

TECHNION – Israel Institute of Technology
The William Davidson Faculty of Industrial Engineering & Management

Center for Service Enterprise Engineering (SEE)

<https://seelab.net.technion.ac.il/>



SEEGraph Designer and SEEGraph Viewer

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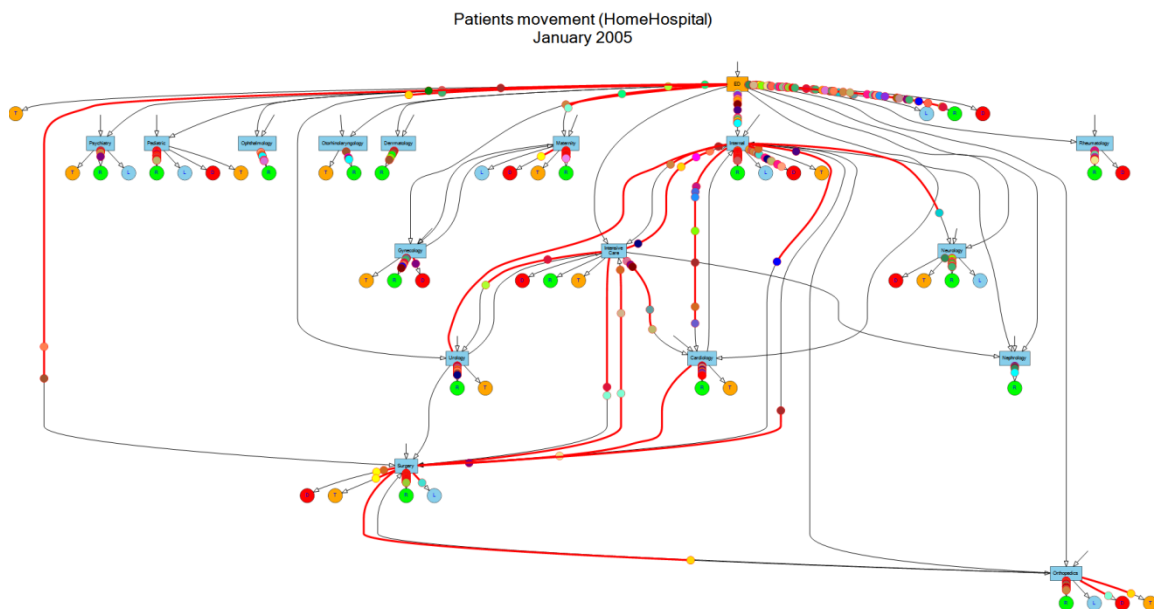
Part I SEEGraph: User Guide

1. *Before you start designing graphs, it is necessary to define first your user extension, if it was not defined yet. (See [Appendix 1](#), Creation of SEEStat user extension).*

2. *This is a beta version of SEEGraph 1.0. Special graph structures are not installed automatically. Please ask the SEELab team to prepare the needed structures.*

Design graph: Flow graph type (one node dimension)

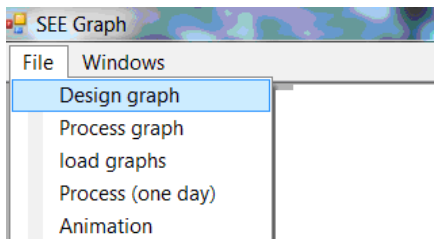
Patients Flow (flow animation), HomeHospital data



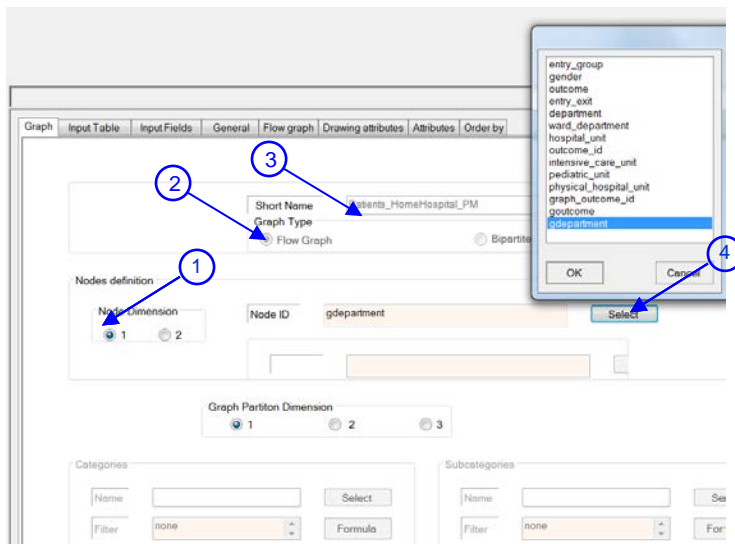
Example of data:

visit_details				
medical_id	department	entry_time	exit_time	outcome
20000310	1	1104833437	1104859349	2
20000310	39	1104859349	1105104780	7
20000312	1	1104782151	1104818427	2
20000312	37	1104818427	1104937200	7
20000321	1	1105004120	1105028039	2
20000321	43	1105028039	1105344000	3
20000321	46	1105344000	1105430400	3
20000321	43	1105430400	1105452720	7

Open SEEGraph 1.0. Select *File->Design graph*. Select the *HomeHospital* study. Click *OK*.

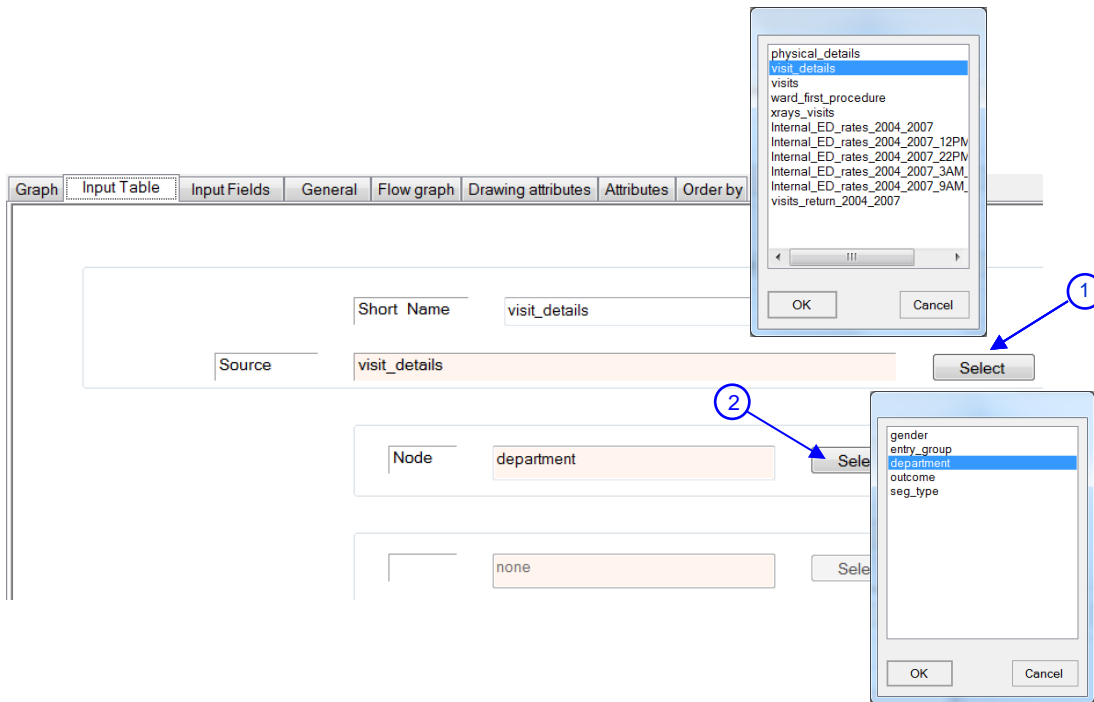


The Graph tab:



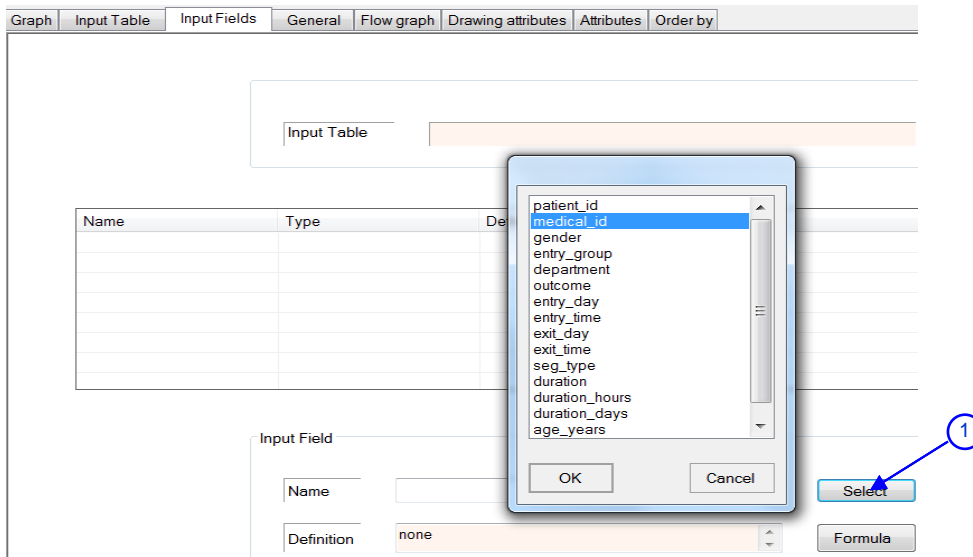
- (1) Node Dimension: 1 (default value)
- (2) Select graph type: *Flow Graph* (default value)
- (3) Fill graph short name: *Patients_HomeHospital_PM*
- (4) Select dictionary for Node ID: click on the *Select* button and select *gdepartment* dictionary, click OK.-> OK

The Input Table tab:



- (1) Click on the *Select* button (Source), select *database* and then select *visit_details* table, click OK.
- (2) Click on the *Select* button (Node) and select *department* field. Click OK.

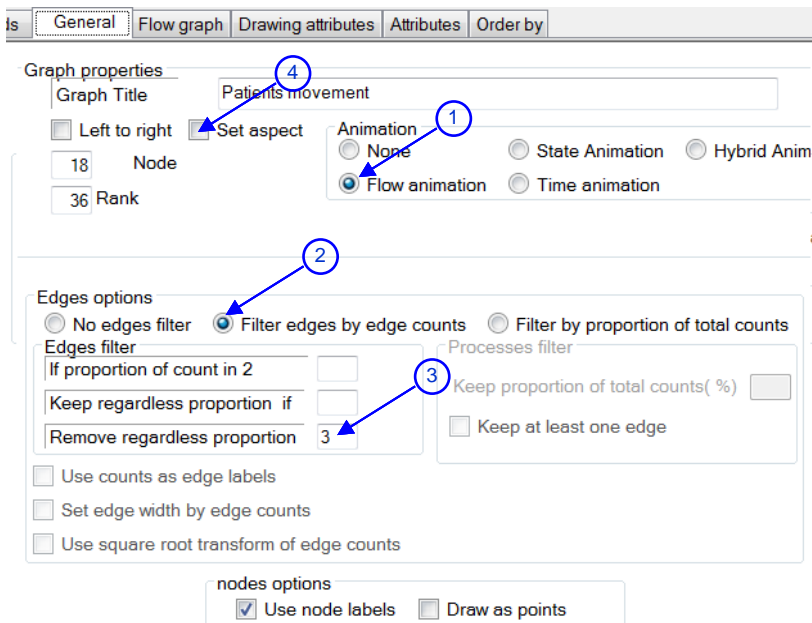
The Input Fields tab:



- (1) Click on the *Select* button and select *medical_id* field, click OK. In the same manner, select the following fields: *entry_time*, *outcome*, *exit_time*.

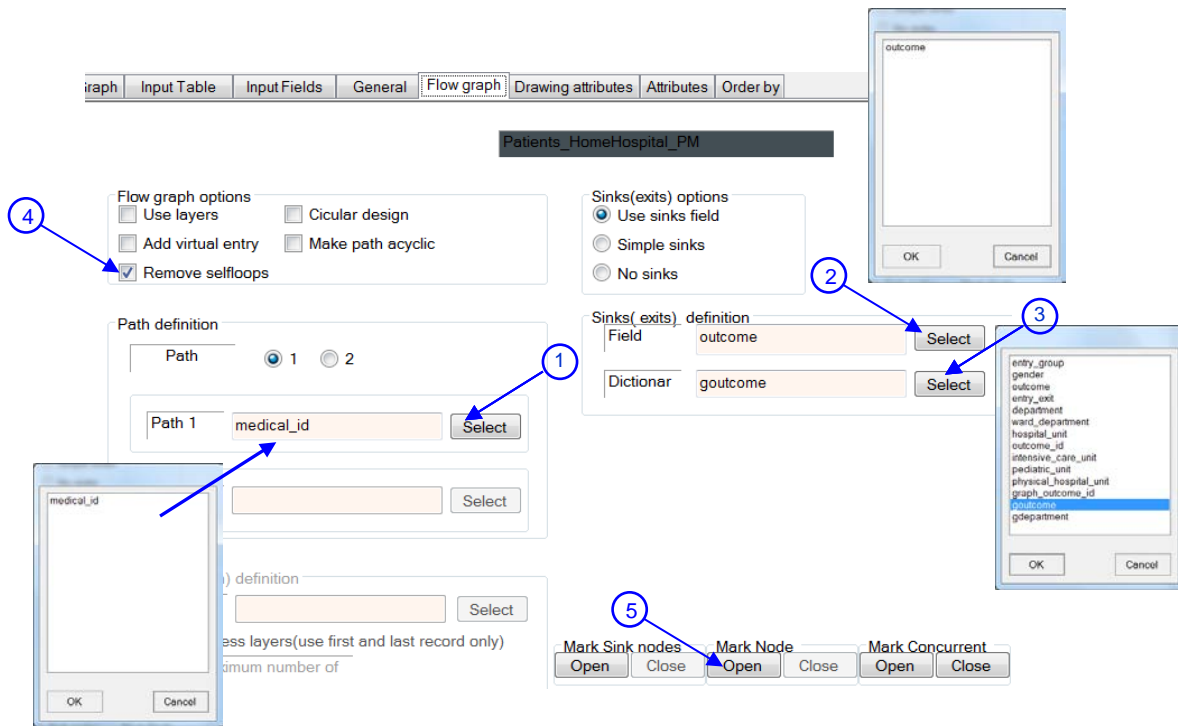
The General tab:

See detailed description of General tab in [Appendix 2](#).

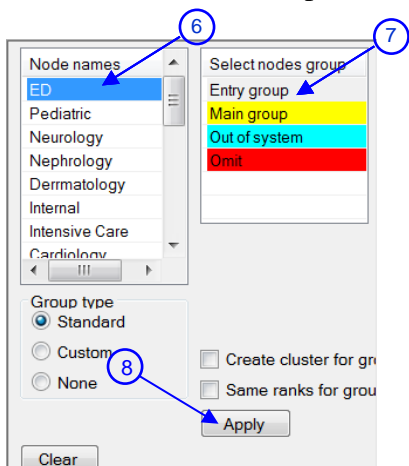


- (1) Select animation type: *Flow animation*
- (2) Select edges options : *Filter edges by edge count*
- (3) Remove regardless proportion if count < 3
- (4) *Set aspect* – full screen resolution

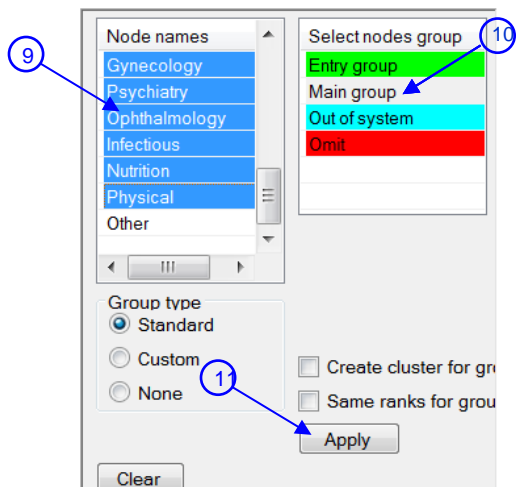
The Flow graph tab:



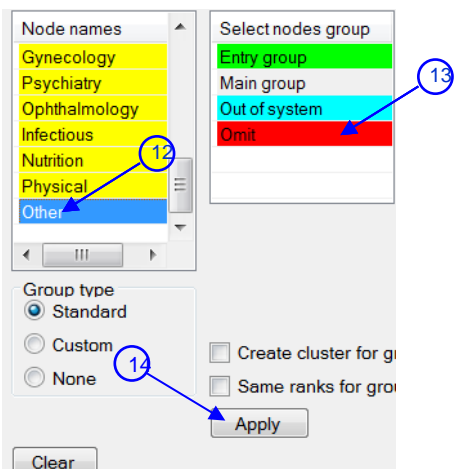
- (1) Select path definition by `medical_id`: click on the *Select* button, select `medical_id` field, and click OK.
- (2) Select field for sinks (exits) definition: click on the *Select* button, select `outcome` field, and click OK.
- (3) Select dictionary field for sinks (exits) definition: click on the *Select* button, select `goutcome` dictionary, and click OK.
- (4) In *Flow graph options* select *Remove self loops*.
- (5) In *Mark Node options* click on the *Open* button.



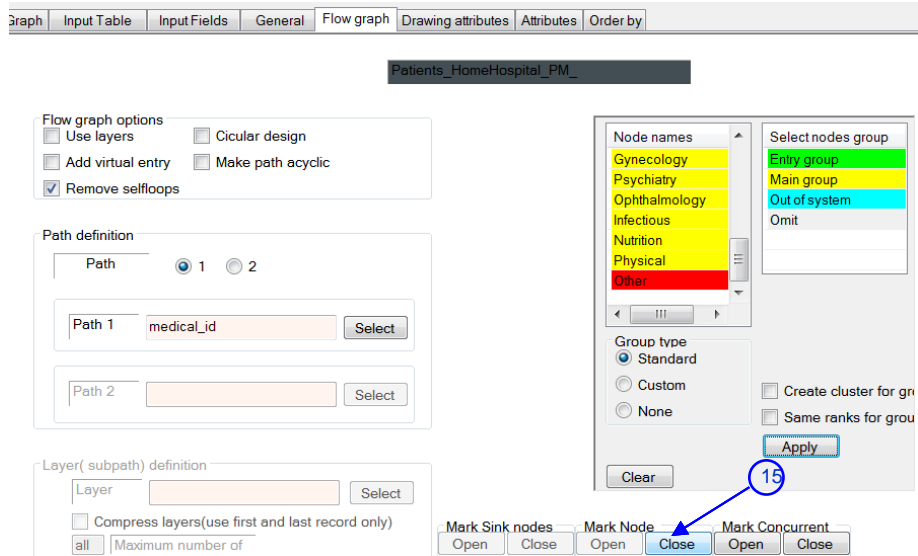
- (6) Select `ED` from the list of *Node names* (on the left side)
- (7) In *Select nodes group* (on the right side) select *Entry group*.
- (8) Click on the *Apply* button



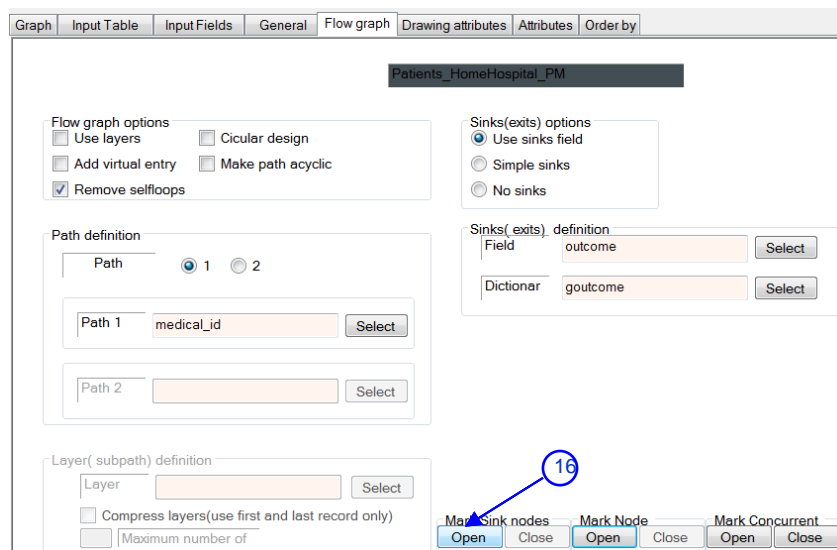
- (9) From the list of Node names (on the left side), select all departments except for *ED* and *Other*.
- (10) In *Select nodes group* (on right side), select *Main group*.
- (11) Click on the *Apply* button



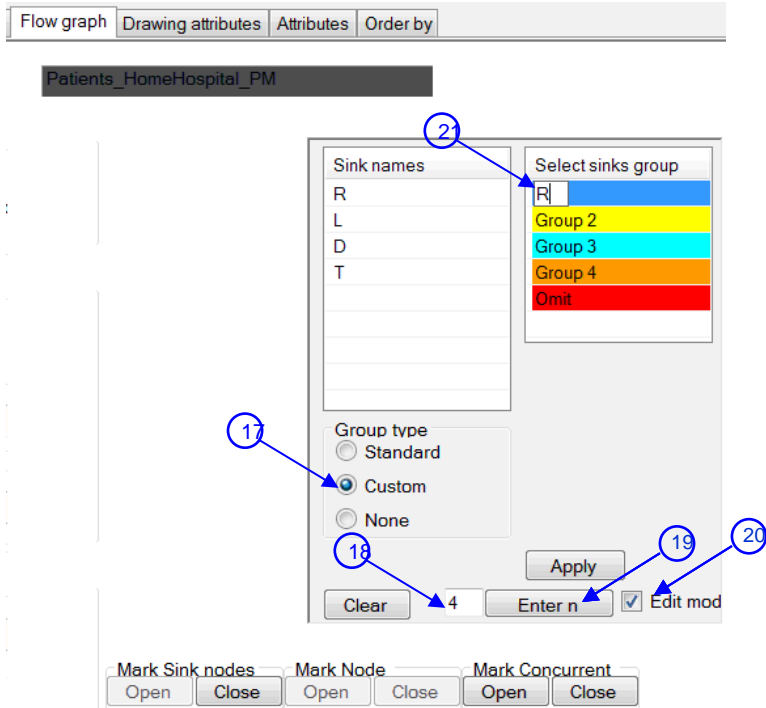
- (12) Select *Other* department from the list of *Node names* (on the left side)
- (13) In *Select nodes group* (on the right side), select *Omit*.
- (14) Click on the *Apply* button.



