



Visualization Techniques for Big Data


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A brief intro to Meta-Nodes

- A meta-node is what we call a node that contains one or more nodes inside of it
- During this week Meta-Nodes and Groups may be used interchangeably, though a Meta-Node can be created from more than just grouping algorithms
 - Some of our alternate sources include Attributes, Measures, Node Classes, and Node Associations
- But the most interesting meta-nodes to look at are probably those based on grouping algorithms
- In the Network Visualizer, meta-nodes can be created two ways
 - On-Demand
 - Automatically. This can happen if you're loading in a sufficiently large dataset.

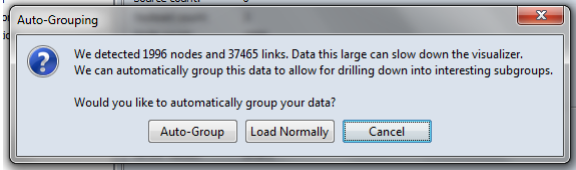
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Creating Meta-Nodes : Automatically on Startup

- If your data has more than (currently) 1,000 nodes or 10,000 links, you'll see the below dialog.
- Selecting "Auto-group" will run a Newman grouping algorithm and display the meta-nodes.
- Opting to Load Normally will load each node and link.
- This dataset has ~2,000 nodes and ~40,000 links. Some machines could handle this as it, some will benefit from the auto-grouping.

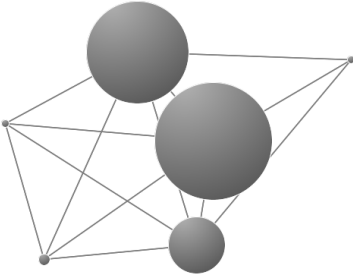


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Creating Meta-Nodes : Automatically on Startup

Chernobyl Alpha_grouped



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Creating Meta-Nodes : Automatically on Startup

- When we create meta-nodes automatically on visualizer startup, we do a little voodoo behind the scenes to make it more memory efficient, versus starting the visualizer and then creating meta-nodes
- Double clicking a node brings up it's Node Status. For these meta-nodes, we can see how many nodes and links are contained within
- Each node is scaled to the number of Contained nodes.

Node Title: 3.0
Nodeset is "Groups"
Node Class is "Unknown"
6 links

| Attributes | | |
|------------|--------|-------|
| Name | Type | Value |
| Node Count | Number | 750 |
| Link Count | Number | 11350 |

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What can we do with a Meta-Node? - Expanding

- The most basic meta-node operation is expanding it. This releases the meta-nodes components into the visualizer.
- The "Expand Node" operation is found by right-clicking on a meta-node

- Pin Submenu
- URI Submenu
- Appearance Submenu
- Labels Submenu
- Visibility Submenu
- Color Adjacent Edges
- Select Node
- Center Node
- Expand Node

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Expanding Meta-Nodes

Chernobyl Alpha_grouped

Chernobyl Alpha_grouped

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What can we do with a Meta-Node? – Open it separately

- We can open a meta-node into it's own instance of the Network Visualizer
- This Option is similarly located under the right-click submenu
- If that sub-meta-network is large enough, it too can be automatically regrouped

- Pin Submenu
- URI Submenu
- Appearance Submenu
- Labels Submenu
- Visibility Submenu
- Color Adjacent Edges
- Select Node
- Center Node
- Expand Node
- Open Group Components in New Visualizer

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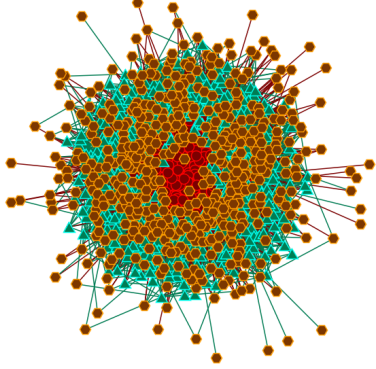


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What can we do with a Meta-Node? – Open it separately

- Opened one of the larger ones. This meta-node was small enough to not require further grouping.

Chernobyl Alpha



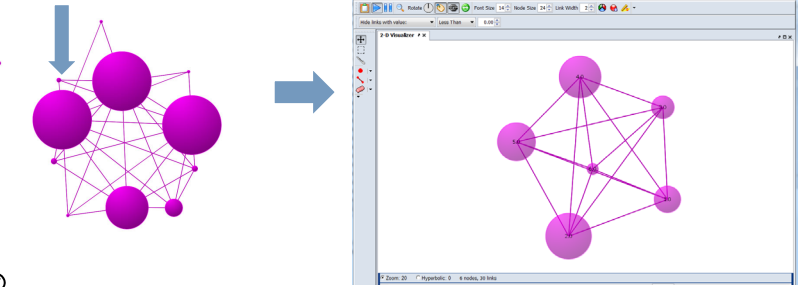
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Launching in own Visualizer

- If instead the data is large, you can get another round of auto-grouping.
- This can effectively be used to drill down to areas of particular interest.



