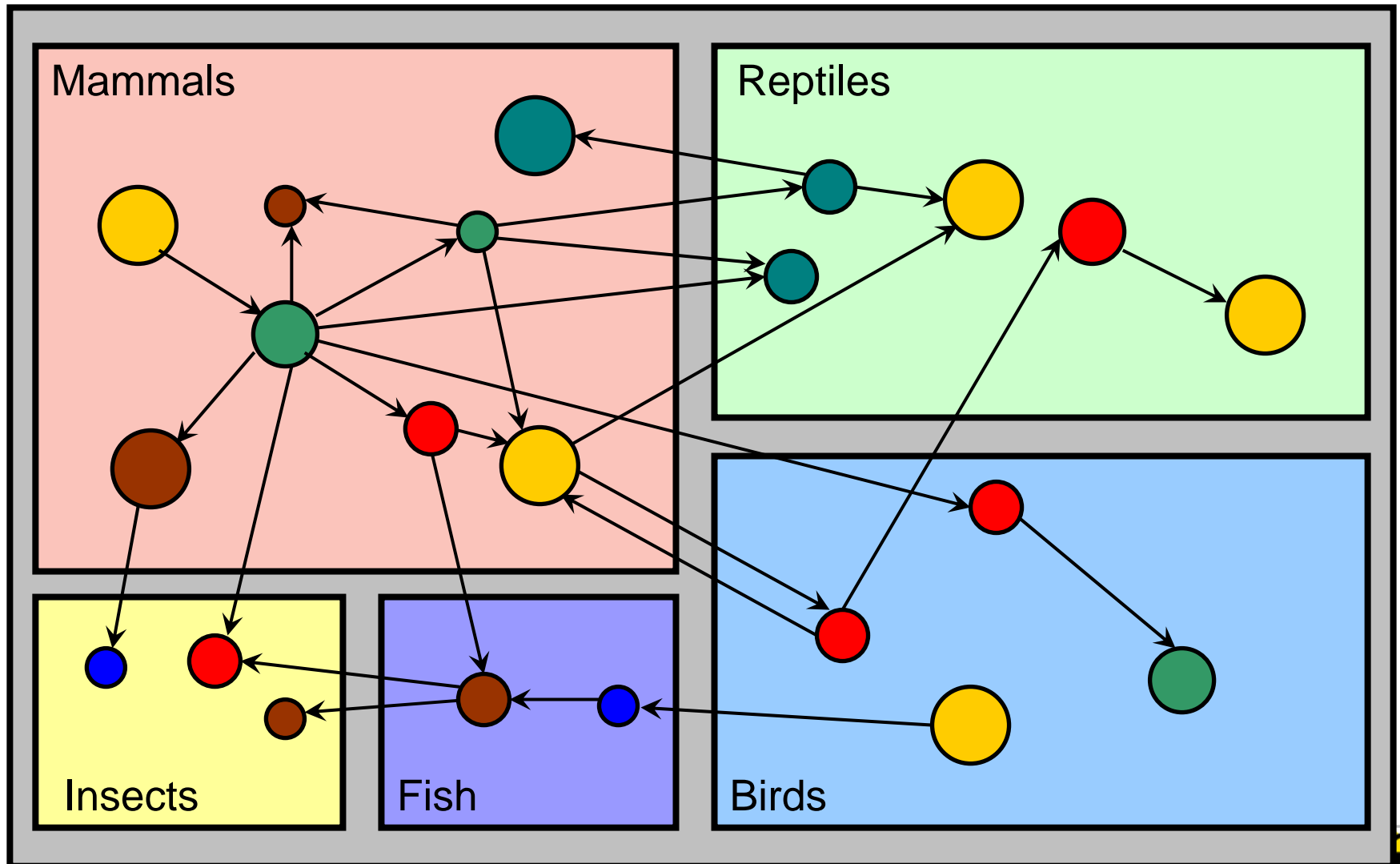
Semantic Substrates

- Advantages
 - Location conveys meaning
 - Rapid visual identification of
 - Different types of nodes
 - Their relative number
 - Missing nodes
 - Connections between different groups of nodes
 - Scalable for nodes and links
- Limitations
 - Beyond 5 regions becomes challenging
 - Node placement interferes with link aesthetics
 - Control panel can get complex

Email To & CC list co-recipients



Foodwebs



Semantic Substrates

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According to an attribute
Categorical, ordinal, or binned numerical
- In each region:
Place nodes according to other attribute(s)
- Give users control of link visibility

Lab www.cs.umd.edu/hcil

Project www.cs.umd.edu/hcil/nvss

Demo www.cs.umd.edu/~aris/nvss





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Challenges of Network Visualization

- C1) Basic networks: nodes and links
- C2) Node labels
 - e.g. article title, book author, animal name
- C3) Link labels
 - e.g. Strength of connection, type of link
- C4) Directed networks
- C5) Node attributes
 - Categorical, Ordinal, Numerical
- C6) Link attributes
 - Categorical, Ordinal, Numerical