(15) Click on the *Close* button in *Mark Node* options.



(16) Click on the *Open* button in *Mark Sink nodes* options.



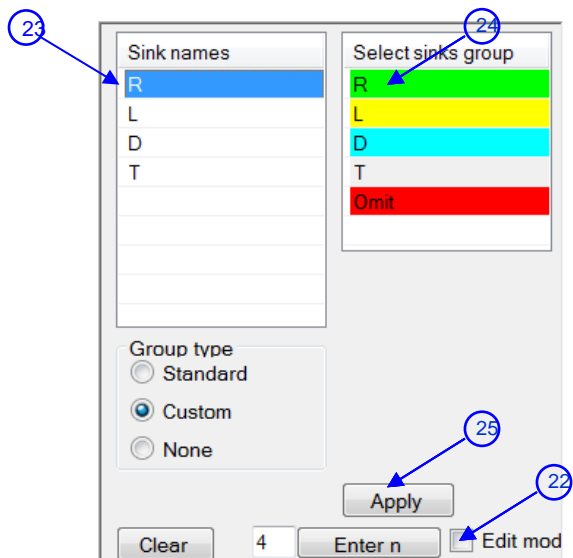
(17) Select group type: *Custom*

(18) Write 4 (group)

(19) Click the *Enter n* button.

(20) Select *Edit mode*.

(21) Rename *Group 1* as *R*, in the same manner, rename the other groups: Group 2 as *L*, Group 3 as *D*, and Group 4 as *T*.



(22) Uncheck *Edit mode*.

(23) In the *Sinks names* list select *R*.

(24) In *Select sinks group* select *R*.

(25) Click on the *Apply* button. Select the other sinks groups in the same manner.
















The Drawing attributes tab:

See detailed description of Drawing attributes tab in section: [3 Edit Graph: Drawing attributes tab.](#)

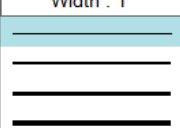
Table	Input Fields	General	Flow graph	Drawing attributes	Attributes	Order by
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Nodes drawing attributes(Entry group)

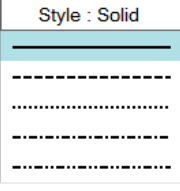
Shape: Rectangle


			
			
			
			None

Width : 1




Style : Solid



Line color 

☒ Fill nodes

Fill color 

Label

Node types

☒ State nodes

☐ Sink nodes

Select nodes group

Entry group
Main group
Out of system

Select sinks group

R
L
D
T

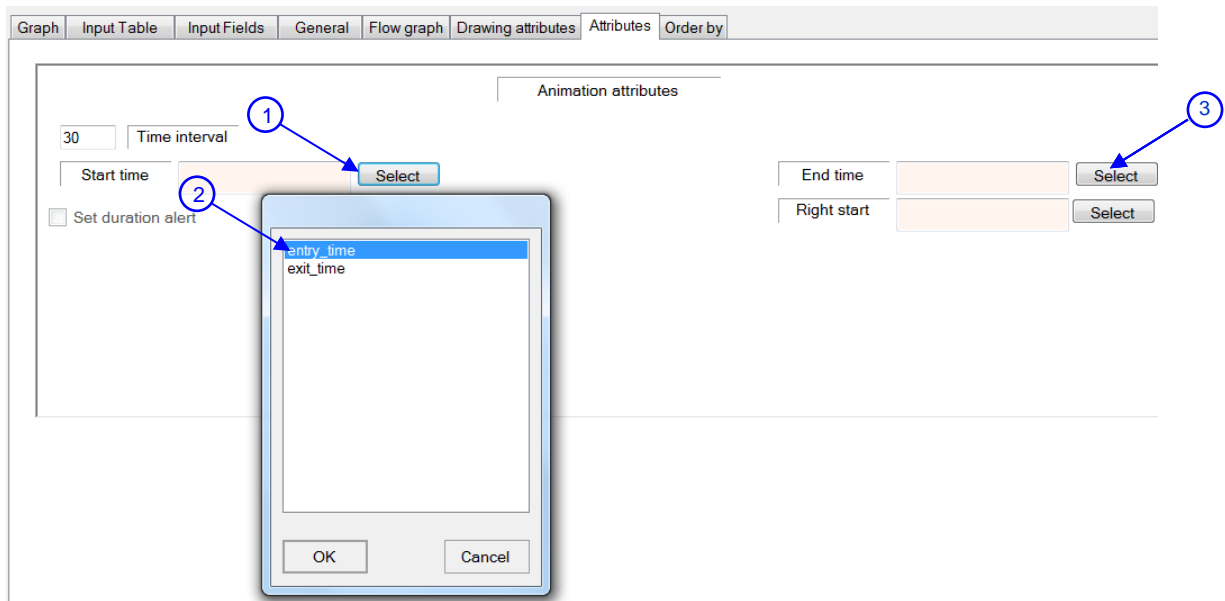
Nodes

Edges

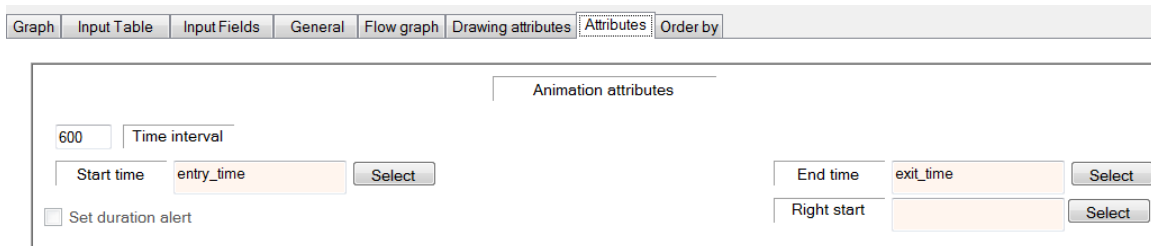
Clusters

Graph

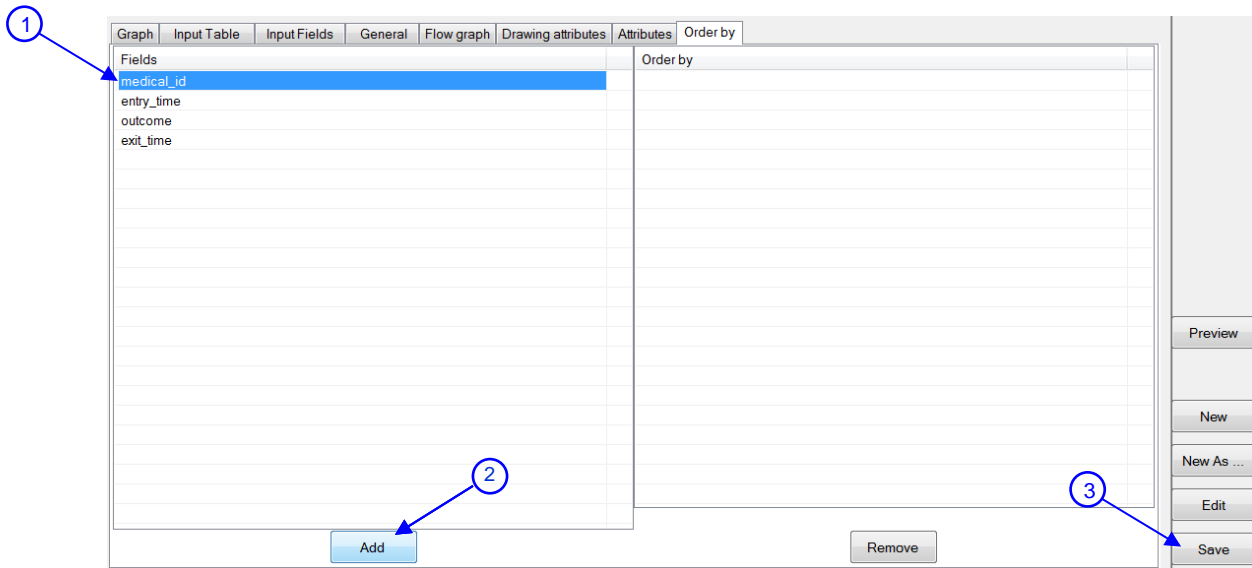
The Attributes tab:



- (1) Start time selection: click on the *Select* button (on the left side).
- (2) Select *entry_time*, click OK.
- (3) End time selection: click on the *Select* button (on the right side) and select *exit_time*, click OK.



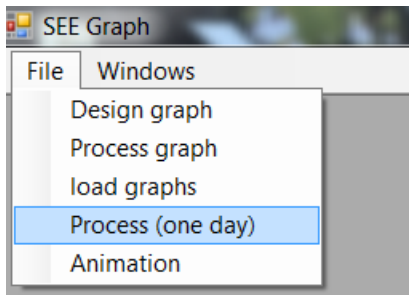
The Order by tab:



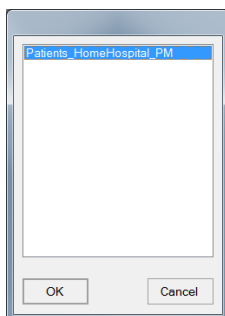
- (1) Select *medical_id* field
- (2) Click on the *Add* button. Select the *entry_time* field in the same manner.
- (3) Click on the *Save* button.

Reopen SEEGraph 1.0.

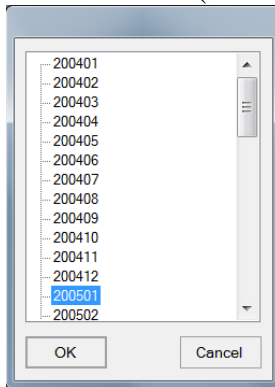
Select *File->Process (one day)*. Select the *HomeHospital* study. Click *OK*.



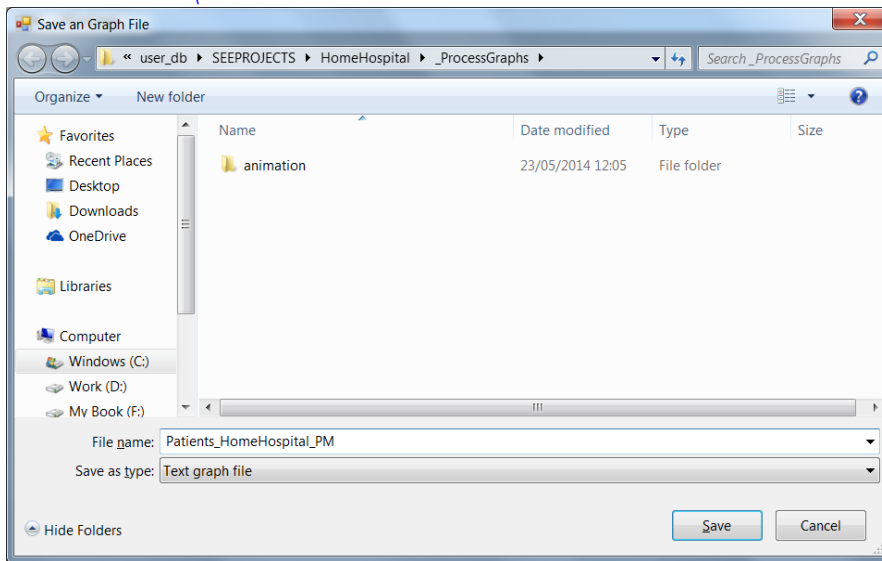
Select *Patients_HomeHospital_PM* graph, click *OK*.



Select *200501* (January 2005), click OK.



Save file in **C:\animation**. Fill the text file name and click Save.

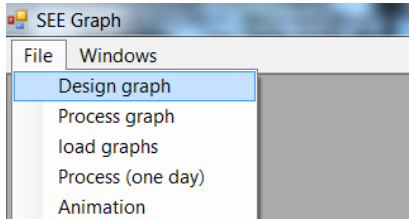


Open *SEEGraph View 1.0*.

Select *File->Open*. Select *Patients_HomeHospital_PM.txt* file from *C:\animation*. Click on the *Open* button.

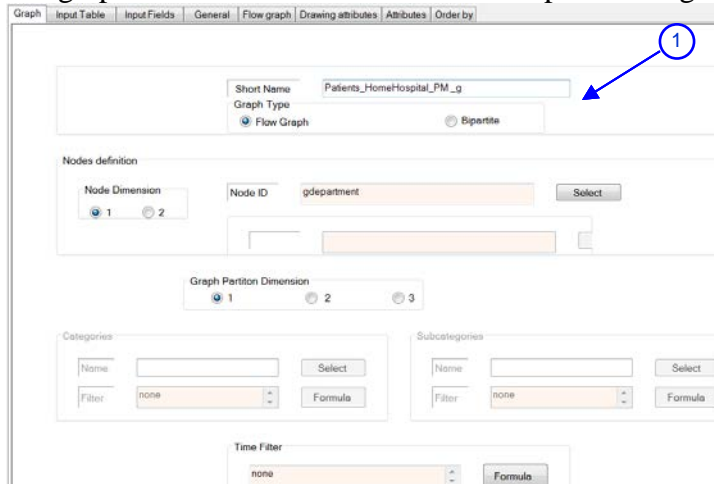
Design Graph: New AS option

Open SEEGraph 1.0. Select *File->Design graph*. Select the *HomeHospital* study. Click *OK*.

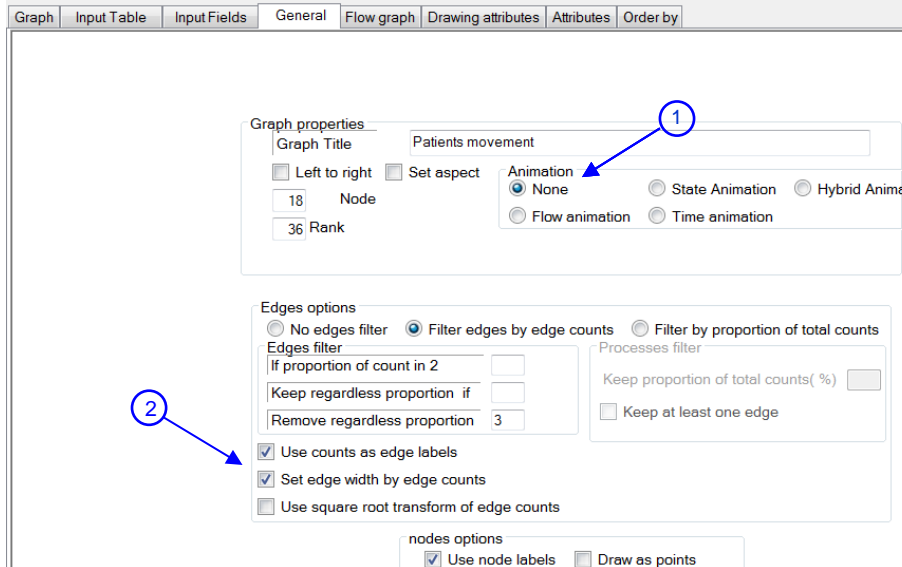


Click on the *New As* button. Select *Patients_HomeHospital_PM* graph. Click *OK*.

Fill graph short name: *Patients_HomeHospital_PM_g* in *Graph* tab.



In the *General* tab: (1) Select without animation option: *None*
(2) Select edges options: *Use counts as edge labels* and *Set edge width by edge counts*.



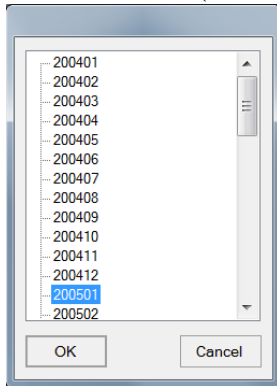
Click *Save* button.

Reopen SEEGraph 1.0.

Select *File->Process (one day)*. Select the *HomeHospital* study. Click *OK*.

Select *Patients_HomeHospital_PM_g* graph, click *OK*.

Select *200501* (January 2005), click *OK*.

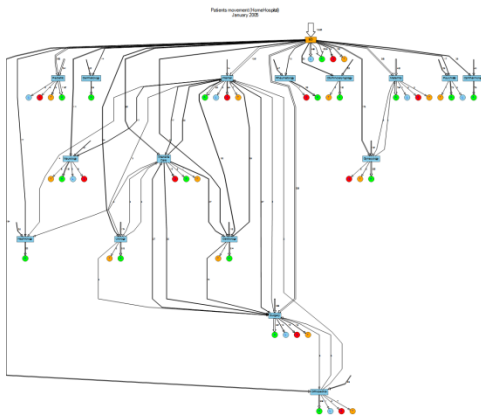


Save file in [C:\ animation](#). Fill the text file name and click *Save*.

Open SEEGraph View 1.0.

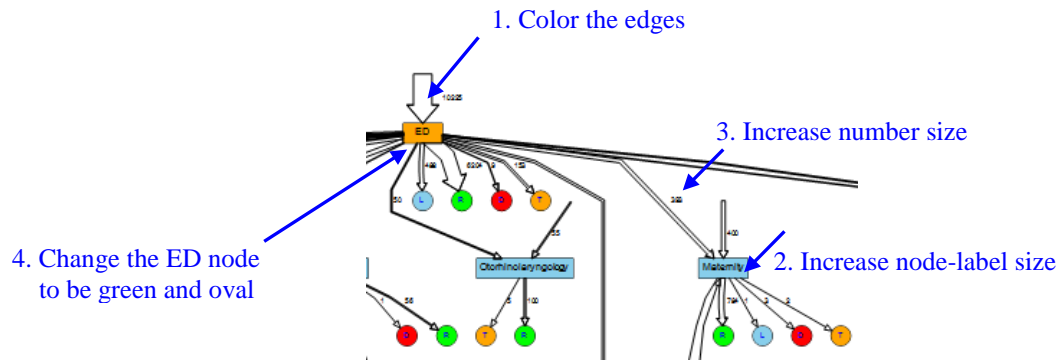
Select *File->Open*. Select *Patients_HomeHospital_PM_g.txt* file from *C:\ animation*.

Click on the *Open* button.