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Fun With Meta-Node Appearance

- Note: These following slides will describe features that currently do not work in conjunction with Meta-Nodes created by auto-grouping.
- First thing that will be explained is how to create meta-nodes via conventional means.
- These slides will operate off of a different meta-network.

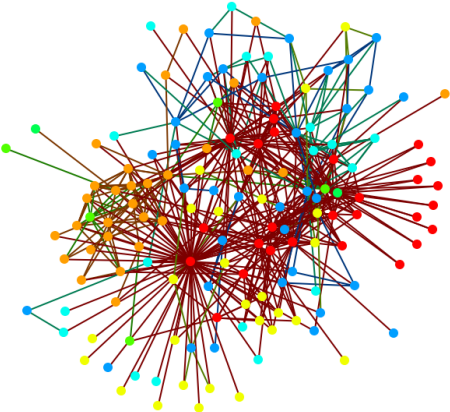
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New Data

- 143 Nodes
- 566 Links

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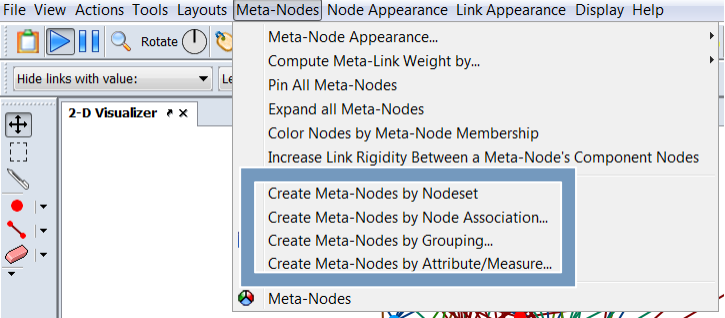
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Creating Meta-Nodes

- Meta-Nodes can be created via the “Create Meta-Nodes by...” options in the Meta-Nodes Menu

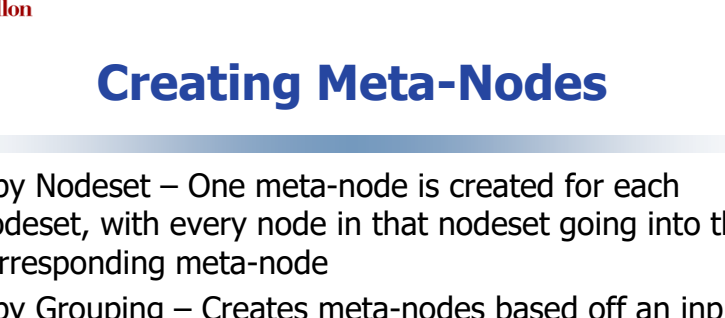


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Creating Meta-Nodes

- ...by Nodeset – One meta-node is created for each Nodeset, with every node in that nodeset going into the corresponding meta-node
- ...by Grouping – Creates meta-nodes based off an input Grouping algorithm
- ...by Attribute/Measure – Creates one meta-node per attribute/measure value, and places nodes matching those values inside the corresponding meta-node
- ...by Node Association – Asks for an input Nodeset. Every node in that nodeset has a meta-node created for it, and any node connected to a node in that nodeset goes into the corresponding meta-node



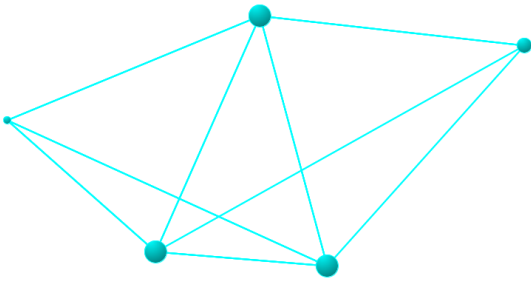
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Creating Meta-Nodes

- Using the input network, meta-nodes were created by Grouping.
- Newman was used, with 5 Newman groups created
- This is the default appearance

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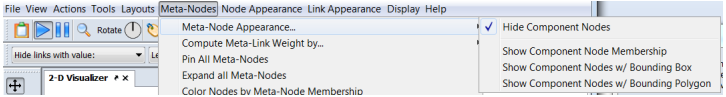
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Alternate Appearances

