

# Converting a network with dates into a dynamic network

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last modified: 2021-09-22



## Goals of this tutorial

- We take a normal network, where nodes have attributes which can serve as time indication (a date, a number...)
- We convert this network into a dynamic network: nodes will appear and disappear according to their attributes.

## download a network file for practice

[download this zip file](#) and unzip it on your computer.

or use this direct link: <https://tinyurl.com/gephi-tuto-4>

You should find the file **miserables-with-dates.gexf** in the zip file. Save it in a folder you will remember (or create a folder specially for this small project).

This file contains a network representing "who appears next to whom" in the 19th century novel *Les Misérables* by Victor Hugo<sup>[1]</sup>.

A link between characters A and B means they appeared on the same page or paragraph in the novel.

The file name ends with ".gexf", which just means this is a text file where the network information is stored (name of the characters, their relations, etc.), following some conventions.

This file has been modified to add some dates to each character in the novel:

- a "start date", which is a day (example: 22/09/1835). This is the date when the character **enters** the action in the novel
- an "end date", also a day (example: 22/09/1840). This is the date when the character **leaves** the action in the novel
- a "peak moment". This is a number (example: 14263). This is an instant when the character is at the center of the plot. This number has no historical meaning, this is just a chronological moment in time.

#### NOTE

Values for start date, end date and peak moment have no real significance in the novel. They are made up for this exercise.

## open the network in Gephi

- open Gephi. On the Welcome screen that appears, click on **Open Graph File**
- find **miserables-with-dates.gexf** on your computer and open it

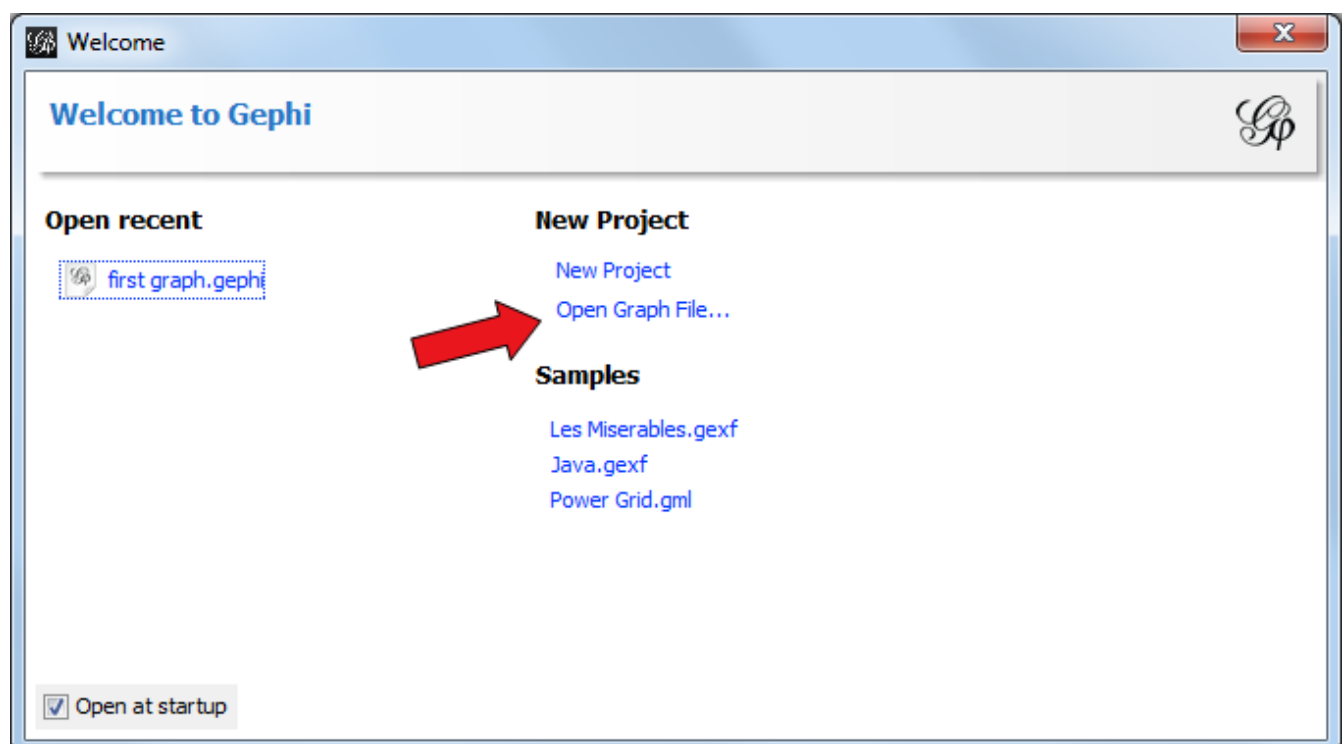


Figure 1. welcome screen

A report window will open, giving you basic info on the network you opened:

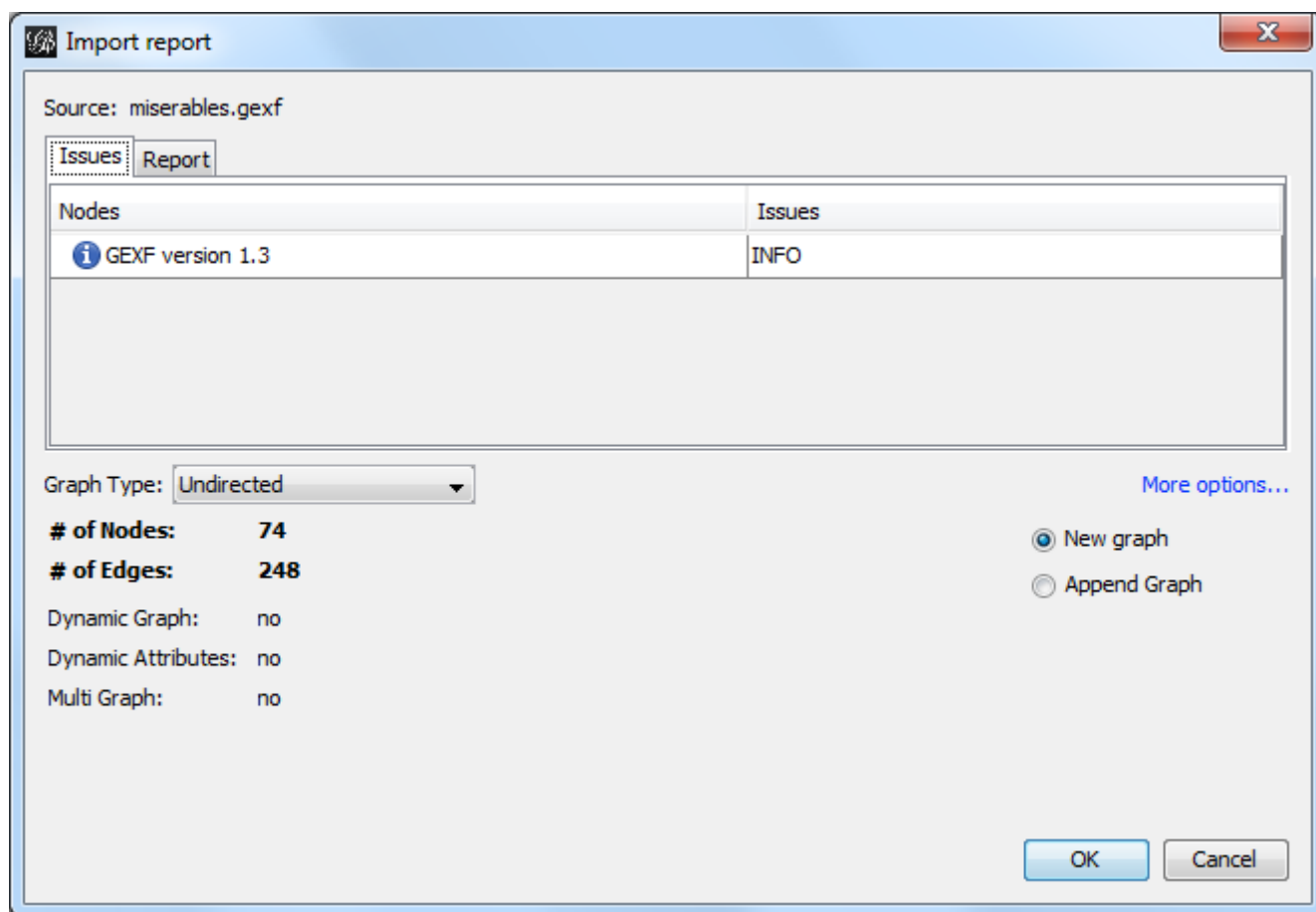


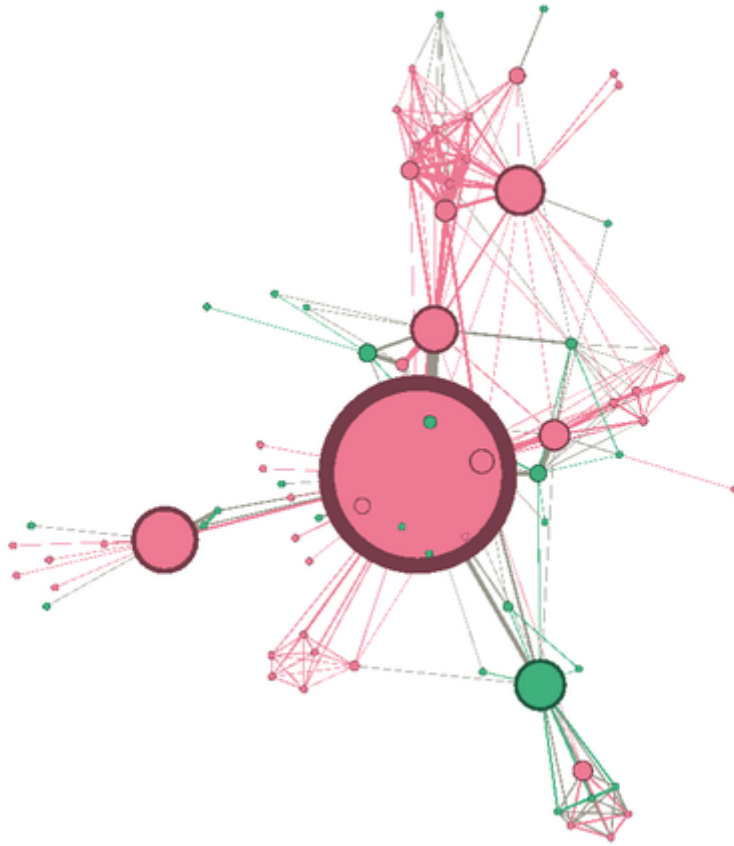
Figure 2. report window

This tells you that the network comprises 74 characters, connected by 248 links.

Links are undirected, meaning that if A is connected to B, then it is the same as B connected to A.

The report also tells us the graph is not dynamic: it means there is no evolution or chronology, it won't "move in time".

Click on **OK** to see the graph in Gephi.



*Figure 3. The network we will use*

## getting a sense of the attributes in the data laboratory

We can switch to the data laboratory to see the underlying data:

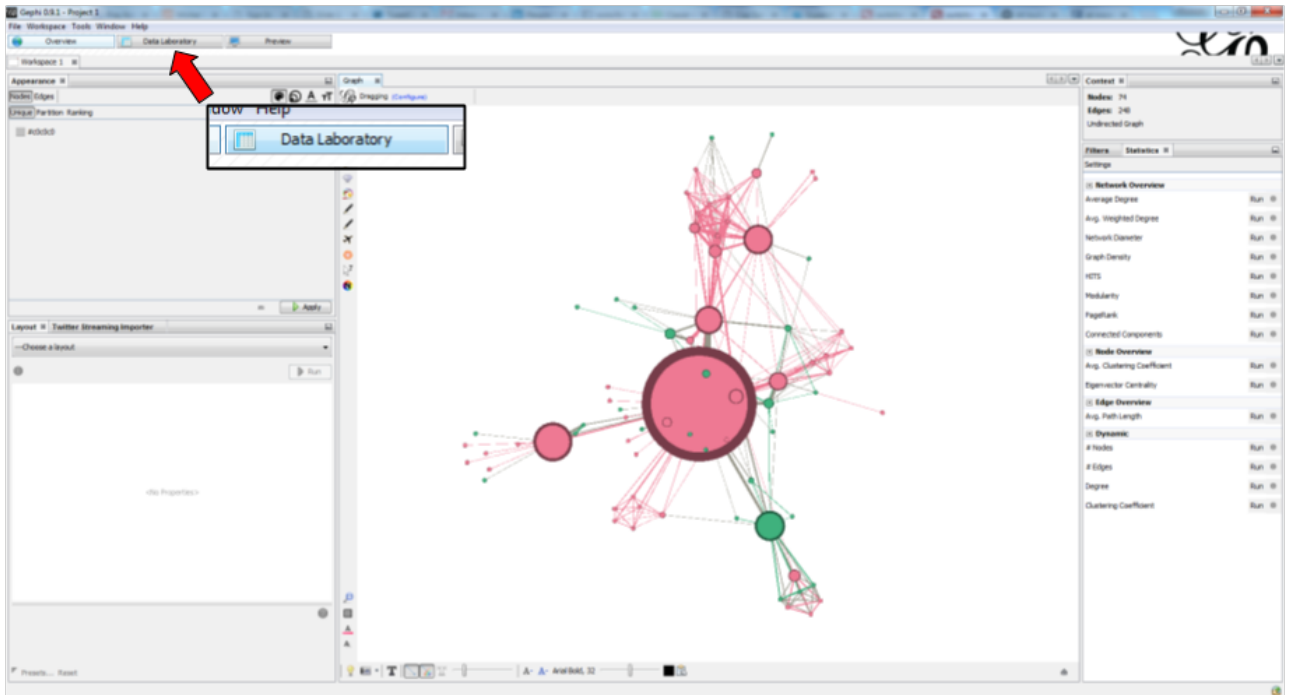


Figure 4. Switching to the data laboratory

Id	Label	Interval	Gender	Eccentricity	Betweenness Centrality	Harmonic Closeness Centrality	Closeness Centrality	Modularity Class	start date	end date	peak moment
11	Valjean		M	3.0	1532.151142	0.744292	0.657658	2	04/04/1833	04/04/1838	13061
0	Myriel		M	4.0	483.0	0.498858	0.437126	0	01/01/1818	01/01/1823	44013
23	Fantine		F	4.0	359.370275	0.549007	0.470949	4	30/10/1850	30/10/1855	19479
48	Gervaise		M	3.0	351.988886	0.618772	0.51773	3	12/09/1845	12/09/1850	17604
55	Marius		M	3.0	331.391799	0.602274	0.532847	2	06/11/1836	06/11/1840	14006
25	Thénardier, Jondrette		M	3.0	396.891955	0.586798	0.521429	1	03/03/1846	03/03/1853	47729
17	Javert		M	3.0	141.40912	0.591224	0.521429	3	18/07/1847	18/07/1842	14628
58	Ermilas		M	3.0	120.417945	0.559361	0.486667	3	14/03/1838	14/03/1843	14868
16	Tholomyes		M	4.0	106.276976	0.461187	0.394995	4	31/01/1848	31/01/1853	18475
51	McGillenmand		F	3.0	90.502811	0.484018	0.442424	2	18/07/1836	18/07/1841	14263
44	Bonassit		M	3.0	86.795224	0.545653	0.480363	3	17/06/1840	17/06/1845	15692
24	MineThénardier		F	3.0	81.01655	0.5					
57	Habert		M	4.0	75.584524	0.47					
28	Fauchelevent		M	4.0	72.5	0.44					
54	L'Ellemand		M	3.0	47.30265	0.46					
26	Coettie		F	3.0	47.18837	0.53					
41	Eponine		F	4.0	33.628408	0.47					
31	Stimpie		F	4.0	23.491308	0.46					