Edit Graph: Drawing attributes tab

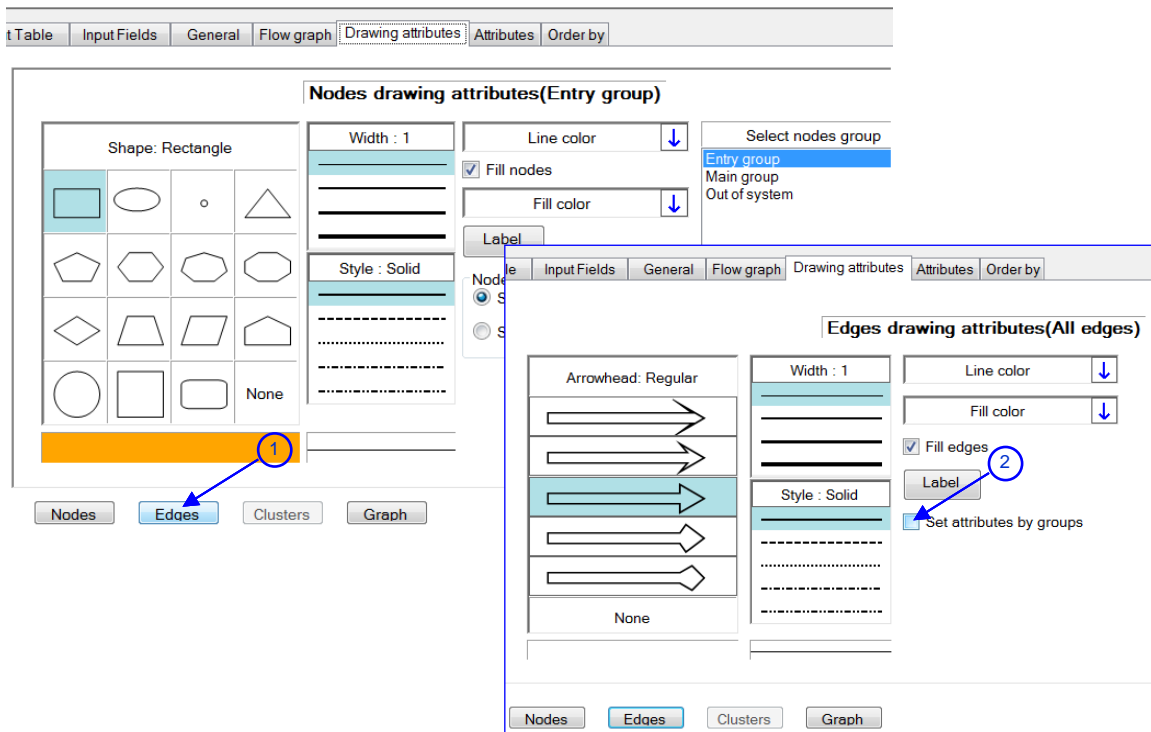
Edit tasks:



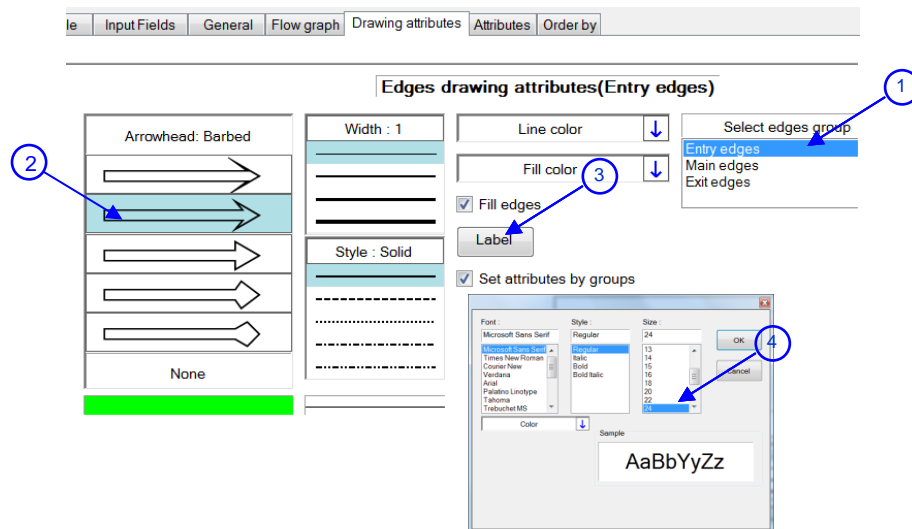
Open SEEGraph 1.0. Select *File->Design graph*. Select the *HomeHospital* study. Click *OK*.

Click on the *Edit* button. Select *Patients_HomeHospital_PM_g* graph. Click *OK*.

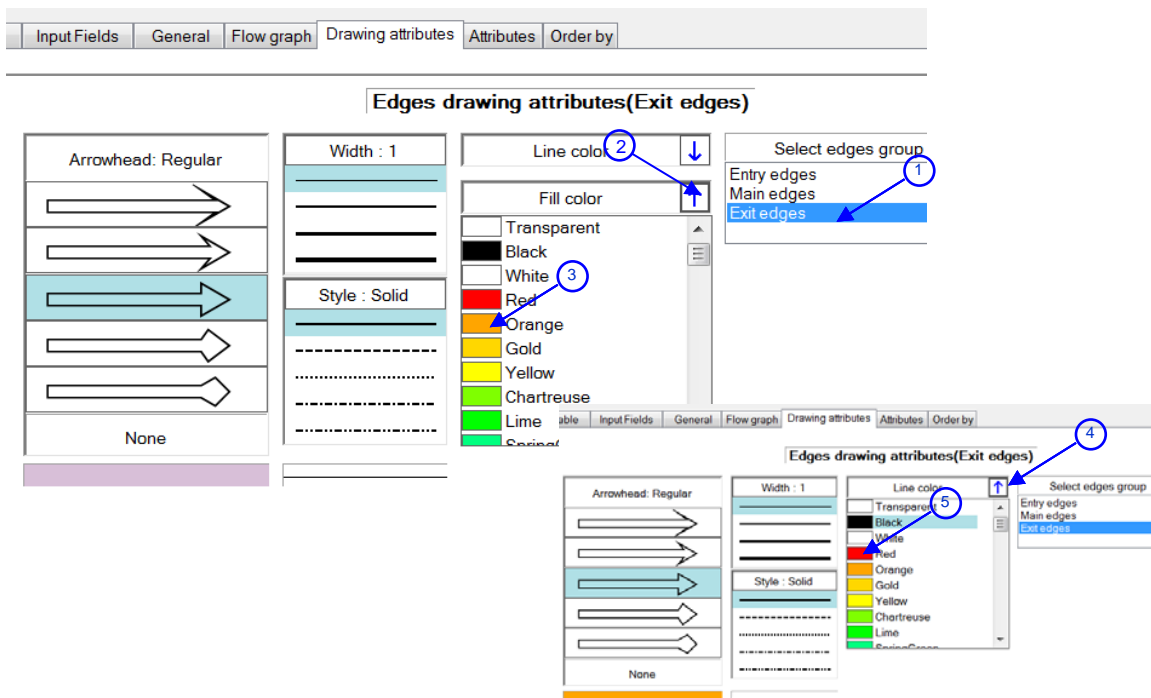
Open the *Drawing attributes* tab.



- (1) Click on the *Edges* button.
- (2) Select *Set attributes by groups*.

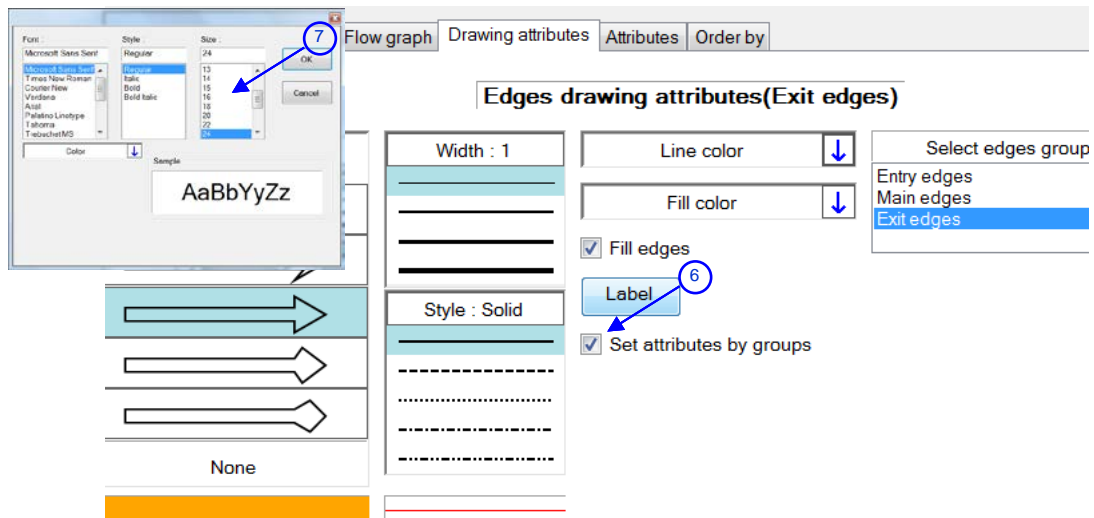


- (1) Select edge group: *Entry edges*
- (2) Select arrowhead: *Barbed*
- (3) Click on the *Label* button
- (4) Select font size: 24. Click OK. Change the font size for the *Main edges* group in the same manner.

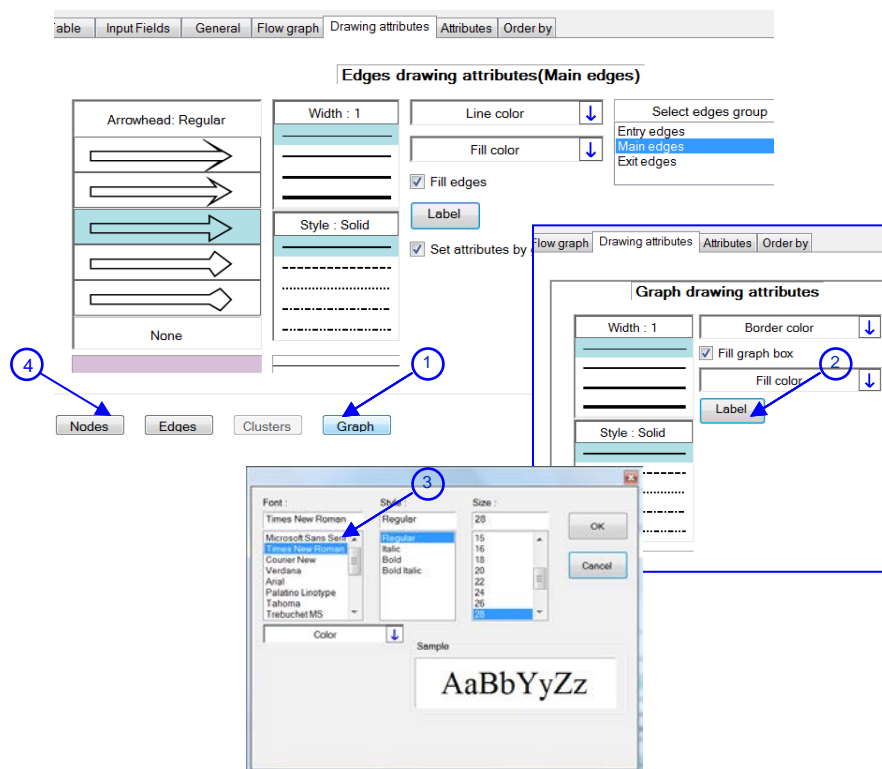


- (1) Select edge group: *Exit edges*
- (2) Click on the arrow in *Fill color*.

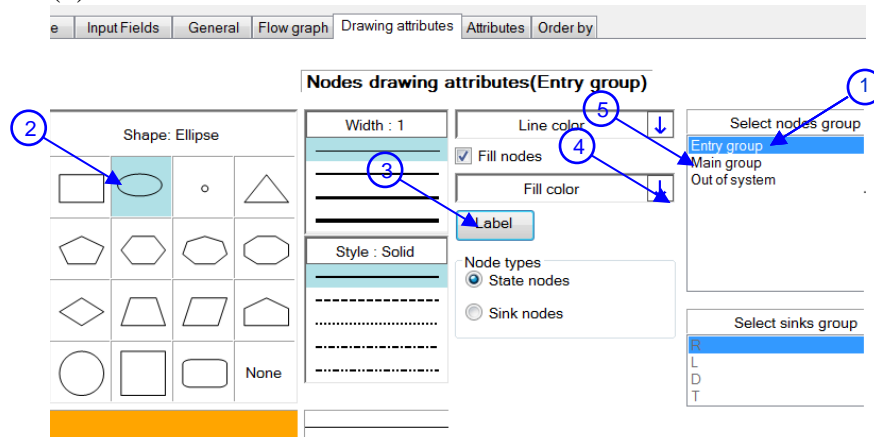
- (3) Click on the orange color.
- (4) Click on the arrow in *Line color*
- (5) Click on the red color.



- (6) Click on the *Label* button
- (7) Select font size: 24. Click OK.



- (1) Click on the *Graph* button
- (2) Click on the *Label* button
- (3) Select *Times New Roman* font. Click OK.
- (4) Click on the *Nodes* button.



- (1) Select nodes group: *Entry group*.
- (2) Select node shape: *Ellipse*.
- (3) Click on the *Label* button and select font size 24. Click OK.
- (4) Click on the arrow in *Fill color*, and select the lime color.
- (5) Select node group: *Main group*. Change font size to 34.

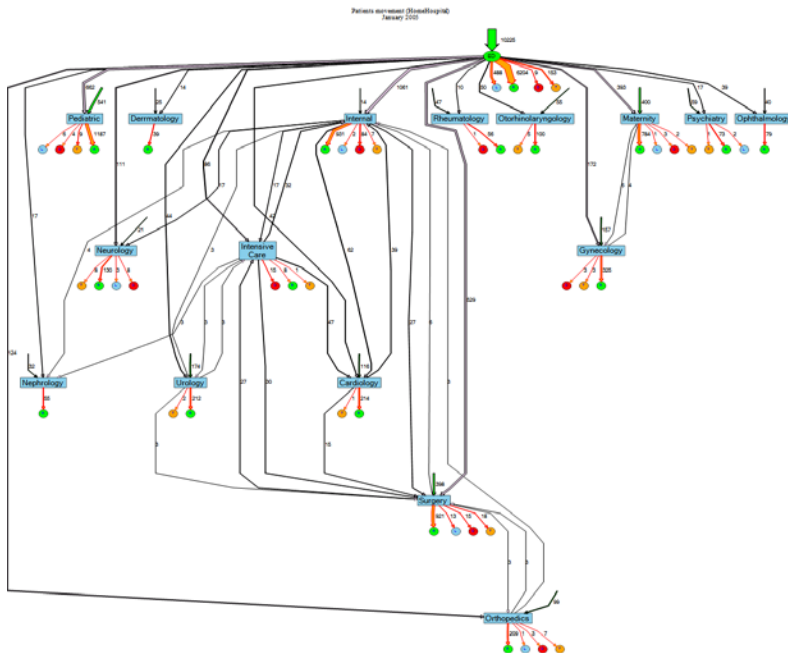
Save graph.

Reopen SEEGraph 1.0 and process graph.

Save file in [C:\ animation](#). Name the text file *Patients_HomeHospital_PM_g_edited.txt* and click Save.

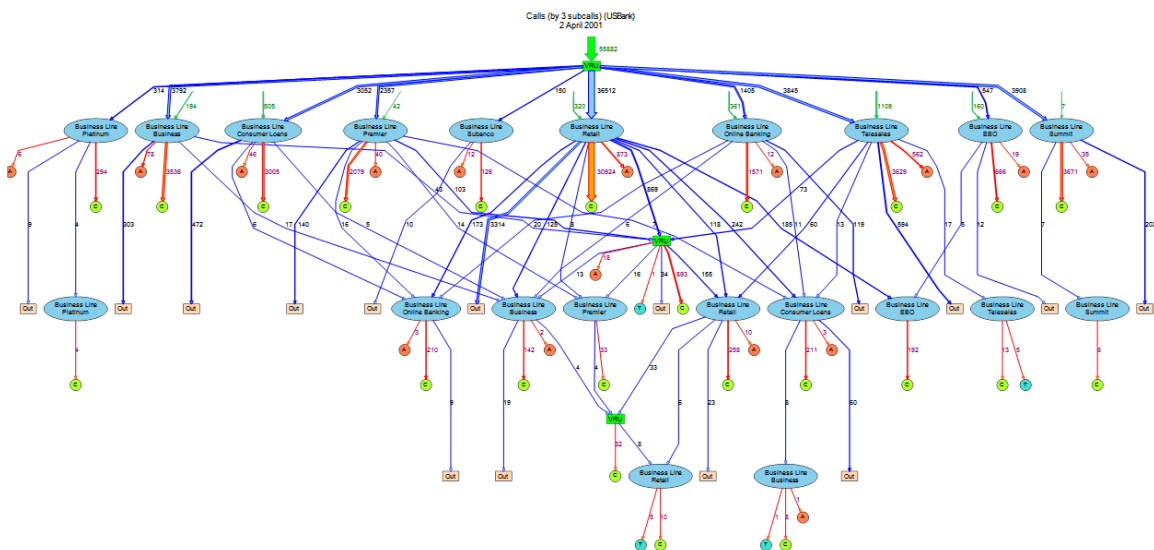
Open *SEEGraph View 1.0*.

Select *File->Open*. Select *Patients_HomeHospital_PM_g_edited.txt* file from [C:\ animation](#). Click on the *Open* button.



Design graph: Flow graph type (two node dimension)

Calls Flow (USBank data)



Example of data:

cust_subcalls table					
call_id	segment_start	cust_subcall	service	service_group	outcome
457260248	986255571	1	1	1	22
457260248	986255641	1	1	3	20
457260248	986255671	1	1	2	22
457260248	986255872	2	1	1	22

cust_subcalls table					
call_id	segment_start	cust_subcall	service	service_group	outcome
457260248	986256031	2	1	3	20
457260248	986256099	2	1	2	22
457260248	986256373	3	1	1	22
457260248	986256778	3	1	3	20
457260248	986256845	3	1	2	1
457260259	986255591	1	1	1	22
457260259	986255710	1	1	3	20
457260259	986255768	1	1	2	2
457260263	986255593	1	8	3	20
457260263	986255640	1	8	2	22
457260263	986256046	2	8	2	1
457260264	986255595	1	1	1	22
457260264	986255732	1	1	3	20
457260264	986255768	1	1	2	1

The Graph tab:

The screenshot shows the 'Graph' tab configuration interface. At the top is a horizontal menu with tabs: 'Graph', 'Input Table', 'Input Fields', 'General', 'Flow graph', 'Drawing attributes', 'Attributes', and 'Order by'. The 'Graph' tab is active. Below the menu, the configuration is organized into several sections. The first section contains a 'Short Name' text field with the value 'flow_subcalls' (annotated with a blue circle 2) and a 'Graph Type' section with two radio buttons: 'Flow Graph' (selected, annotated with a blue circle 1) and 'Bipartite Graph'. The 'Nodes definition' section follows, containing a 'Node Dimension' section with radio buttons for '1' and '2' (radio '2' is selected, annotated with a blue circle 3), a 'Group ID' text field with the value 'service_group_flow', and a 'Select' button (annotated with a blue circle 4). Below this is a 'Node ID' text field with the value 'service' and another 'Select' button (annotated with a blue circle 5). A 'Graph Partition Dimension' section has three radio buttons for '1', '2', and '3', with '1' selected. The bottom section is divided into 'Categories' and 'Subcategories', each with 'Name' and 'Filter' text fields and 'Select' and 'Formula' buttons. A 'Time Filter' section at the very bottom has a 'Filter' text field and a 'Formula' button.

- (1) Select graph type: *Flow Graph* (default value)
- (2) Fill graph short name: *flow_subcalls*
- (3) Select node dimension 2.
- (4) Select dictionary for Group ID: click on the *Select* button and select *service_group_flow* dictionary, click OK.-> OK
- (5) Select dictionary for Node ID: click on the *Select* button and select *service* dictionary, click OK.-> OK

The Input Table tab:

Graph **Input Table** Input Fields General Flow graph Drawing attributes Attributes Order by

Short Name

Source Table

Group ID

Node ID

Categories Field

SubCategories Field

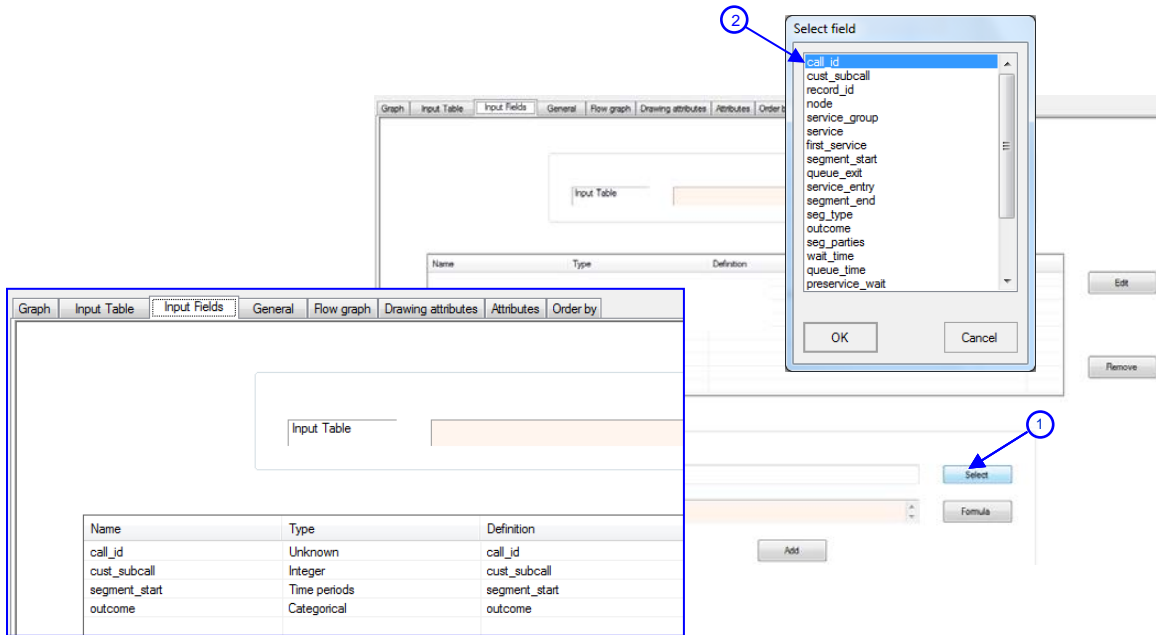
Time Filter Field

Where

Where

- (1) Click on the *Select* button (Source), select *database* and then select *cust_subcalls* table, click OK.
- (2) Click on the *Select* button (Group ID) and select *service_group* field. Click OK.
- (3) Click on the *Select* button (Node ID) and select *service* field. Click OK.
- (4) Click on the *Formula* button and fill formula: *service <> 10 or (service = 10 and service_group <> 5)*(see [Appendix 5 How to type formulas in SEESat](#))

The Input Fields tab:



- (1) Click on the *Select* button.
- (2) Select *call_id* field, click OK. In the same manner, select the fields: *cust_subcall*, *segment_start*, *outcome*.