- Accessed via the Meta-Node appearance submenu under the Meta-Nodes menu.
- Hide Component Nodes – (Default) shows just the Group x Group network
- Show Component Node Membership – Shows the Group x Group network, and all component nodes, with links from the component nodes to the group node they belong to
- Show Component Nodes w/ Bounding Box – Shows the basic network diagram, with a box surrounding any nodes in a meta-node
- Show Component Nodes w/ Bounding Polygon – Shows the basic network diagram, with a polygon surrounding any nodes in a meta-node

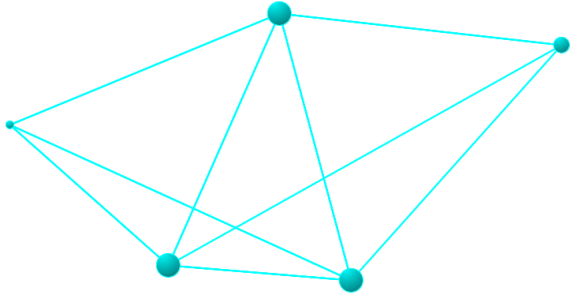


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Hide Component Nodes

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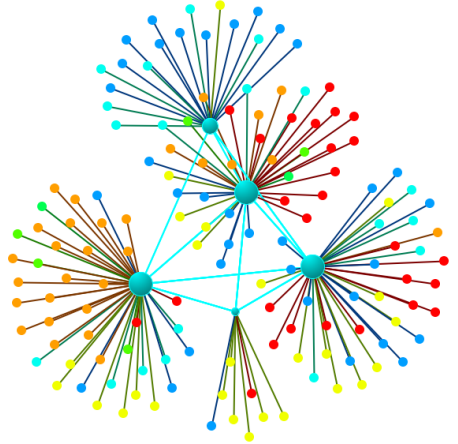
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Show Component Node Membership

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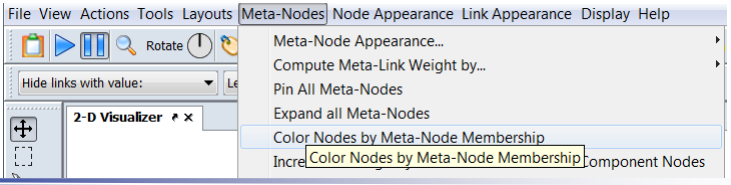
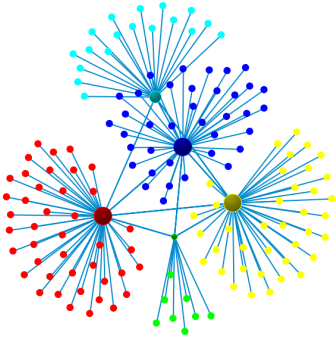


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Coloring Component Nodes by Meta-Node

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- For a quick interim, let's look at this feature.
- Each meta-node gets a random color, and all component nodes get that node's color



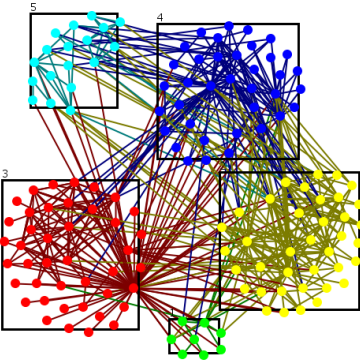
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Show Component Nodes w/ Bounding Box

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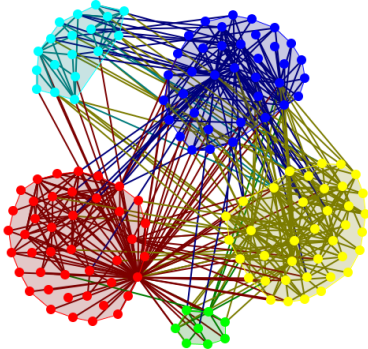
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Show Component Nodes w/ Bounding Polygon

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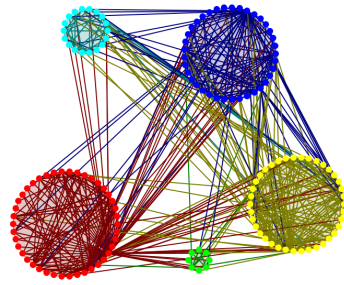
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One Last Thing

- Under “layouts” there’s the option “Run Circular Layout for Groups”. This places each component node in a circle around their meta-node, with the circle’s radius being proportional to the meta-node’s size

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Layouts | Meta-Nodes | Node Appearance | Link Appearance

- Run Active Layout
- Stop Active Layout
- Spring Embedded Layout
- Spring Embedded (with enhancements for large data)
- Run MDS Layout
- Run Tree Layout
- Run Circle Layout (Pendants to Outside)
- Run Circle Layout (Center is Highest Betweenness)
- Run Circular Layout for Groups

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