29	Banastubois		M	4.0	22.95667	0.46					
61	Proflit		M	4.0	14.070956	0.46					
70	Claqueous		M	3.0	13.856142	0.51					
68	Gueulemer		M	3.0	12.95138	0.52					
69	Babert		M	3.0	12.95138	0.52					
71	Murpasse		M	3.0	10.540415	0.51					
63	Bahort		M	4.0	5.538562	0.476027	0.394995	3	08/08/1840	08/08/1845	15745
65	Joly		M	4.0	5.538562	0.476027	0.394995	3	22/04/1844	22/04/1849	17097
59	Combeferre		M	4.0	5.140693	0.49179	0.394995	3	18/02/1844	18/02/1849	17032
61	Proflit		M	4.0	5.140693	0.49179	0.394995	3	22/04/1844	22/04/1849	17032
75	Brujon		M	4.0	0.75	0.437215	0.380208	1	09/02/1832	09/02/1837	12640
90	Magnon		F	4.0	0.63048	0.365297	0.337963	2	18/10/1839	18/10/1844	15480
66	Grantere		M	4.0	0.428571	0.437215	0.361386	2	07/06/1841	07/06/1846	16047
67	Neodien		M	5.0	0.0	0.328082	0.305439	0	18/10/1818	18/10/1824	44671
1	MadameToussaint		F	4.0	0.0	0.450913	0.41954	0	14/07/1822	14/07/1827	45671
3	MmeMagone		F	4.0	0.0	0.450913	0.41954	0	04/05/1826	04/05/1831	47061
4	CourmesDela		F	5.0	0.0	0.328082	0.305439	0	28/02/1822	28/02/1827	45332
6	Belordand		F	5.0	0.0	0.328082	0.305439	0	01/01/1827	01/01/1832	47380
6	Champerceur		M	5.0	0.0	0.328082	0.305439	0	14/03/1818	14/03/1825	44818

Figure 5. Zoom on three attributes representing time

The nodes (characters) of the network have attributes (start date, end date, peak moment) which can make this graph dynamic - but it is not yet.