The General tab:

See detailed description of General tab in [Appendix 2](#).

The screenshot shows the 'General' tab of a graph visualization tool. The interface includes tabs for 'General', 'Flow graph', 'Drawing attributes', 'Attributes', and 'Order by'. The 'General' tab is selected.

Graph properties

- Graph Title: *Calls (by 3 subcalls)* (1)
- ☐ Left to right
- ☐ Set aspect (2)
- Node separation: 18
- Rank separation: 36
- Animation**
 - ☒ None
 - ☐ State Animation
 - ☐ Hybrid Animation
 - ☐ Flow animation
 - ☐ Time animation

Edges options

- ☐ No edges filter
- ☒ Filter edges by edge counts (3)
- ☐ Filter by proportion of total counts (4)
- Edges filter**
 - If proportion of count in 2 nodes volume < 0.02
 - Keep regardless proportion if count > 30
 - Remove regardless proportion if count < 4
- ☒ Use counts as edge labels
- ☒ Set edge width by edge counts
- ☒ Use square root transform of edge counts

Processes filter

- Keep proportion of total counts(%)
- ☐ Keep at least one edge

nodes options

- ☒ Use node labels
- ☐ Draw as points

- (1) Fill graph title: *Calls (by 3 subcalls)*
- (2) Graph without animation: select *None*
- (3) Select edges options : *Filter edges by edge count*
- (4) Fill edges filters as presented in the picture.

The Flow graph tab:

The screenshot shows the 'Flow graph' tab of a software interface. The tabs at the top are: Graph, Input Table, Input Fields, General, Flow graph, Drawing attributes, Attributes, and Order by. The 'Flow graph' tab is active. A dark grey bar at the top of the main area contains the text 'flow_subcalls'.

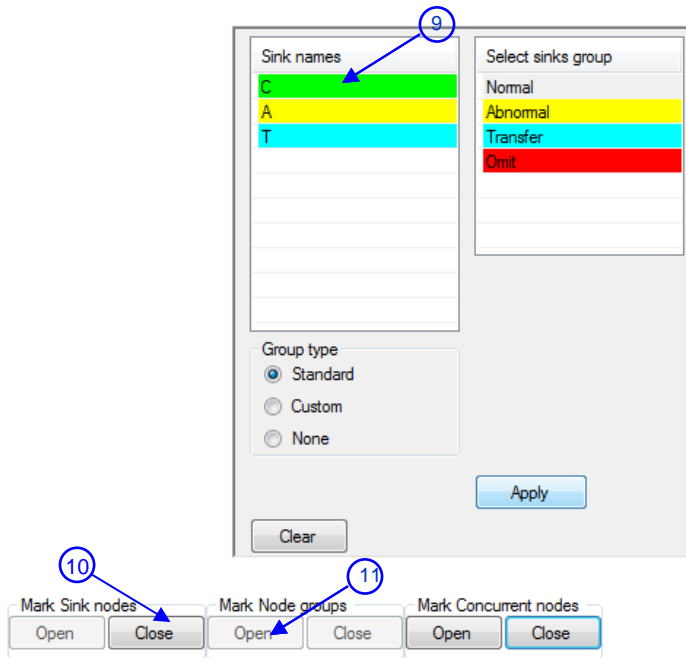
Numbered callouts point to the following elements:

- 2**: Points to the 'Flow graph options' section, specifically the 'Use layers' checkbox which is checked.
- 3**: Points to the 'Layer (subpath) definition' section, specifically the 'Select' button next to the 'Layer' field.
- 4**: Points to the 'Compress layers(use first and last record only)' checkbox which is checked.
- 5**: Points to the 'Maximum number of layers' input field, which contains the value '3'.
- 6**: Points to the 'Sinks(exits) options' section, specifically the 'Use sinks field' radio button which is selected.
- 7**: Points to the 'Field' input field in the 'Sinks(exits) definition' section, which contains the text 'outcome'.
- 8**: Points to the 'Mark Sink nodes' button in the bottom right section.

Other visible elements include:

- Path definition**: 'Path dimension' with radio buttons for '1' (selected) and '2'. 'Path 1' has a text field with 'call_id' and a 'Select' button. 'Path 2' has an empty text field and a 'Select' button.
- Sinks(exits) definition**: 'Dictionary' field with 'flow_outcome' and a 'Select' button.
- Bottom right section**: Three groups of buttons: 'Mark Sink nodes' (Open, Close), 'Mark Node groups' (Open, Close), and 'Mark Concurrent nodes' (Open, Close). The 'Close' button for 'Mark Concurrent nodes' is highlighted with a blue dashed border.

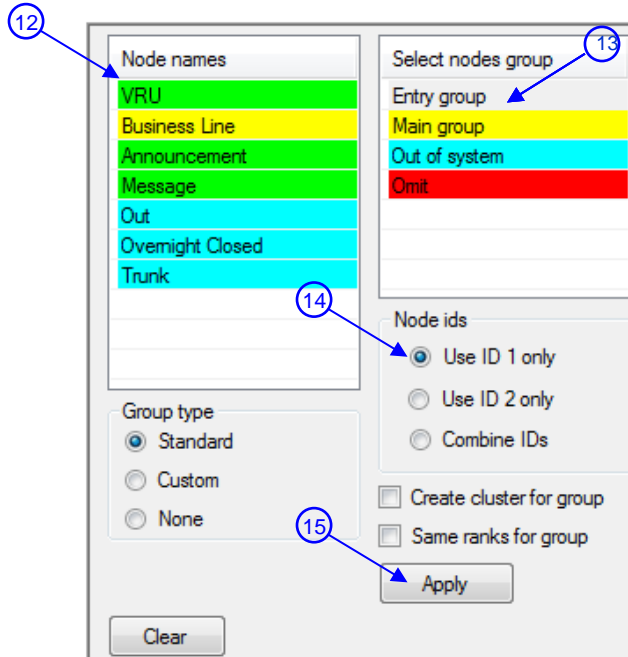
- (1) Select path definition: click on the *Select* button (Path 1), select *call_id* field and click OK.
- (2) Select *Use layers*.
- (3) Define layer (sub path) field: click on the *Select* button, select *cust_subcall* field. Click OK.
- (4) Select *Compress layers use first and last record only*
- (5) Maximum number of layers = 3
- (6) From Sinks (exits) options select *Use sinks field*.
- (7) Define sink field: *outcome* and sink dictionary *flow_outcome*.
- (8) Click on the *Mark Sink nodes* button.



(9) Apply sinks in groups: define *C* as *Normal* group, *A* as *Abnormal* group, and *T* as *Transfer* group.

(10) Close Mark Sink nodes panel.

(11) Open Mark Node groups panel

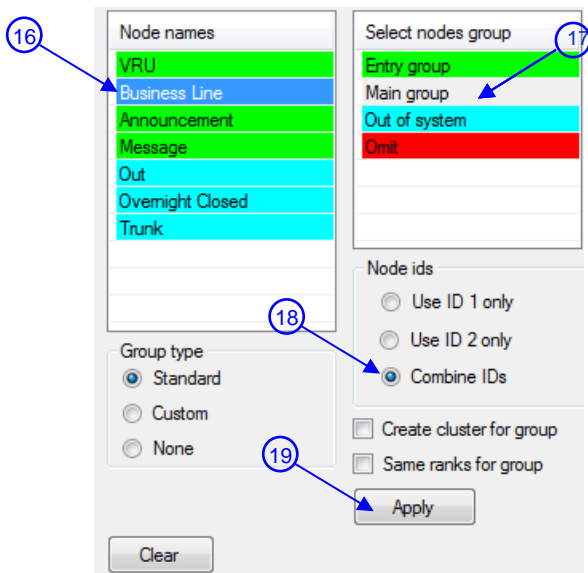


(12) Select nodes: *VRU*, *Announcement*, *Message* (on the left side)

(13) Select *Entry group* (on the right side)

(14) Select *Use ID 1 only*.

(15) Click on the *Apply* button.

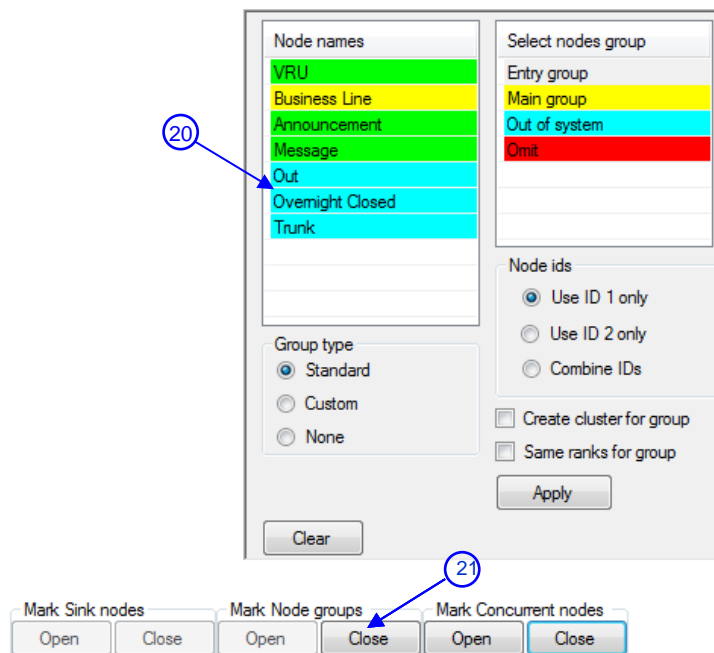


(16) Select *Business Line* node (on the left side)

(17) Select *Main group* (on the **right** side)

(18) Select *Combine IDs*.

(19) Click on the *Apply* button.



(20) In the same manner, apply the nodes: *Out*, *Overnight Closed*, and *Trunk* to the *Out of system* group, with *Use ID 1 only*.
















(21) Close *Mark node groups* panel.

The Drawing attributes tab:


Fields General Flow graph **Drawing attributes** Attributes Order by

Nodes drawing attributes(Entry group)


Shape: Rectangle

			
			
			
			None

Width : 1

Line color 

☒ Fill nodes

Fill color 

Label font

Style : Solid

Node types

☒ State nodes

☐ Sink nodes

Select nodes group

Entry group
Main group
Out of system

Select sinks group

Normal
Abnormal
Transfer

Nodes Edges Clusters Graph

The Order by tab:

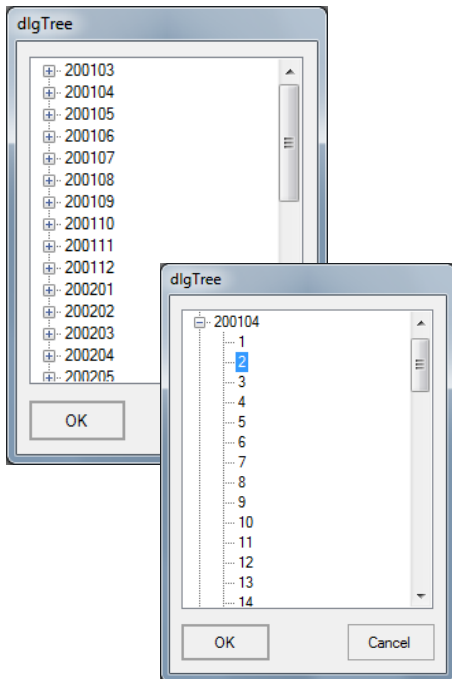
Graph	Input Table	Input Fields	General	Flow graph	Drawing attributes	Attributes	Order by
Fields							Order by
call_id							call_id
cust_subcall							segment_start
segment_start							
outcome							

Reopen SEEGraph 1.0.

Select *File->Process (one day)*. Select the *USBank* study. Click *OK*.

Select *flow_subcalls* graph, click *OK*.

Select *200104* (April 2001), and select 2 (2 April, 2001), click OK.



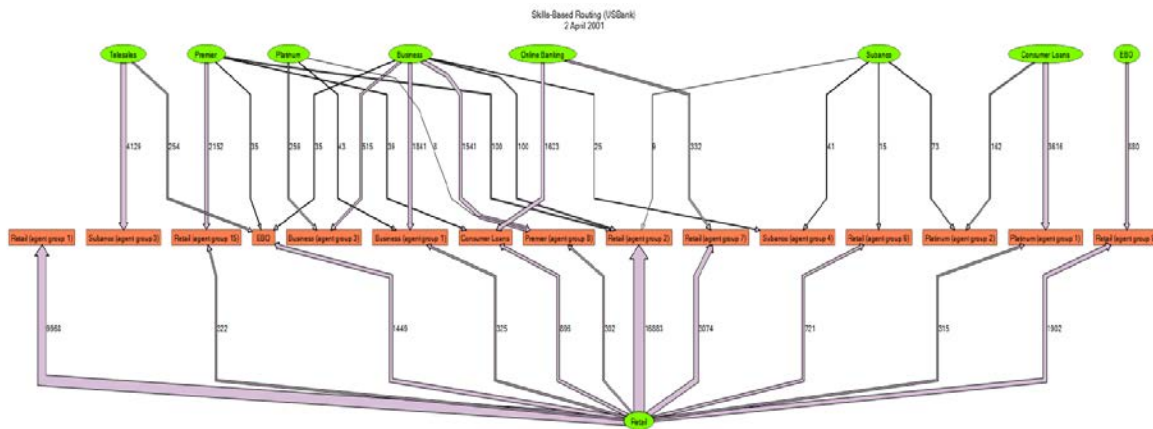
Save file in **C:\ animation**. Name the text file *flow_subcalls* and click Save.

Open *SEEGraph View 1.0*. Select *File->Open*. Select *flow_subcalls.txt* file from **C:\ animation**. Click on the *Open* button.

Part II Practice

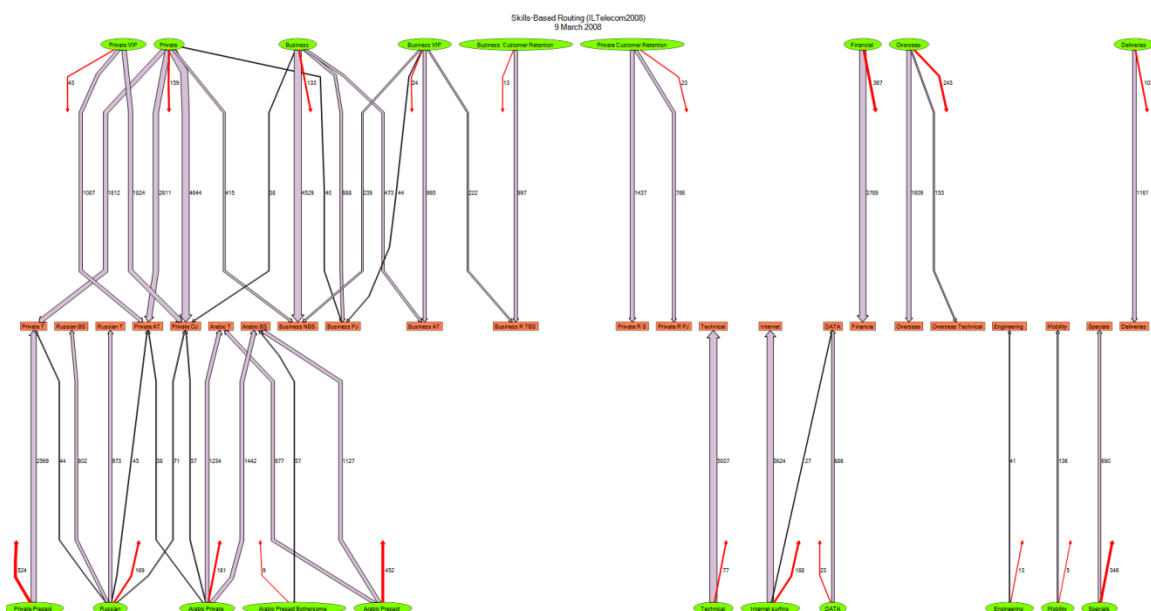
Exercise 1: Create SBR graph

1. Go over the following [examples](#) of SBR graphs (ILTelecom2008 data).
2. Read the document on *Skills-Based- Routing in US Bank* http://ie.technion.ac.il/Labs/Serveng/files/Skills-Based-Routing_USBank.pdf.
3. Create the following bipartite graph (SBR) by using *USBank* data: without animation, without sinks, balance by main left, from source table cust_subcalls. See [Appendix 4](#) for a description of cust_subcalls table.



Examples of design: Skills-Based Routing (SBR) bipartite graph type

1. Graph (without animation)



Example of data:

```
SELECT cust_subcalls.queue_id, cust_subcalls.skills_group, cust_subcalls.service, cust_subcalls.service_time,
cust_subcalls.segment_start, cust_subcalls.service_entry, cust_subcalls.segment_end, cust_subcalls.service_group,
cust_subcalls.outcome
FROM cust_subcalls
WHERE (((cust_subcalls.queue_id)<99) AND ((cust_subcalls.skills_group)>0 And (cust_subcalls.skills_group)<99) AND
((cust_subcalls.service_group)=2)) OR (((cust_subcalls.queue_id)<99) AND ((cust_subcalls.skills_group)=0) AND
((cust_subcalls.service_group)=2) AND ((cust_subcalls.outcome)>10 And (cust_subcalls.outcome)<20));
```

cust_subcalls								
segment_start	service_entry	segment_end	queue_id	skills_group	service	service_time	service_group	outcome
1205020808	1205020843	1205020867	17	24	11	24	2	1
1205020978	1205020989	1205020989	13	0	19	0	2	12
1205021347	1205021353	1205021536	17	24	11	183	2	2
1205021402	1205021563	1205021563	13	0	19	0	2	12
1205021566	1205021566	1205021779	17	24	11	213	2	1
1205021798	1205021828	1205021828	13	0	19	0	2	12
1205023070	1205023071	1205023377	17	24	11	306	2	1
1205023418	1205023424	1205023424	17	0	11	0	2	12
1205024544	1205024632	1205024632	13	0	19	0	2	12

The Graph tab:

SEESat dictionary: queue_id

SEESat dictionary: skills_group

Graph Input Table Input Fields General Bipartite Drawing attributes Attributes Order by

Short Name skills_sinks

Graph Type ☐ Flow Graph ☒ Bipartite

Nodes definition

Node Dimension ☐ 1 ☒ 2

Left ID queue_id

Right ID skills_group

Graph Partition Dimension ☒ 1 ☐ 2 ☐ 3

Categories

Name Select

Filter none Formula

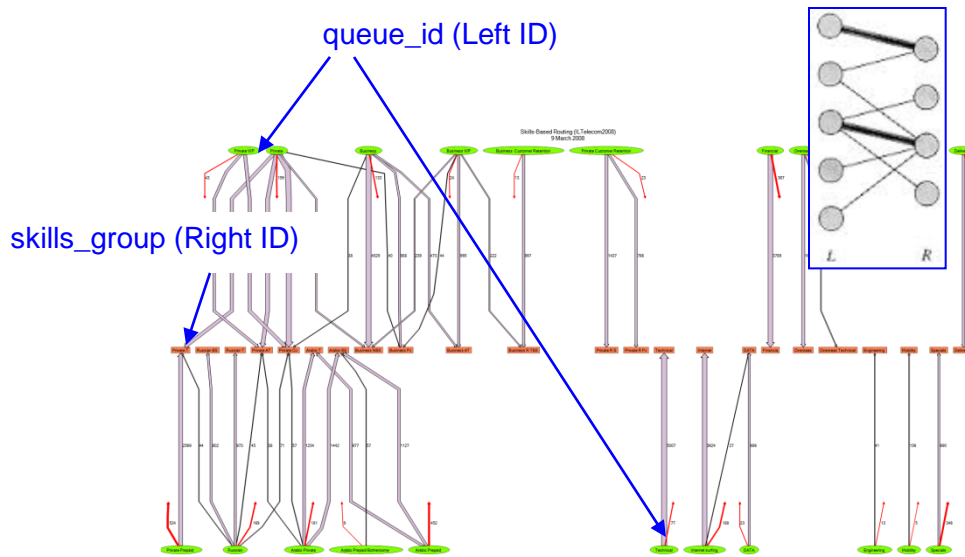
Subcategories

Name Select

Filter none Formula

Time Filter

none Formula



The *Input Table* tab:

Graph	Input Table	Input Fields	General	Bipartite	Drawing attributes	Attributes	Order by
<div> <div>Short Name</div> <div>cust_subcalls</div> </div>							
<div> <div>Source</div> <div>cust_subcalls</div> <div>Select</div> </div>							
<div> <div>Left ID</div> <div>queue_id</div> <div>Select</div> </div>							
<div> <div>Right ID</div> <div>skills_group</div> <div>Select</div> </div>							
<div> <div>Categories Field</div> <div></div> <div>Select</div> </div>							
<div> <div>SubCategories Field</div> <div></div> <div>Select</div> </div>							
<div> <div>Time Filter Field</div> <div>none</div> <div>Select</div> <div>Formula</div> </div>							
<div> <div>Where</div> <div> <div>Where</div> <div>service_group = 2 and queue_id < 99 and (skills_group > 0 and</div> <div>Formula</div> </div> </div>							
<div> <div>service_group = 2 and queue_id < 99 and (skills_group > 0 and skills_group < 99 or skills_group = 0 and outcome > 10 and outcome < 20)</div> </div>							

The *Input Fields* tab:

Graph Input Table **Input Fields** General Bipartite Drawing attributes Attributes Order by

Input Table

Name	Type	Definition
service	Categorical	service
service_time	Duration	service_time
segment_start	Time periods	segment_start
service_entry	Time periods	service_entry
segment_end	Time periods	segment_end
skills_group	Categorical	skills_group
served	Integer	skills_group > 0

Edit

Remove

Input Field

Name

Select

Definition

none

Formula

Add

The *General* tab:

Input Fields **General** Bipartite Drawing attributes Attributes Order by

Graph properties

Graph Title Skills routing

☐ Left to right
 ☒ Set aspect

18 Node separation
 144 Rank separation

Animation
☒ None
 ☐ State Animation
 ☐ Hybrid Animation
☐ Flow animation
 ☐ Time animation

Edges options

☐ No edges filter
 ☒ Filter edges by edge counts
 ☐ Filter by proportion of total counts

Edges filter

If proportion of count in 2 nodes volume < 0.02
 Keep regardless proportion if count > 30
 Remove regardless proportion if count < 5

Processes filter

Keep proportion of total counts(%)
☐ Keep at least one edge

☒ Use counts as edge labels
☒ Set edge width by edge counts
☒ Use square root transform of edge counts

nodes options

☒ Use node labels
 ☐ Draw as points

The *Bipartite* tab:

See detailed description of *Bipartite* tab in [Appendix 2](#).

Bipartite graph options

☐ No sinks Sinks filter

☒ Directed graph ☒ Use simple sinks served

Balance graph

☐ No balance

☐ Balance by main left

☐ By left nodes

☒ By left node groups

Nodes service

☐ Remove single pairs

The *Drawing attributes* tab:

Nodes drawing attributes(Left nodes)

Shape: Ellipse

Width : 1

Line color

☒ Fill nodes

Fill color

Label

Node types

☒ State nodes

☐ Sink nodes

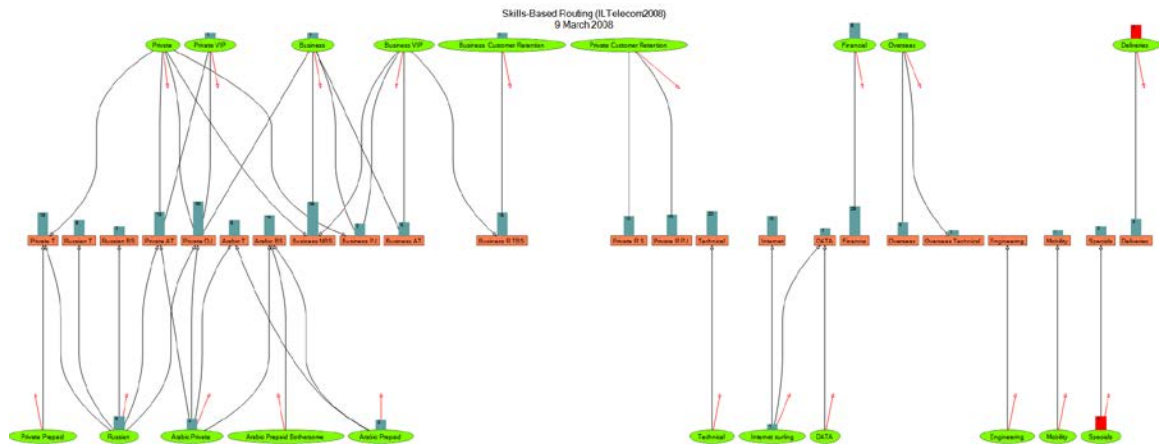
Select nodes group

Left nodes

Right nodes

Nodes Edges Clusters Graph

2. State animation: Operations Research (or queueing) view



Graph	Input Table	Input Fields	General	Bipartite	Drawing attributes	Attributes	Order by
<div> <div>Short Name</div> <div>skills_anim2</div> </div>							
<div> <div>Graph Type</div> <div> <input type="radio"/> Flow Graph <input checked="" type="radio"/> Bipartite </div> </div>							
<div>Nodes definition</div> <div> <div> <div>Node Dimension</div> <div> <input type="radio"/> 1 <input checked="" type="radio"/> 2 </div> </div> <div> <div>Left ID</div> <div>queue_id</div> <div>Select</div> </div> <div> <div>Right ID</div> <div>skills_group</div> <div></div> </div> </div>							
<div> <div>Graph Partiton Dimension</div> <div> <input checked="" type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 </div> </div>							
<div> <div>Categories</div> <div> <div> <div>Name</div> <div></div> <div>Select</div> </div> <div> <div>Filter</div> <div>none</div> <div>Formula</div> </div> </div> <div> <div>Subcategories</div> <div> <div> <div>Name</div> <div></div> <div>Select</div> </div> <div> <div>Filter</div> <div>none</div> <div>Formula</div> </div> </div> </div> </div>							
<div> <div>Time Filter</div> <div> <div>v > 07:30:00</div> <div>Formula</div> </div> </div>							

Graph **Input Table** Input Fields General Bipartite Drawing attributes Attributes Order by

Short Name

Source

Left ID

Right ID

Categories Field

SubCategories Field

Time Filter Field

Where

Where

service_group = 2 and (skills_group > 0 and skills_group < 99 or outcome > 0) and queue_id < 99

Field name	Field type
call_id	ID
cust_subcall	Integer
record_id	ID
customer_id	ID
customer_type	Categorical
service_group	Categorical
service	Categorical
segment_start	Time
queue_exit	Time
service_entry	Time
segment_end	Time
seg_type	Categorical
outcome	Categorical
seg_parties	Categorical

Operators/fun...
(
)
and
or
not
=
<>
<
<=
>
>=

Scalars

Number

Functions

Graph

Input Table

Input Fields

General

Bipartite

Drawing attributes

Attributes

Order by

Input Table

Name	Type	Definition
service	Categorical	service
service_time	Duration	service_time
segment_start	Time periods	segment_start
service_entry	Time periods	service_entry
segment_end	Time periods	segment_end
skills_group	Categorical	skills_group
served	Integer	skills_group > 0

Edit

Remove

Input Field

Name

Select

Definition

none

Formula

Add

ds

General

Bipartite

Drawing attributes

Attributes

Order by

Graph properties

Graph Title

Skills-Based Routing

☐ Left to right
 ☐ Set aspect

18

Node

136

Rank

Animation

☐ None
 ☒ State Animation
 ☐ Hybrid Animation

☐ Flow animation
 ☐ Time animation

Edges options

☐ No edges filter
 ☒ Filter edges by edge counts
 ☐ Filter by proportion of total counts

Edges filter

If proportion of count in 2

0.02

Keep regardless proportion if

30

Remove regardless proportion

5

Processes filter

Keep proportion of total counts(%)

☐ Keep at least one edge

☐ Use counts as edge labels

☐ Set edge width by edge counts

☐ Use square root transform of edge counts

nodes options

☒ Use node labels
 ☐ Draw as points

Bipartite	Drawing attributes	Attributes	Order by
-----------	--------------------	------------	----------

skills_anim2

Bipartite graph options

☐ No sinks
 ☒ Directed graph
 ☐ Use simple sinks

Sinks filter:

Balance graph

☐ No balance
☐ Balance by main left
☐ By left nodes
☒ By left node groups

Nodes:

☐ Remove single pairs

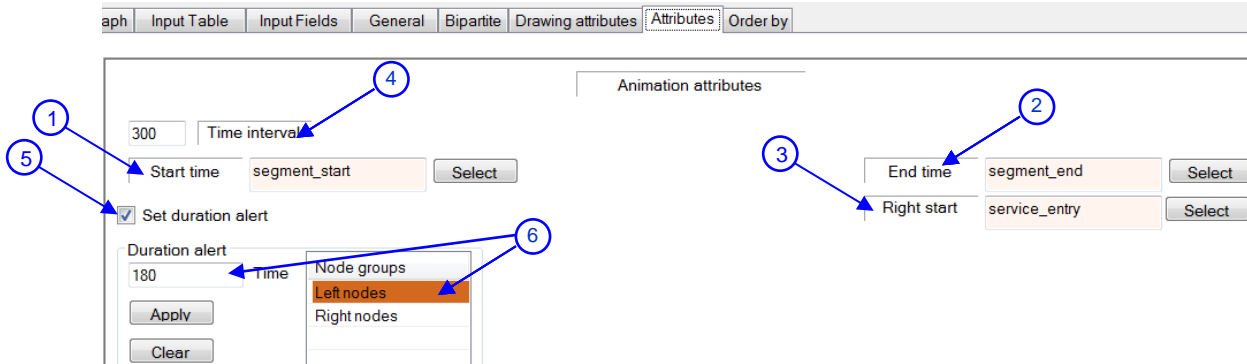
able	Input Fields	General	Bipartite	Drawing attributes	Attributes	Order by
------	--------------	---------	-----------	--------------------	------------	----------

Nodes drawing attributes(Left nodes)

Shape: Ellipse 	Width : 1 	Line color: <input type="text" value=""/> <input checked="" type="checkbox"/> Fill nodes Fill color: <input type="text" value=""/> <input type="button" value="Label"/>	Select nodes group: <input checked="" type="radio"/> Left nodes <input type="radio"/> Right nodes
Style : Solid 		Node types: <input checked="" type="radio"/> State nodes <input type="radio"/> Sink nodes	

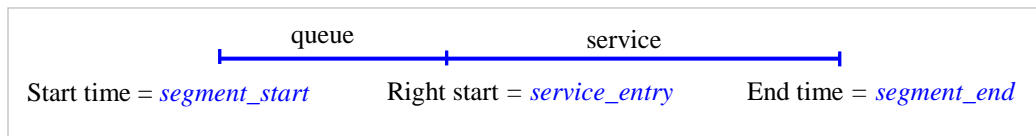
Nodes	Edges	Clusters	Graph
-------	-------	----------	-------

The *Attributes* tab:

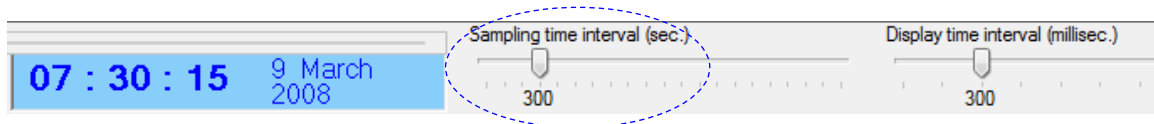


Animation attributes:

- (1) Start time = *segment_start*
- (2) End time = *segment_end*
- (3) Right start = *service_entry*



- (4) Time interval = 300 – default value for time animation

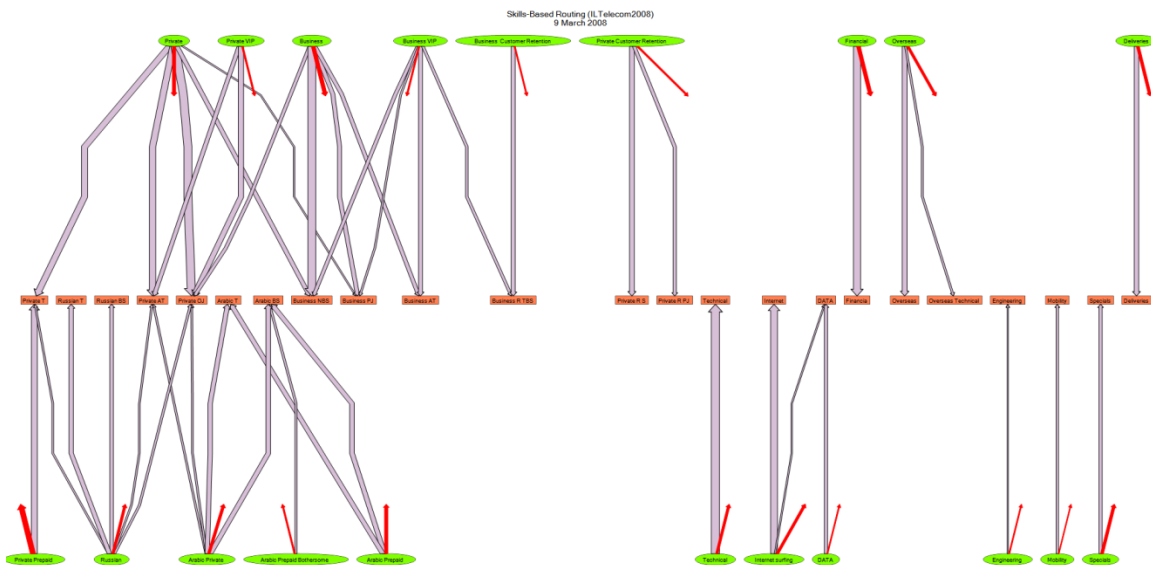


- (5) Set duration alert:
Duration alert = 180 – if the **maximum** waiting time, among all the calls in queue at the current moment, exceeds 3 minutes, give an alert by red color.
- (6) Node groups = *Left nodes* – gives alert according to the measured waiting time in **queue** (in this example 180 seconds).
If Node groups = *Right nodes* – gives alert according to the measured **service** time (not relevant for this case).

Graph	Input Table	Input Fields	General	Bipartite	Drawing attributes	Attributes	Order by
Fields							Order by
service							1
service_time							
segment_start							
service_entry							
segment_end							
skills_group							

(1) In bipartite graphs there is no need to select *Order by* fields.

3. Time animation: Network (structure) view



Graph	Input Table	Input Fields	General	Bipartite	Drawing attributes	Attributes	Order by
<div> <div>Short Name</div> <div>islills_anim3</div> </div> <div> <div>Graph Type</div> <div> <input type="radio"/> Flow Graph <input checked="" type="radio"/> Bipartite </div> </div>							
<div>Nodes definition</div> <div> <div>Node Dimension</div> <div> <input type="radio"/> 1 <input checked="" type="radio"/> 2 </div> </div> <div> <div>Left ID</div> <div>queue_id</div> <div>Select</div> </div> <div> <div>Right ID</div> <div>skills_group</div> <div></div> </div>							
<div>Graph Partition Dimension</div> <div> <input checked="" type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 </div>							
<div>Categories</div> <div> <div>Name</div> <div></div> <div>Select</div> </div> <div> <div>Filter</div> <div>none</div> <div>Formula</div> </div>							
<div>Subcategories</div> <div> <div>Name</div> <div></div> <div>Select</div> </div> <div> <div>Filter</div> <div>none</div> <div>Formula</div> </div>							
<div>Time Filter</div> <div> <div>v > 07:00:00</div> <div>Formula</div> </div>							

Graph **Input Table** Input Fields General Bipartite Drawing attributes Attributes Order by

Short Name

Source

Left ID

Right ID

Categories Field

SubCategories Field

Time Filter Field

Where

Where

Graph **Input Table** Input Fields General Bipartite Drawing attributes Attributes Order by

Input Table

Name	Type	Definition
service	Categorical	service
service_time	Duration	service_time
segment_start	Time periods	segment_start
service_entry	Time periods	service_entry
segment_end	Time periods	segment_end
skills_group	Categorical	skills_group
served	Integer	skills_group > 0

Input Field

Name

Definition

Graph Input Table Input Fields **General** Bipartite Drawing attributes Attributes Order by

Graph properties

Graph Title Skills-Based Routing

☐ Left to right ☐ Set aspect

18 Node

216 Rank

Animation

☐ None ☐ State Animation ☐ Hybrid Anin

☐ Flow animation ☒ Time animation

Edges options

☐ No edges filter ☒ Filter edges by edge counts ☐ Filter by proportion of total counts

Edges filter

If proportion of count in 2 0.02

Keep regardless proportion if 30

Remove regardless proportion 5

Processes filter

Keep proportion of total counts(%)

☐ Keep at least one edge

☐ Use counts as edge labels

☒ Set edge width by edge counts

☒ Use square root transform of edge counts

nodes options

☒ Use node labels ☐ Draw as points

Bipartite Drawing attributes Attributes Order by

islills_anim3

Bipartite graph options

☒ Directed graph ☐ No sinks ☒ Use simple sinks

Sinks filter

served

Balance graph

☐ No balance

☐ Balance by main left

☐ By left nodes

☒ By left node groups

Nodes service

☐ Remove single pairs

Graph Input Table Input Fields General Bipartite Drawing attributes **Attributes** Order by

Animation attributes

1200 Time interval

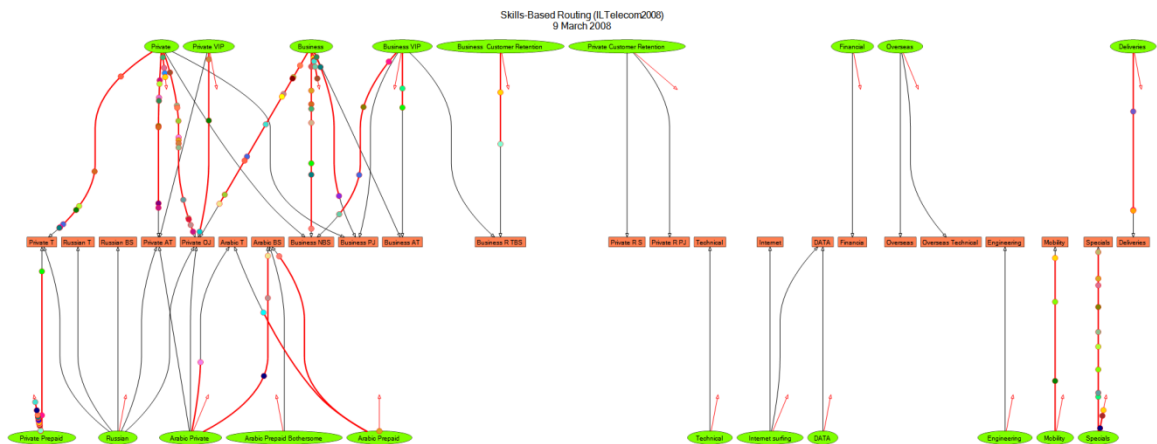
Start time service_entry

☐ Set duration alert

End time service_entry

Right start service_entry

4. Flow animation: Process Mining view



Graph Input Table Input Fields General Bipartite Drawing attributes Attributes Order by

Short Name skills_anim1

Graph Type
☐ Flow Graph ☒ Bipartite

Nodes definition

Node Dimension
☐ 1 ☒ 2

Left ID queue_id

Right ID skills_group

Graph Partiton Dimension
☒ 1 ☐ 2 ☐ 3

Categories

Name

Filter none

Subcategories

Name

Filter none

Time Filter

v >= 07:30:00 and v < 24:00:00

Input Table	Input Fields	General	Bipartite	Drawing attributes	Attributes	Order by
-------------	--------------	---------	-----------	--------------------	------------	----------

Short Name

cust_subcalls

Source

cust_subcalls

Select

Left ID

queue_id

Select

Right ID

skills_group

Select

Categories Field

Select

SubCategories Field

Select

Time Filter Field

segment_start

Select

Formula

Where

Where

service_group = 2 and (skills_group > 0 and skills_group < 99 or outcome >

Formula

service_group = 2 and (skills_group > 0 and skills_group < 99 or outcome > 10 and outcome < 20 and skills_group = 0) and queue_id < 99

Undo

Field name	Field type
call_id	ID
cust_subcall	Integer
record_id	ID
customer_id	ID
customer_type	Categorical
service_group	Categorical
service	Categorical
segment_start	Time
queue_exit	Time
service_entry	Time
segment_end	Time
seg_type	Categorical
outcome	Categorical
seg_parties	Categorical

Operators/fun...
(
)
and
or
not
=
<>
<
<=
>
>=

Scalars

Number

Add

Functions

Add

Cancel

OK

Graph | **Input Table** | Input Fields | General | Bipartite | Drawing attributes | Attributes | Order by

Input Table

Name	Type	Definition
service	Categorical	service
service_time	Duration	service_time
segment_start	Time periods	segment_start
service_entry	Time periods	service_entry
segment_end	Time periods	segment_end
skills_group	Categorical	skills_group
served	Integer	skills_group > 0