A couple of steps are needed to enable the dynamic features, and here a choice must be made:

Do we prefer to have...

1. ... nodes appearing on screen at their start date, and staying on screen for ever after?
2. ... nodes appearing on screen at their start date, and leaving the screen at their end date?
3. ... nodes being represented simply by their "peak moment" (a number), without reference to chronological dates?

We will present these 3 possibilities.

## 1. dynamic nodes with a start date

Click on "Merge columns"

id	Label	Interval	Gender	Eccentricity	Betweenness Centrality	Harmonic Closeness Centrality	Closeness Centrality	Modularity Class	start date	end date	peak moment
11	Valjean		M	3.0	1532.151142	0.744292	0.657658	2	04/04/1833	04/04/1838	13061
0	Myriel		M	4.0	483.0	0.498858	0.437126	0	01/01/1818	01/01/1823	44013
23	Fantine		F	4.0	359.370275	0.549687	0.470968	4	30/10/1850	30/10/1855	29479
48	Gervaise		M	3.0	351.388886	0.611872	0.517773	3	12/06/1846	12/06/1850	17604
55	Marius		M	3.0	331.391799	0.60274	0.532847	2	06/11/1835	06/11/1840	14006
25	Thenardier, Jondrette		M	3.0	196.859155	0.586758	0.521429	1	03/03/1828	03/03/1833	47729
27	Javert		M	3.0	141.49812	0.591324	0.521429	2	18/07/1837	18/07/1842	14628
38	Eponine		M	3.0	120.417546	0.559361	0.486837	3	14/02/1838	14/02/1843	14968
16	Tholomyes		M	4.0	106.276976	0.461187	0.394595	4	31/01/1848	31/01/1853	18475
51	McGlenormand		F	3.0	90.502381	0.484018	0.442424	2	18/07/1836	18/07/1841	14263
64	Bossuet		M	3.0	86.795324	0.545662	0.480363	3	17/06/1840	17/06/1845	15992
24	Mme Thenardier		F	3.0	81.011655	0.537597	0.407949	1	02/11/1831	02/11/1836	12541
57	Mabeuf		M	4.0	75.584524	0.473744	0.396739	3	28/05/1843	28/05/1848	16889
28	Fauchelevent		M	4.0	72.5	0.444064	0.407821	2	02/01/1838	02/01/1843	14794
54	McGlenormand		M	3.0	47.301065	0.484018	0.442424	2	18/11/1839	18/11/1844	15480
36	Coette		F	3.0	47.18837	0.534247	0.420444	2	30/11/1833	30/11/1838	13300
41	Eponine		F	4.0	33.428408	0.477169	0.401099	1	17/09/1830	17/09/1835	12130
31	Simplice		F	4.0	23.491308	0.460046	0.424429	2	30/03/1837	30/03/1842	14518
29	Banastatos		M	4.0	22.916667	0.487443	0.434824	2	22/02/1836	22/02/1841	14114
62	Couferrier		M	4.0	14.020596	0.487443	0.401099	3	23/01/1842	23/01/1847	16276
70	Cloquecous		M	3.0	13.856142	0.518365	0.463235	1	01/06/1834	01/06/1839	13485
68	Gaudemier		M	3.0	12.95138	0.522831	0.467949	1	12/12/1830	12/12/1835	12217
69	Babette		M	3.0	12.95138	0.522831	0.467949	1	22/04/1835	22/04/1840	13810
71	Monsieur		M	3.0	10.540415	0.513699	0.463235	1	15/05/1829	15/05/1834	96167
43	Rahoul		M	4.0	5.538562	0.476027	0.394595	3	08/08/1840	08/08/1845	11746
63	Joly					0.476027	0.394595	3	22/04/1844	22/04/1849	17097
99	Combeferre					0.469178	0.392473	3	18/02/1844	18/02/1849	17032
81	Frédéric					0.469178	0.392473	3	22/04/1843	22/04/1848	16752
75	Brutus					0.437215	0.380208	1	09/02/1832	09/02/1837	12640
50	Magnon					0.365297	0.337963	2	18/10/1839	18/10/1844	15480
66	Grantaire		M	4.0	0.428371	0.437215	0.361386	3	07/06/1841	07/06/1846	16047
1	Nephtalim		M	5.0	0.0	0.328082	0.305439	0	18/10/1818	18/10/1824	44671
2	Madame Thenardier		F	4.0	0.0	0.450913	0.41954	0	14/07/1822	14/07/1827	45671
3	Madame Thenardier		F	4.0	0.0	0.450913	0.41954	0	04/05/1826	04/05/1831	47061
4	Countess De La		F	5.0	0.0	0.328082	0.305439	0	28/02/1822	28/02/1827	45532
5	Lebrun		F	5.0	0.0	0.328082	0.305439	0	01/01/1827	01/01/1832	47200
6	Champerdier		M	5.0	0.0	0.328082	0.305439	0	14/03/1818	14/03/1823	44818