Edit

Remove

Input Field

Name

Select

Definition

none

Formula

Add

General | **Bipartite** | Drawing attributes | Attributes | Order by

Graph properties

Graph Title

Skills-Based Routing

☐ Left to right
 ☐ Set aspect

18

Node

136

Rank

Animation

☐ None
☒ Flow animation

☐ State Animation
☐ Time animation

☐ Hybrid Animation

Edges options

☐ No edges filter
 ☒ Filter edges by edge counts
 ☐ Filter by proportion of total counts

Edges filter

If proportion of count in 2

0.02

Keep regardless proportion if

30

Remove regardless proportion

5

Processes filter

Keep proportion of total counts(%)

☐ Keep at least one edge

☐ Use counts as edge labels
 ☐ Set edge width by edge counts
 ☐ Use square root transform of edge counts

nodes options

☒ Use node labels
 ☐ Draw as points

49

Graph	Input Table	Input Fields	General	Bipartite	Drawing attributes	Attributes	Order by
<div> <div>Short Name</div> <input type="text" value="skills_hybrid"/> </div> <div> <div>Graph Type</div> <div> <input type="radio"/> Flow Graph <input checked="" type="radio"/> Bipartite </div> </div>							
<div>Nodes definition</div> <div> <div>Node Dimension</div> <div> <input type="radio"/> 1 <input checked="" type="radio"/> 2 </div> </div> <div> <div>Left ID</div> <input type="text" value="queue_id"/> <div>Select</div> </div> <div> <div>Right ID</div> <input type="text" value="skills_group"/> <div>Select</div> </div>							
<div>Graph Partiton Dimension</div> <div> <input checked="" type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 </div>							
<div>Categories</div> <div> <div>Name</div> <input type="text"/> <div>Select</div> </div> <div> <div>Filter</div> <input type="text" value="none"/> <div>Formula</div> </div>							
<div>Subcategories</div> <div> <div>Name</div> <input type="text"/> <div>Select</div> </div> <div> <div>Filter</div> <input type="text" value="none"/> <div>Formula</div> </div>							
<div>Time Filter</div> <div> <input type="text" value="v > 07:30:00"/> <div>Formula</div> </div>							

Graph	Input Table	Input Fields	General	Bipartite	Drawing attributes	Attributes	Order by
<div> <div>Short Name</div> <input type="text" value="cust_subcalls"/> </div> <div> <div>Source</div> <input type="text" value="cust_subcalls"/> <div>Select</div> </div>							
<div> <div>Left ID</div> <input type="text" value="queue_id"/> <div>Select</div> </div>							
<div> <div>Right ID</div> <input type="text" value="skills_group"/> <div>Select</div> </div>							
<div>Categories Field</div> <div> <input type="text"/> <div>Select</div> </div>							
<div>SubCategories Field</div> <div> <input type="text"/> <div>Select</div> </div>							
<div>Time Filter Field</div> <div> <div> <input type="text" value="segment_start"/> <div>Select</div> </div> <div> <input type="text"/> <div>Formula</div> </div> </div>							
<div>Where</div> <div> <div>Where</div> <input type="text" value="service_group = 2 and (skills_group > 0 and skills_group < 99 or outcome >"/> <div>Formula</div> </div>							

Graph	Input Table	Input Fields	General	Bipartite	Drawing attributes	Attributes	Order by																								
<div>Input Table</div> <table border="1"> <thead> <tr> <th>Name</th> <th>Type</th> <th>Definition</th> </tr> </thead> <tbody> <tr> <td>service</td> <td>Categorical</td> <td>service</td> </tr> <tr> <td>service_time</td> <td>Duration</td> <td>service_time</td> </tr> <tr> <td>segment_start</td> <td>Time periods</td> <td>segment_start</td> </tr> <tr> <td>service_entry</td> <td>Time periods</td> <td>service_entry</td> </tr> <tr> <td>segment_end</td> <td>Time periods</td> <td>segment_end</td> </tr> <tr> <td>skills_group</td> <td>Categorical</td> <td>skills_group</td> </tr> <tr> <td>served</td> <td>Integer</td> <td>skills_group > 0</td> </tr> </tbody> </table>								Name	Type	Definition	service	Categorical	service	service_time	Duration	service_time	segment_start	Time periods	segment_start	service_entry	Time periods	service_entry	segment_end	Time periods	segment_end	skills_group	Categorical	skills_group	served	Integer	skills_group > 0
Name	Type	Definition																													
service	Categorical	service																													
service_time	Duration	service_time																													
segment_start	Time periods	segment_start																													
service_entry	Time periods	service_entry																													
segment_end	Time periods	segment_end																													
skills_group	Categorical	skills_group																													
served	Integer	skills_group > 0																													
s	General	Bipartite	Drawing attributes	Attributes	Order by																										

Graph properties

Graph Title: Skills-Based Routing

☐ Left to right
 ☐ Set aspect

18 Node
 216 Rank

Animation:
 ☐ None
 ☐ State Animation
 ☒ Hybrid Animation
 ☐ Flow animation
 ☐ Time animation

Edges options

☐ No edges filter
 ☒ Filter edges by edge counts
 ☐ Filter by proportion of total counts

Edges filter

If proportion of count in 2: 0.02
 Keep regardless proportion if: 30
 Remove regardless proportion: 5

Processes filter

Keep proportion of total counts(%):
☐ Keep at least one edge

☐ Use counts as edge labels
☐ Set edge width by edge counts
☐ Use square root transform of edge counts

nodes options

☒ Use node labels
 ☐ Draw as points

skills_hybrid

Bipartite graph options

☒ Directed graph
 ☐ No sinks
 ☒ Use simple sinks

Sinks filter

served

Select

Balance graph

☐ No balance
 ☐ Balance by main left
 ☐ By left nodes
 ☒ By left node groups

Nodes

service

Select

☐ Remove single pairs

Graph

Input Table

Input Fields

General

Bipartite

Drawing attributes

Attributes

Order by

Animation attributes

100

Time interval

Start time

segment_start

Select

End time

segment_end

Select

Right start

service_entry

Select

☒ Set duration alert

Duration alert

180

Time

Apply

Clear

Node groups

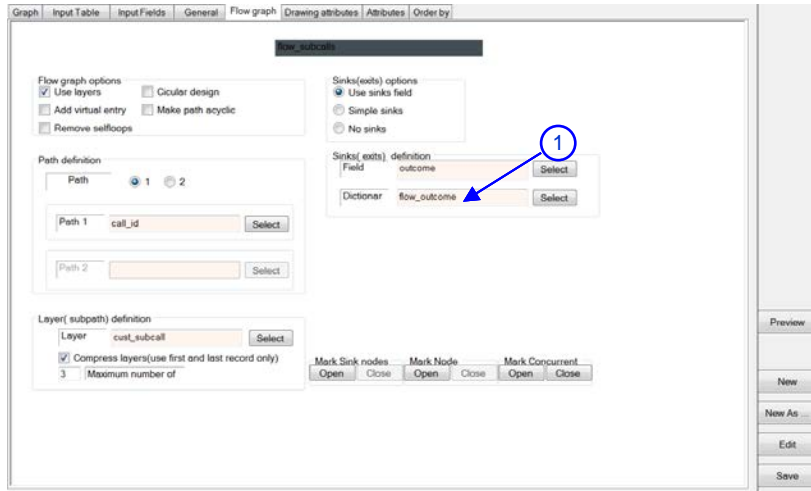
Left nodes

Right nodes

Graph	Input Table	Input Fields	General	Bipartite	Drawing attributes	Attributes	Order by
Fields							Order by
service							
service_time							
segment_start							
service_entry							
segment_end							
skills_group							
served							

Exercise 2: Modify a graph – change sinks dictionary

1. Modify *flow_subcalls* graph (which was created in [Part I](#)): change sinks dictionary from *flow_outcome* to *outcome*.



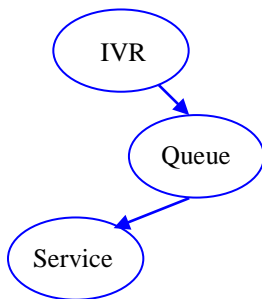
2. Process the edited *flow_subcalls* graph for April 2, 2001.
3. View graph via SEEGraph viewer.

Exercise 3: Create graph – use NEW AS option

1. Create *aggregated outcome* dictionary (see [Appendix 2](#))
2. Create new graph by using *New AS* option from *flow_subcalls* graph, use *aggregated outcome* dictionary as sinks dictionary. Group sinks into Normal, Abnormal and Transfer sinks groups.

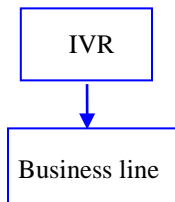
Exercise 4: Create Calls Flow graph

Create calls flow graph with following structure:



- (a) graph with layers, with maximum of 5 layers.
- (b) graph without sinks.
- (c) graph with 2 node dimensions.

For this task you will need to build a few procedures based on the source table *cust_subcalls* and create regular study dictionary.
The current structure of *cust_subcalls* table is:



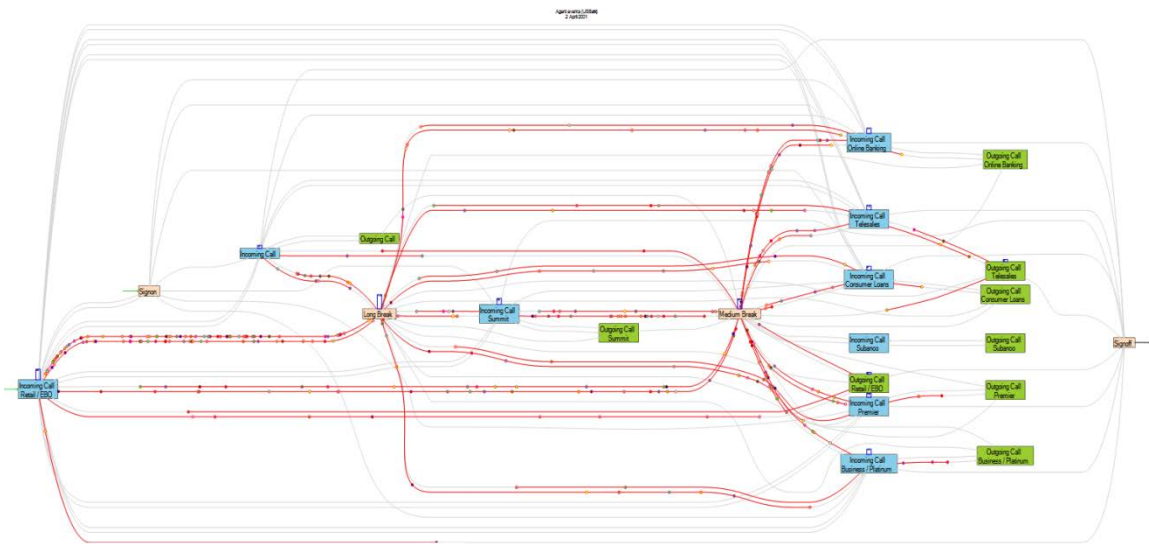
See [Appendix 4](#) for a description of *cust_subcalls* table.
See [Appendix 2](#) for a description how to create dictionary.
See [Appendix 6](#) for a description how change type of field.

Exercise 5: Create Agent events graph

Create the following agent events graph by using *USBank* data:

- hybrid animation type
- with simple sinks
- 2 node dimension
- source table *agent_events*.

See [Appendix 4](#) for a description of *agent_events* table.

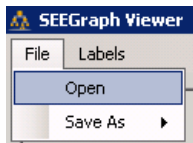


Part III SEEGraph View: User Guide

SEE Graphs Animations

Opening an animation file:

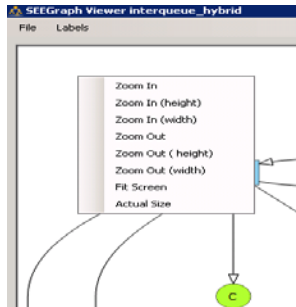
Click 'File -> Open' and choose the desired animation from the available animation list:



Press the 'Play' button on the bottom left side of the screen to run the animations.

Zooming:

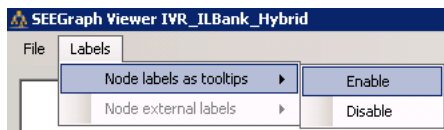
Right clicking the screen will open the following dialog box:



Choose the desired option (e.g. Zoom-in, Zoom-in height).

Labels:

In order to see the node labels, select 'Labels -> Node labels as tooltips -> Enable':

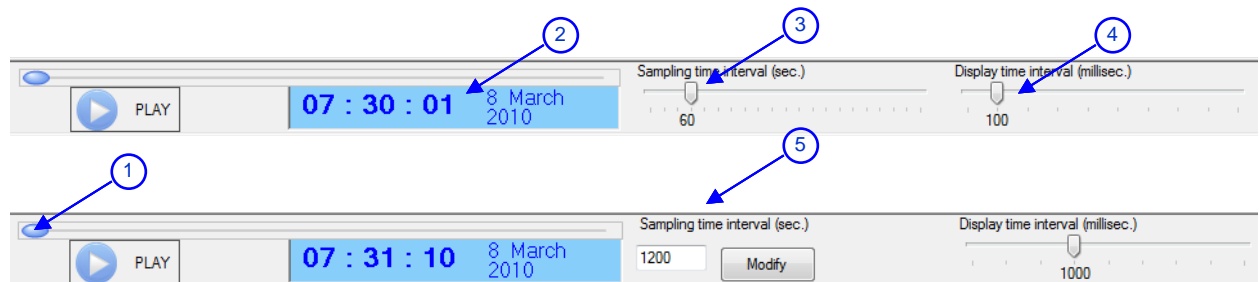


Sampling time interval:

In the animation files that include the word Network (structural animations), each frame in is based on an aggregation of all the events that occurred during a specific time interval. In the Process-Mining (flow) animations, the OR (queuing perspective) animations and the Hybrid animations each frame represents system state by the end of a specific time interval. For all cases, the time-interval lengths can be modified using the 'Sampling time interval' adjustment bar.

Display time interval

This adjustment bar controls the time between displays of consequent animation frames. Increased (decreased) 'Display time interval' value makes the animation run slower (faster).



(1) Time scroll

(2) Current time in hh:mm:ss dd/month/yyyy format.

(3) Sampling time interval (sec.) 60 seconds means that if current time is 7:31:10 then the next picture will be at 7:32:10.

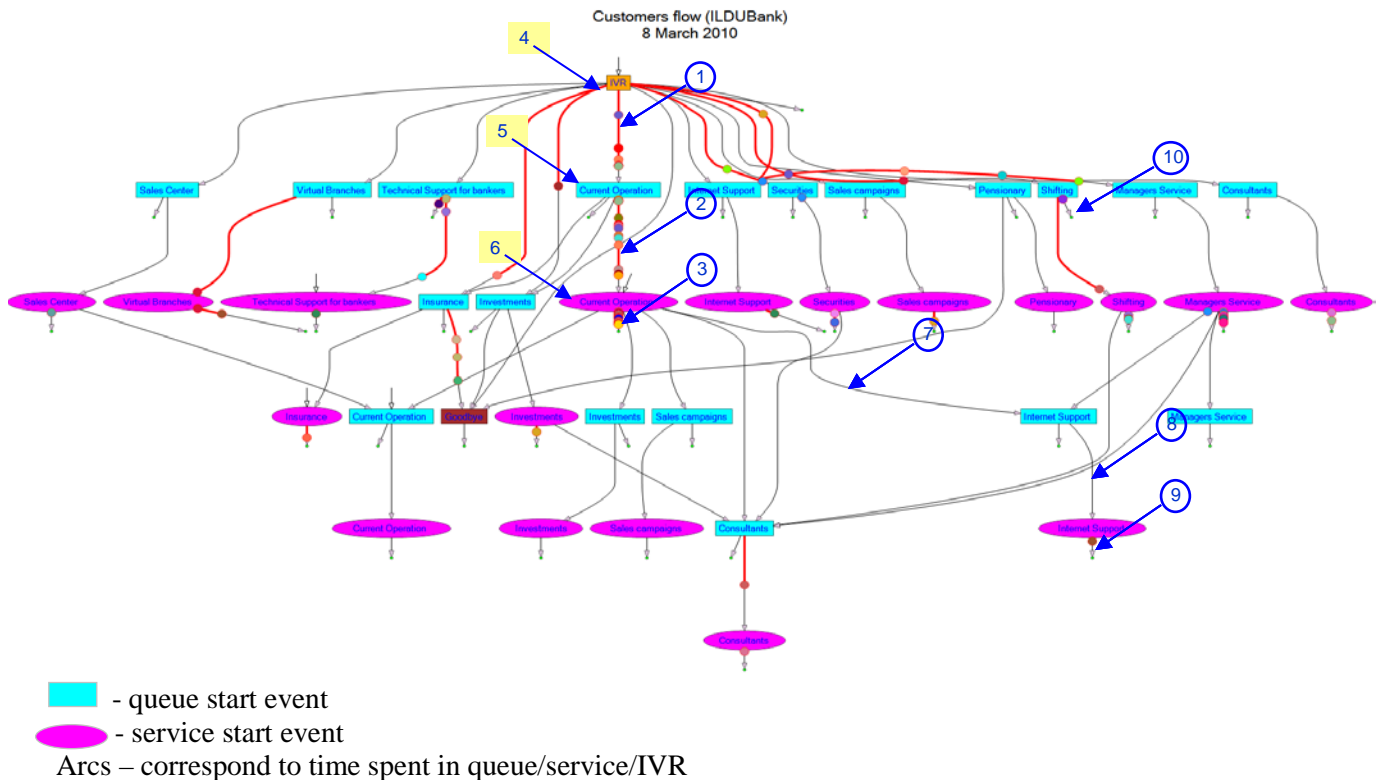
(4) Display time interval (milisec.) time between consequent updates of the picture.

(5) Sampling time interval (sec.) for time animation – 1200 seconds.

Examples

At your convenience we provide four basic animation screenshots, to further explain the different views available in SEEGraphView:

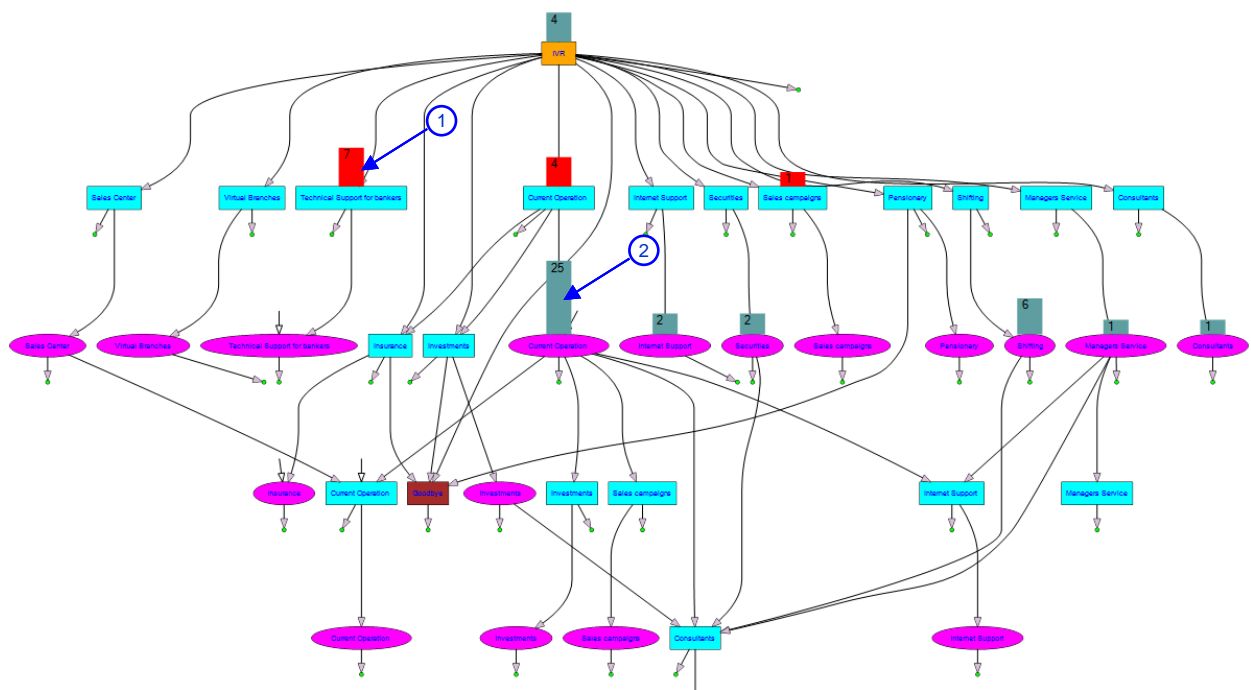
1. The Process Mining (Flow) view:



- (1) On arc: customer in the IVR. Duration on arc corresponds to IVR time.
- (2) On arc: customer in queue. Duration on arc corresponds to WAIT time.
- (3) On arc: customer in service. Duration on arc corresponds to SERVICE time.
- (4) Node: corresponds to IVR start time (start event).
- (5) Node: corresponds to Queue entry of Current Operations customer (entry event); this is the first customer sub-call
- (6) Node: corresponds to Service entry of Current Operations customer (entry event); this is still the first customer sub-call
- (7) On arc: SERVICE time for a Current Operations customer; at the end of the service he is transferred to the Internet support queue; this is still part of the first sub-call
- (8) On arc: Waiting time in the Internet Support queue for customers who were transferred from a different service; this is the second sub call.
- (9) On arc: Service time in the Internet Support queue for customers who were transferred from a different service; this is the second sub call
- (10) On arc: customers who abandon. Duration on arc corresponds to WAIT time before abandonment.

2. The Operations Research (or queueing) view:

Customers flow (ILDUBank)
8 March 2010

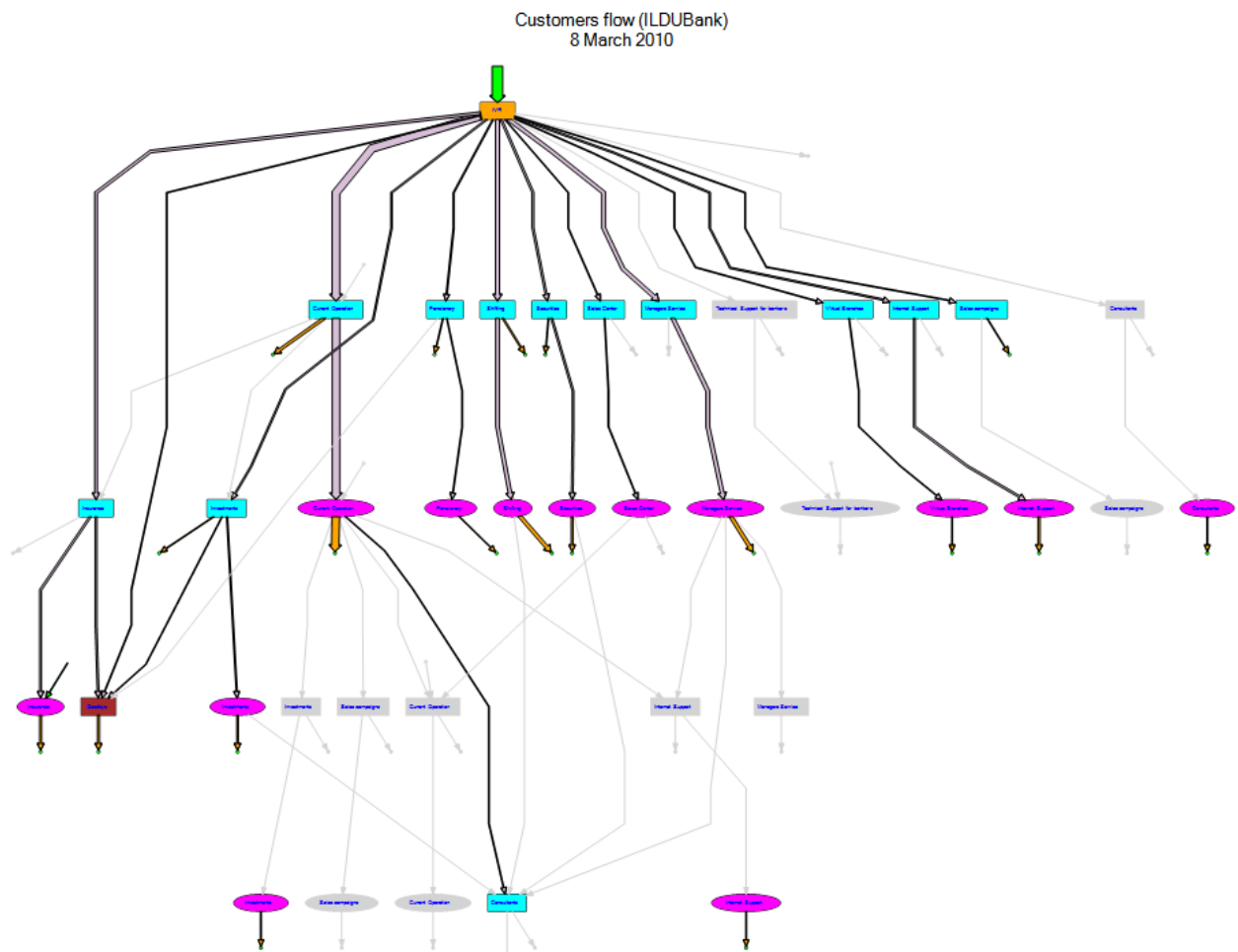


(1) Number of customers in the Technical Support queue. The red color indicates that maximal waiting time is above 120 seconds.

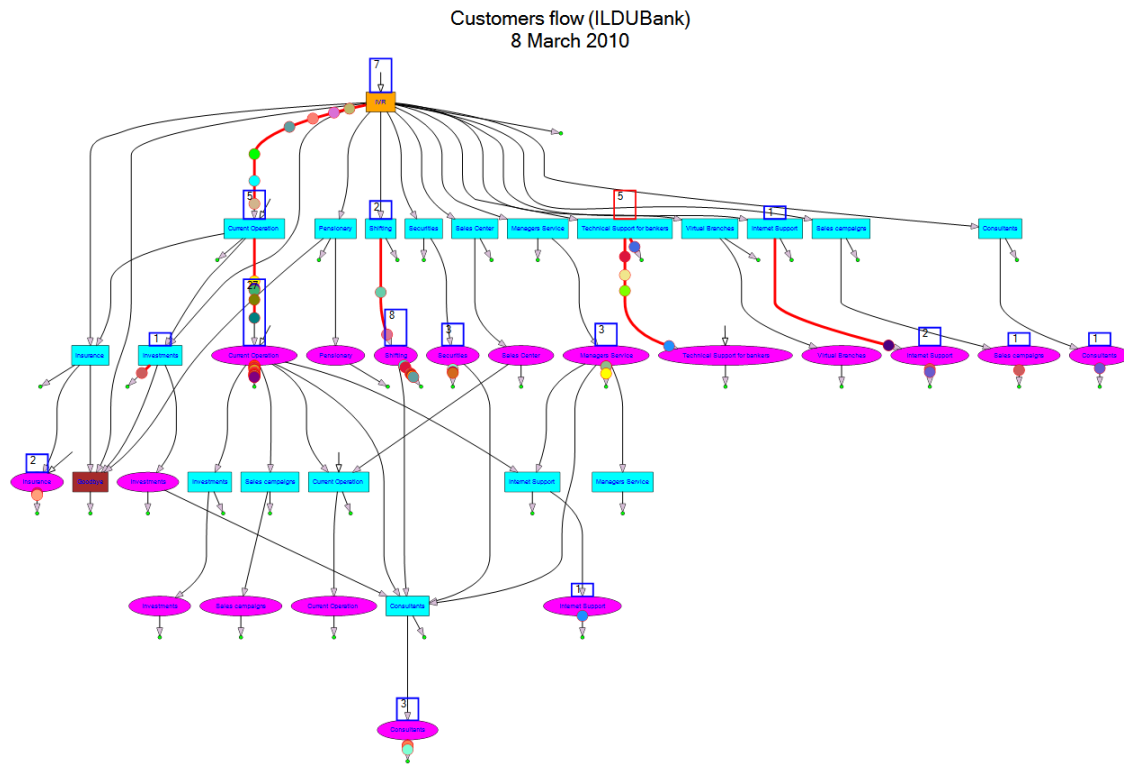
(2) Number of Current Operations customers that receive service.

Calculation: count events between start time and end time

3. The network (structure) view:



4. The hybrid (Process Mining + Operations Research) view:

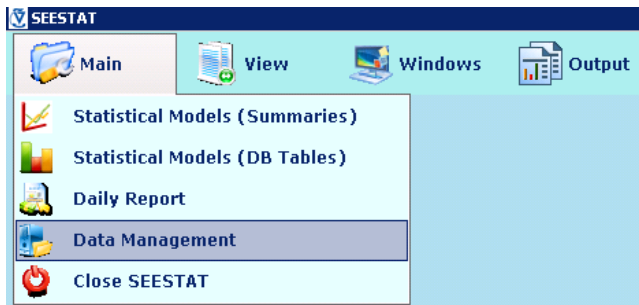


Appendix 1 Creation of SEESTat user extension

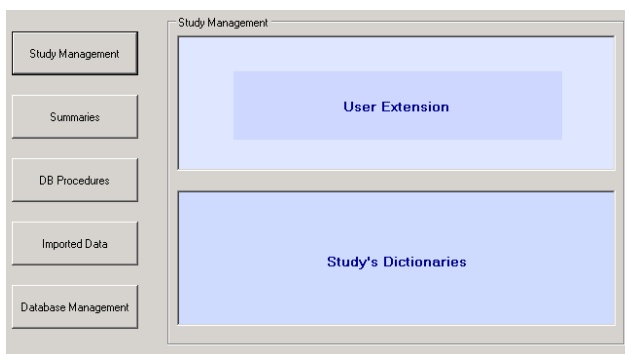
Do it only one time, there is no need to repeat it afterwards. Note: user capacity in the SEE Server is limited to 150MB.

1.1 Register user folder

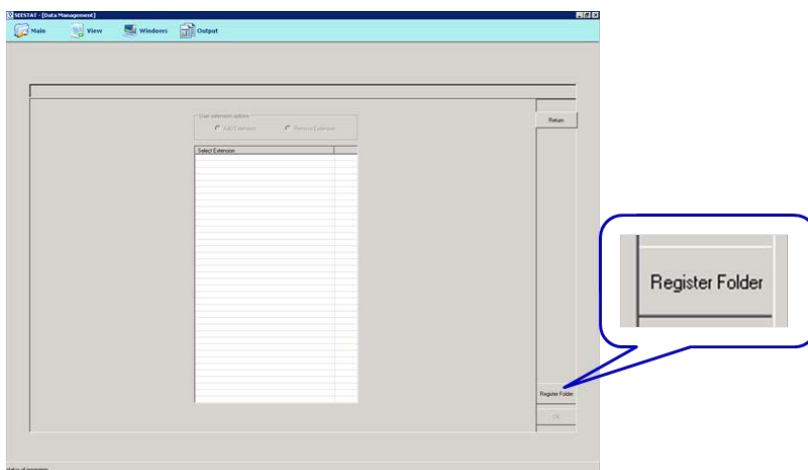
Click Main → Data Management



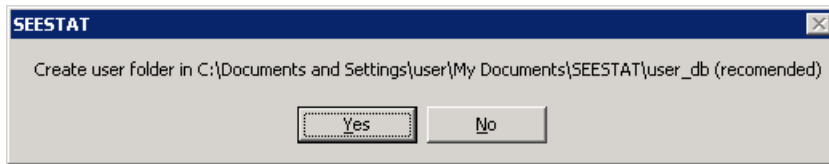
Click Study Management → User Extension



Click Register Folder

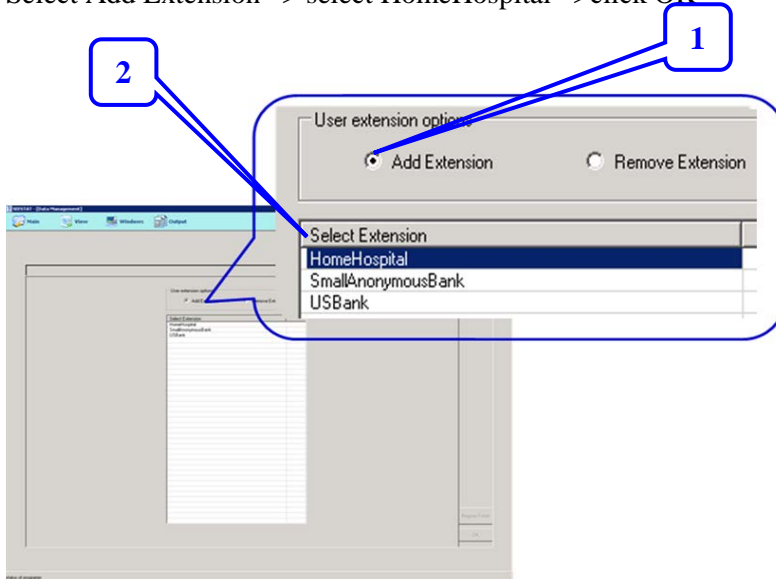


Click Yes



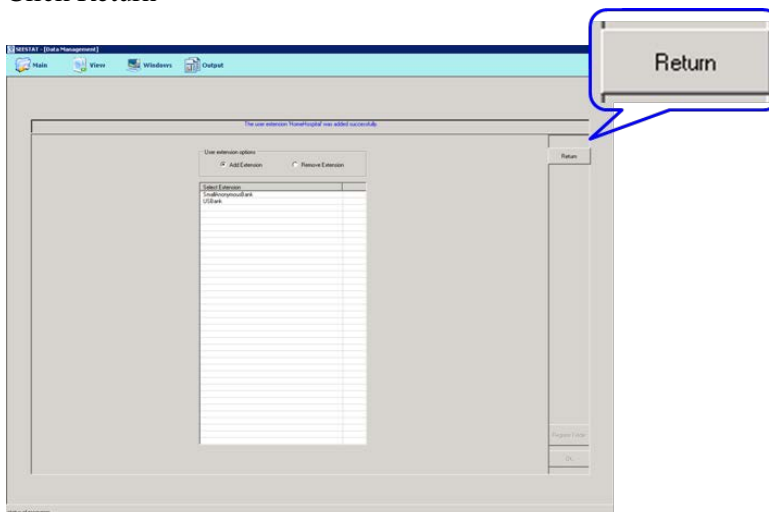
1.2 Add user extension

Select Add Extension → select HomeHospital → click OK



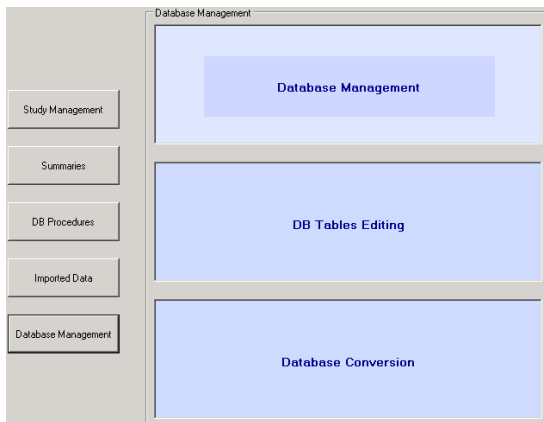
If the message: “Unable to add or rename extension of the open study HomeHospital” appeared, reopen SEESTat. Click Main → Data Management → Study Management → User Extension. Select Add Extension → select HomeHospital → click OK

If the above message did not appear, continue with next step:
Click Return



1.3 Create user database

Select Database Management → Database Management

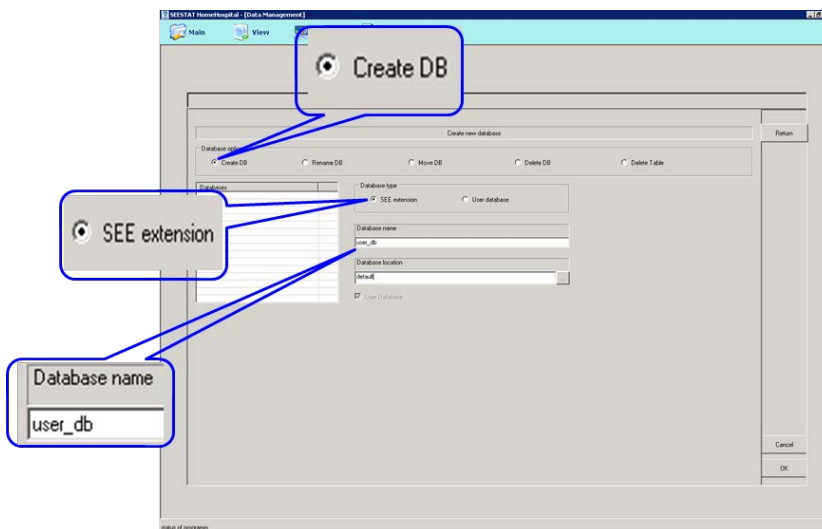


Select HomeHospital study and OK.



From database options select Create DB (radio-button), select database type: SEE extension (radio-button),

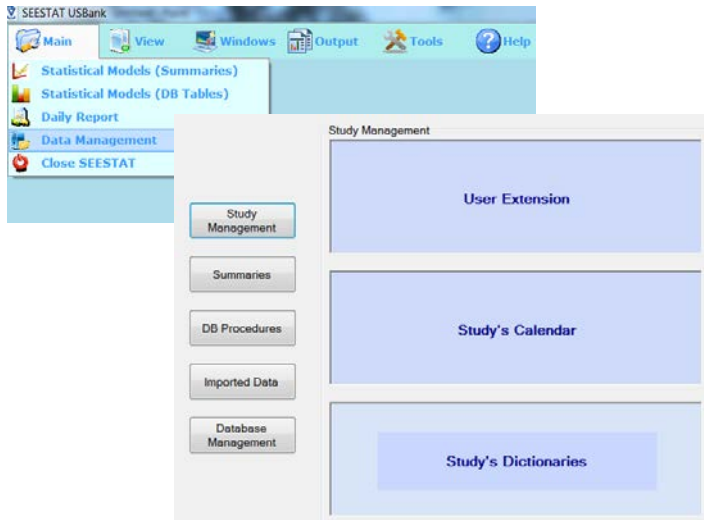
Under database name fill: user_db, click OK



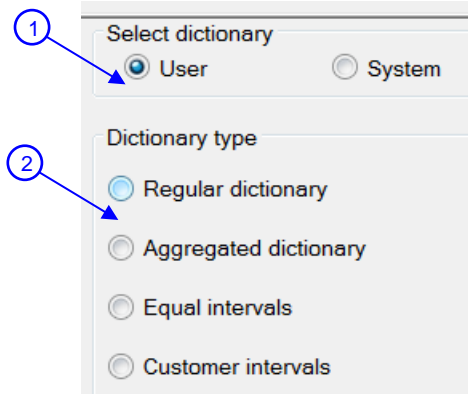
Appendix 2 Create Study's Dictionaries

Regular dictionary

Click *Main->Data Management->Study Management-> Study's Dictionaries*



Select study (if needed).



(1) Select dictionary: *User*

(2) Select dictionary type: *Regular dictionary*

For example needs to create dictionary this following structure:

code	name
1	IVR
2	Queue
3	Service

Aggregated dictionary

Click *Main->Data Management->Study Management-> Study's Dictionaries*

The screenshot shows a 'Select dictionary' dialog box. It has two main sections: 'Select dictionary' and 'Dictionary type'. The 'Select dictionary' section has two radio buttons: 'User' (selected) and 'System'. The 'Dictionary type' section has five radio buttons: 'Regular dictionary', 'Aggregated dictionary' (selected), 'Equal intervals', and 'Customer intervals'. To the right of these sections is a 'Dictionaries' table with a list of existing dictionaries. The 'outcome' dictionary is highlighted. At the bottom of the dialog are 'OK' and 'Cancel' buttons. On the far right, there is a vertical sidebar with buttons: 'Return', 'Delete', 'Rename', 'New', 'New as', 'Edit', 'Preview', and 'Save'. Numbered annotations are present: (1) points to the 'User' radio button, (2) points to the 'Aggregated dictionary' radio button, (3) points to the 'outcome' dictionary in the table, and (4) points to the 'OK' button.

Existing Dictionaries	
entry_units	
service	
outcome	
agent_groups	
main_service	
node	
service_groups	
g_outcome	

- (1) Select dictionary-> *User*
- (2) Select dictionary type-> *Aggregated dictionary*
- (3) Select existing dictionary: *outcome*
- (3) Click *OK*

Select dictionary
☒ User ☐ System

Aggregated dictionary

Base dictionary name: outcome

Dictionary name:

Cancel

	From Code	Category Name	To Code
	0	Total	0
	1	Caller Termination	1
	2	Agent Termination	1
	3	Undetermined Termination	1
	4	Termination Error	1
	11	Abandoned Short	2
	12	Abandoned	2
	13	Other Unhandled	2
	14	Unhandled Error	2
	20	Transfer	3
	21	Outgoing Transfer	3
	22	Agent Transfer	3
	23	Process Remotely	3
	30	NIQ Disconnected	3
	40	Missing record	3
	50	Outbound call	3

Next

Return

Delete

Rename

New

New as

Edit

Preview

Save

- (1) Fill *To Code* values
- (2) Click *Next* button

Select dictionary
☒ User ☐ System

Aggregated dictionary

Base dictionary name: outcome

Dictionary name: aggregated_outcome

Cancel

	Aggregate Code	Aggregate Name
	0	Total
	1	complete
	2	abandoned
	3	transfer

Previous

Save

Return

Delete

Rename

New

New as

Edit

Preview

- (1) Change *aggregated names*
- (2) Fill *dictionary name*
- (3) Click *Save*

Click View->Dictionaries->aggregated_outcome

The dictionary 'aggregated_outcome' was saved successfully.