Figure 6. Merge columns

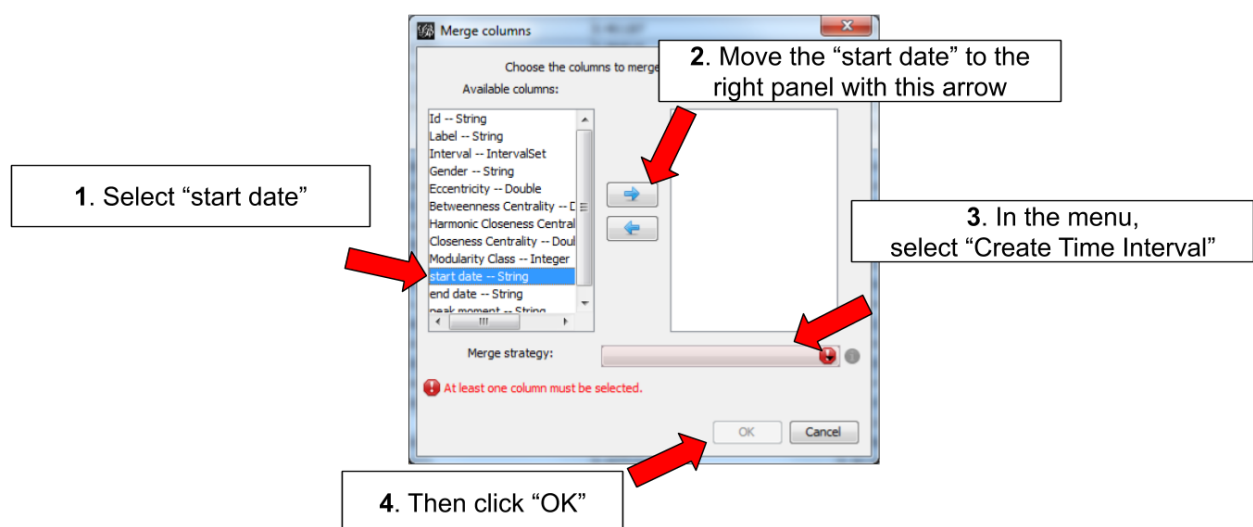


Figure 7. Set up the parameters - 1

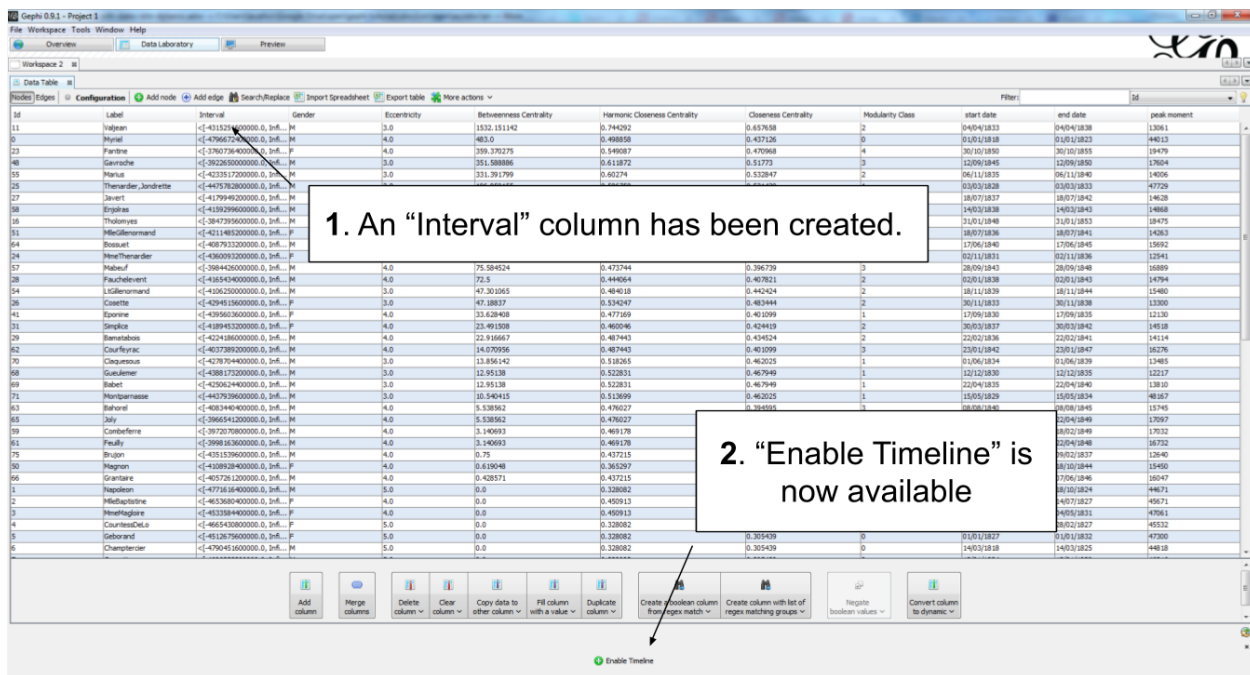


Figure 8. Result

Let's switch back to the Overview to see the graph and how it evolves in time.

## IMPORTANT

We are going to use the timeline to play the animation. The timeline has many features which are explained in a specific tutorial.

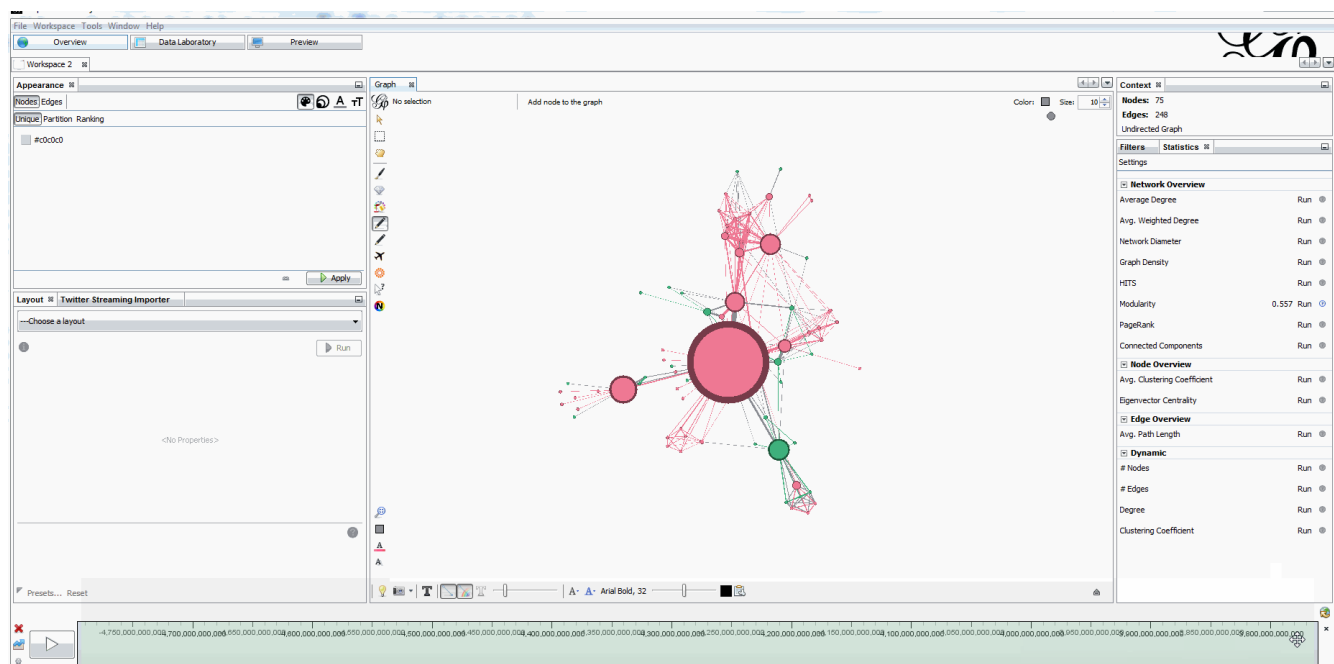


Figure 9. Animating the dynamic network

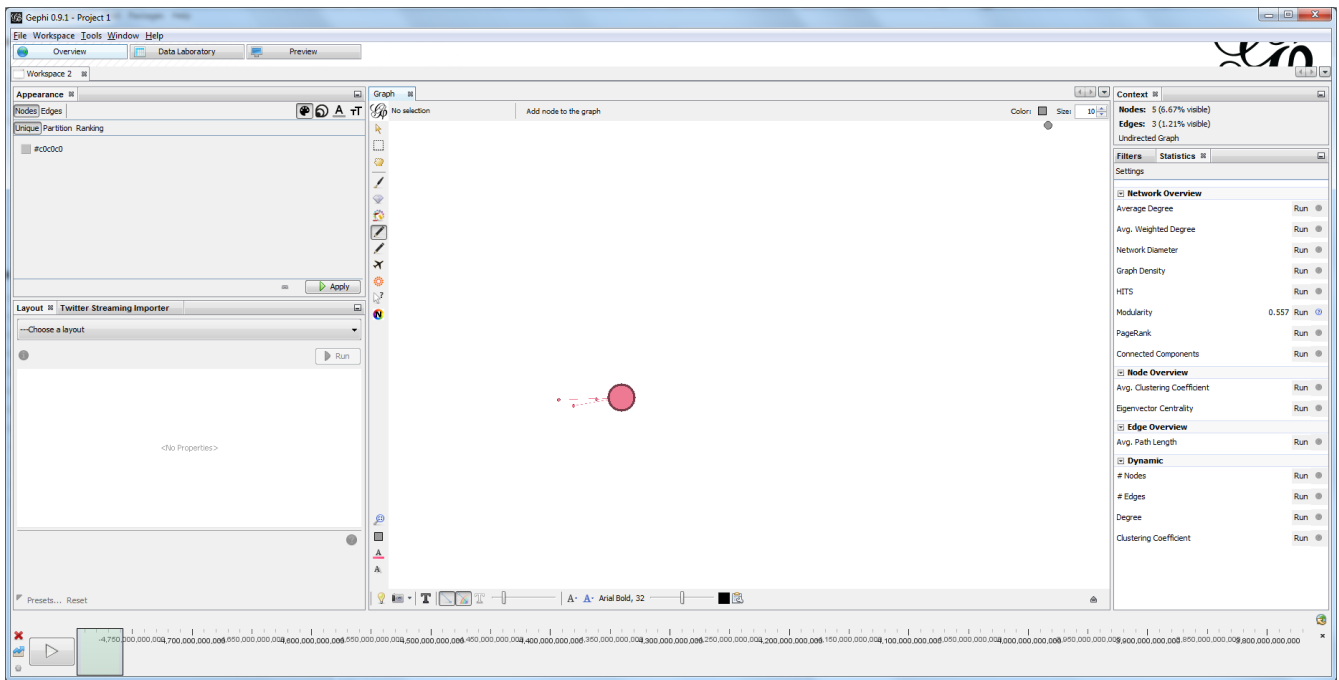


Figure 10. Animating the dynamic network

view online animation - link: <https://tinyurl.com/gephi-tuto-5>

# to be continued

# more tutorials on dynamic networks with Gephi

- [The wiki on gephi.org](http://wiki.gephi.org)

# the end

Visit [the Gephi group on Facebook](#) to get help,

or visit [the website for more tutorials](http://seinecle.github.io/gephi-tutorials) ://seinecle.github.io/gephi-tutorials[the website for more tutorials] ://seinecle.github.io/gephi-tutorials[the website for more tutorials] ://seinecle.github.io/gephi-tutorials[the website for more tutorials] ://seinecle.github.io/gephi-tutorials[the website for more tutorials] ://seinecle.github.io/gephi-tutorials[the website for more tutorials]

[1] D. E. Knuth, The Stanford GraphBase: A Platform for Combinatorial Computing, Addison-Wesley, Reading, MA (1993)