Select dictionary
☒ User ☐ System

Dictionary type
☐ Regular dictionary
☐ Aggregated dictionary
☐ Equal intervals
☐ Customer intervals

Dictionary	Code	Name
entry_units	0	Total
service	1	complete
aggr_service	2	abandoned
service_termination	3	transfer
outcome		
aggr_events		
agent_groups		
main_service		
node		
service_groups		
flow_outcome		
service_group_flow		
interqueue_outcome		
g_outcome		
aggregated_outcome		

Return

Delete

Rename

New

New as

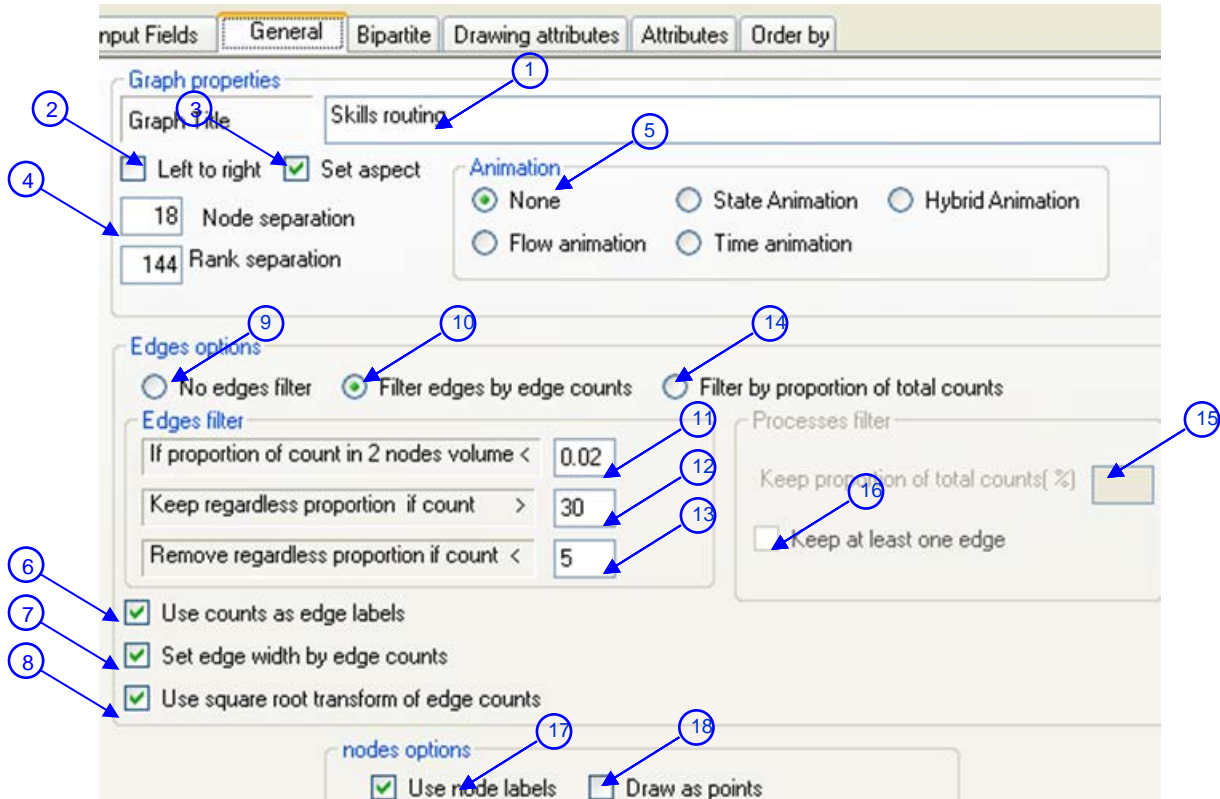
Edit

Preview

Save

Appendix 3 SEEGraph Selected Tabs

The General tab



Graph properties:

- (1) **Graph Title:** This option allows inserting a meaningful name to the graph, which will then be presented on the top of the screen. Note that the name of the study and the date are placed automatically as part of the title (no need to write those).
- (2) **Left to right:** The option (when selected) places the graph flow from left-to-right instead of top-down.
- (3) **Set aspect:** set full screen graph view (*not active for current version*)
- (4) **Node separation:**
Rank separation:
- (5) Select animation type: **None:** without animation; Flow animation depicts customer dynamics as they flow through the states of the graph; State animation depicts the queueing perspective, i.e. presenting counts of customers in queue/in service; Time animation presents the intensity of the flow over time, with width of arcs corresponding to flow intensity. Lastly, the hybrid animation presents both the State view and the Flow view together.

Edge options:

- (6) **Use counts of edge as labels:** Presents the number of flowing cases through a certain edge (note that it is not recommended to use both width and count).
- (7) **Set edge width by edge counts:** Setting the width of the arcs correspondingly to the number of customers that flow through the specific arc.
- (8) **Use square root transform of edge counts:** An option that scales widths to be non-linear (square root function) of the counts.
- (9) **No edges filter:** Every possible route between two nodes is presented.
- (10) **Filter edges by edge counts:** Filtering some of the routes from the process map.

Filter options:

- (11) **If proportion of count in 2 nodes volume < (e.g. 0.02):** If the proportion of traffic through an arc is smaller than x% of the total flow in pairs of nodes (e.g. 2%) then it will be eliminated from the graph.
- (12) **Keep regardless proportion if count > 30:** This option keeps the arc (even if it is below x% of total count) if it is “important enough”, i.e. with value being over some y (e.g. y= 30 in our example).
- (13) **Remove regardless proportion if count < 5:** The option removes edges that are above x%, if they are below a certain absolute count z (e.g. z=5 in our example). So, if an edge qualifies proportion-wise it might still be removed due to total count constraints.
- (14) **Filter by proportion of total counts:** Options that consider the total flow (and not only pairs of nodes).
- (15) **Keep proportion of total counts (%):** Keeps a proportion of total counts per arc.
- (16) **Keep at least one edge:** Keeps at least one edge, if all edges qualify for removal.

Nodes options:

- (17) **Use node labels:** Nodes can be empty, so checking this option would present the node label (e.g. name of activity).
- (18) **Draw as point:** This option allows drawing nodes as points (takes zero space).

The Bipartite tab

The screenshot shows the 'Bipartite' tab in a software interface. At the top, there is a navigation bar with tabs: 'Bipartite', 'Drawing attributes', 'Attributes', and 'Order by'. Below this, a dark grey box contains the text 'skills_sinks'. The main area is titled 'Bipartite graph options' and contains several settings. A blue circle with the number '1' has an arrow pointing to the 'Directed graph' checkbox, which is checked. To the right of this section are radio buttons for 'No sinks' and 'Use simple sinks', and a 'Sinks filter' section with a text input 'served' and a 'Select' button. Below the 'Directed graph' section is a 'Balance graph' section with radio buttons for 'No balance', 'Balance by main left', 'By left nodes', and 'By left node groups' (which is selected). A blue circle with the number '3' has an arrow pointing to this 'Balance graph' section. Below the 'Balance graph' section is a 'Nodes' section with a text input 'service' and a 'Select' button. A blue circle with the number '2' has an arrow pointing to the 'Remove single pairs' checkbox, which is unchecked.

Bipartite graph options

☒ Directed graph

☐ No sinks

☒ Use simple sinks

Sinks filter

served

Select

Balance graph

☐ No balance

☐ Balance by main left

☐ By left nodes

☒ By left node groups

Nodes

service

Select

☐ Remove single pairs

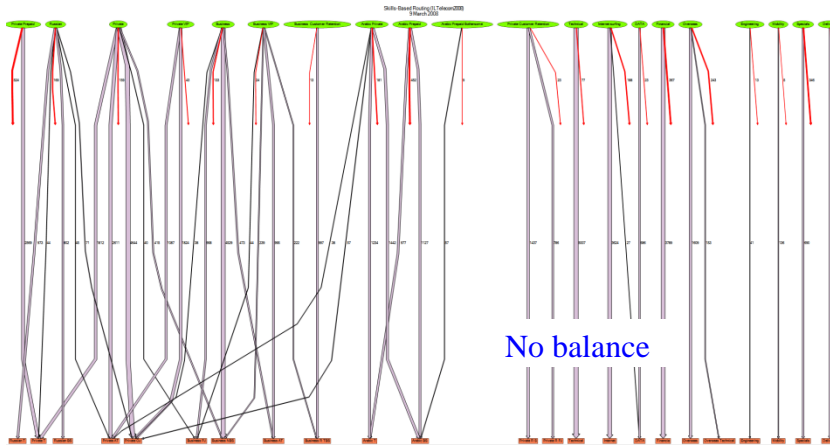
Bipartite graph options:

(1) **Direct graph** – arcs are directed (in contrast to an undirected graph, where arcs have no direction and traffic can go both ways)

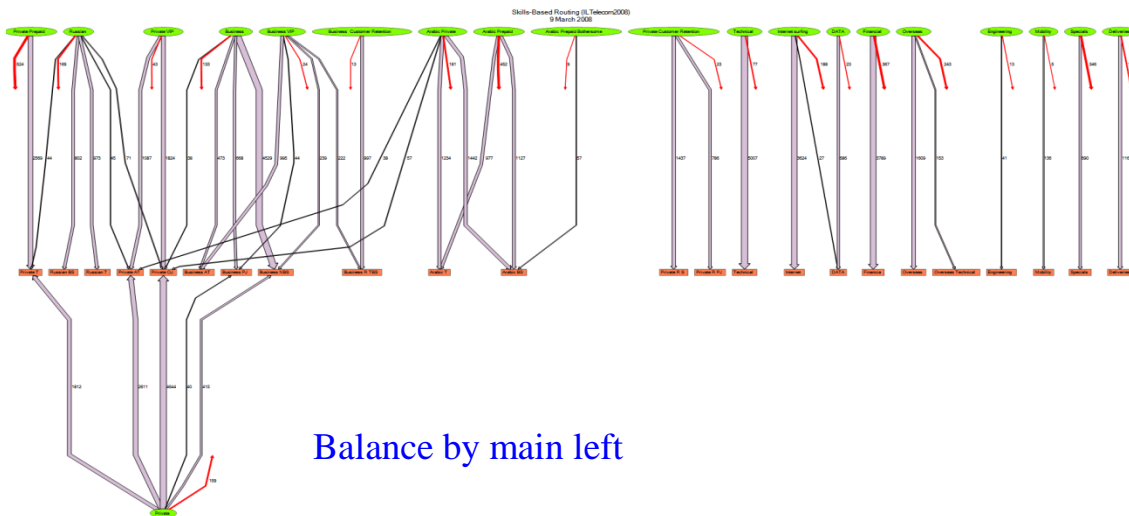
(2) **Remove single pairs** – remove one-to-one connections, i.e. I-architectures.

(3) Balance graph options:

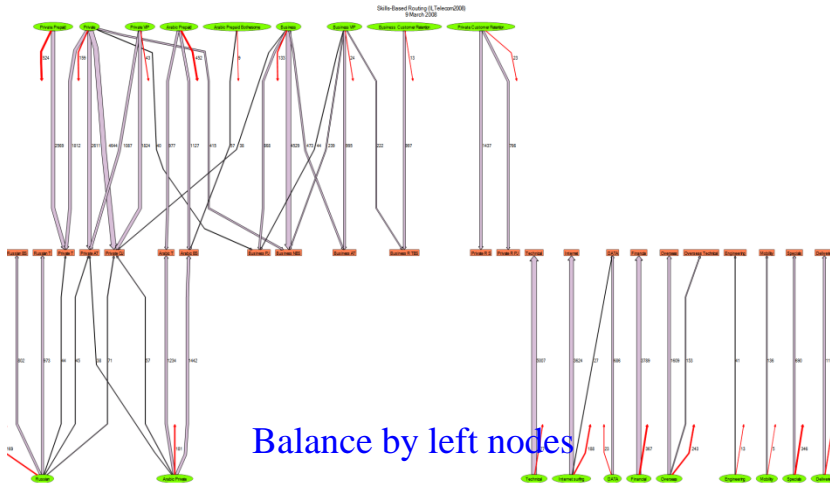
- **No balance** – One set (queues) on the one side, the other set (service pools) on the other side.



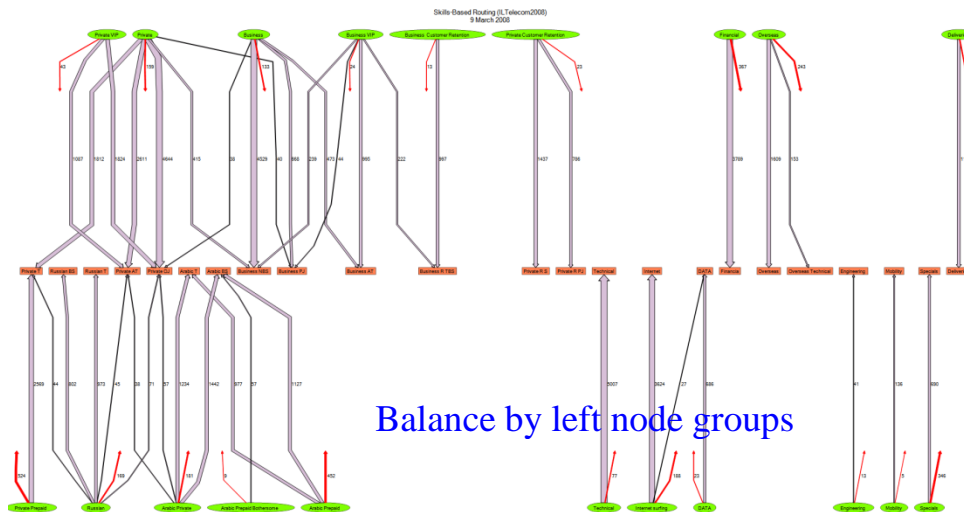
- **Balance by main left** – Most connected components move below



- **By left nodes** – arrange queues in an event manner



- **By left node groups** – arrange the graph so that the queues that connect to the same service pools on one side



Appendix 4 Selected USBank tables

The agent_events table

1. agent – agent extension number.
2. primary_service – service the agent is skilled to provide (see following *service* dictionary).
3. event_start – time in seconds at which the segment is started.
4. event_end – end_time – time in seconds at which the segment is ended.
5. start_time – date/time at which the segment is started.
6. end_time – date/time at which the segment is ended.
7. duration – amount of time agent performing an event specified in field event_id.
8. event_id – event codes for idle states (40–49), breaks (60–62), available state (50), sign-on states (20–21), sign-off states (30–31), agent originated (2) or agent answered (1) call segment (see following *agent events* dictionary).
9. business_line – associated call received at least one service – 1, or otherwise – 0.
10. service – type of service received by the caller (see following *service* dictionary).
11. node – identifier of the site where the agent is situated.
12. record_id – ID number assigned to the record, this is created for all the segments of a particular day.
13. agent_group – skill-group is defined to be a group of agents that have the same skill-set to serve the different service types.
14. main_service – main-service is defined to be the most important service type that a skill-group serves. More specifically, the main-service is defined according to the percentage of the agent calls from each service type and the percentage of the service type calls in each agent group.

The customer sub-calls table

1. call_id – universal identifier associated with the entire call.
2. cust_subcall – sequence number of service that a caller received during his call.
3. record_id – ID number assigned to the record, and is created uniquely for all segments of particular day.
4. node – identifier of the site where the call is currently being processed.
5. service_group – service group that handled the call (see following *service group* dictionary).
6. service – type of service received by the caller (see following *service* dictionary).
7. first_service – first type of service requested by the caller from the primary agent (see following *service* dictionary).
8. segment_start – time in seconds at which the segment is started.
9. queue_exit – time in seconds at which the call exits the queue.
10. service_entry – time in seconds at which the call enters the agent.
11. segment_end – time in seconds at which the segment ends.

12. **seg_type** – state of the call (Begin/End/Intermediate) (see following *segment type* dictionary).
13. **outcome** – cause of call termination (Handled/Transferred/Abandoned/..) (see following *outcome* dictionary).
14. **seg_parties** – type of resource that answered the call (Agent/Supervisor/Conference/..) (see following *segment parties* dictionary).
15. **wait_time** – delay time plus queue time.
16. **queue_time** – queue time.
17. **preservice_wait** – ring time and call_type time.
18. **service_time** – talk time and hold time.
19. **hold_time** – amount of time a caller spent on hold on an agent's teleset.
20. **undefined_time**
21. **party_answered** – resource/code number that answered the call; for example, if the number is greater than 10000, then an agent answered the call.
22. **agent_group** – skill-group is defined to be a group of agents that have the same skill-set to serve the different service types.
23. **main_service** – main-service is defined to be the most important service type that a skill-group serves. More specifically, the main-service is defined according to the percentage of the agent calls from each service type and the percentage of the service type calls in each agent group.

Selected USBank dictionaries:

service dictionary	
1	Retail
2	Premier
3	Business
4	Platinum
5	Consumer Loans
6	Online Banking
7	EBO
8	Telesales
9	Subanco
10	Case Quality
11	Priority Service
12	AST
13	CCO
14	Summit
15	Quick&Reilly
16	Mortgage
17	BPS

service group dictionary	
1	VRU
2	Business Line
3	Announcement
4	Message
5	NonBusiness Line
6	NonCC Service
8	Overnight Closed
9	Trunk
10	Incoming NonBusiness
11	Internal
12	Outgoing
15	Disconnected
99	Unknown

segment type dictionary	
1	customer call start
2	customer call start and end
3	customer call end
4	customer call middle segment
5	processed in another queue
6	outgoing
7	transfer
8	external transfer
9	agent to agent
10	supervisor key pressed
11	message key pressed
12	predictive message

outcome dictionary	
1	Caller Termination
2	Agent Termination
3	Undetermined Termination
4	Termination Error
11	Abandoned Short
12	Abandoned
13	Other Unhandled
14	Unhandled Error
20	Transfer
21	Outgoing Transfer
22	Agent Transfer
23	Process Remotely
30	NIQ Disconnected
40	Missing record
50	Outbound call

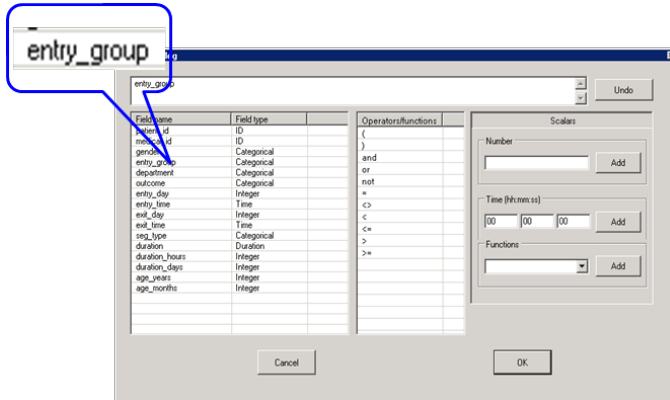
agent events dictionary	
1	Incoming Call
2	Outgoing Call
20	Signon
21	Internal Signon
30	Signoff
31	Internal Signoff
40	Idle Noreason
41	Idle Break
42	Idle Papers
43	Idle Back to Customer
49	Idle Signon
50	Available
60	Short Break
61	Medium Break
62	Long Break

segment parties dictionary	
10	Trunk
11	Trunk + Conference
12	Trunk + Emergency
13	Trunk + Conference + Emergency
20	Agent
21	Agent + Conference
22	Agent + Emergency
23	Agent + Conference + Emergency
30	Announcement
31	Announcement + Conference
32	Announcement+ Emergency
33	Announcement + Conference + Emergency
40	Voice port
41	Voice port + Conference
42	Voice port + Emergency
43	Voice port + Conference + Emergency
50	Agent
51	Agent + Conference
52	Agent + Emergency
53	Agent + Conference + Emergency
80	Virtual trunk
81	Virtual trunk + Conference
82	Virtual trunk + Emergency
83	Virtual trunk + Conference+ Emergency
90	Interflow trunk
91	Interflow trunk + Conference
92	Interflow trunk + Emergency
93	Interflow trunk + Conference + Emergency

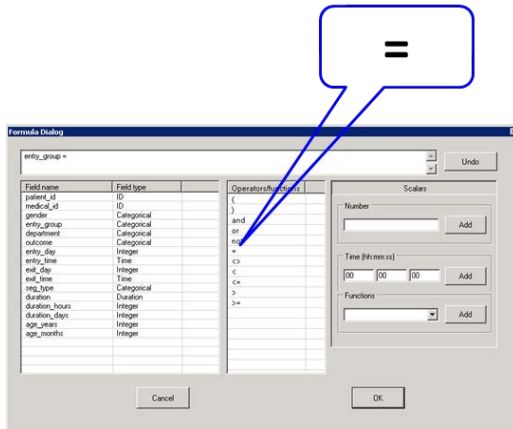
Appendix 5 How to type a formula in SEESat

5.1 Fill in formula: $entry_group = 1$

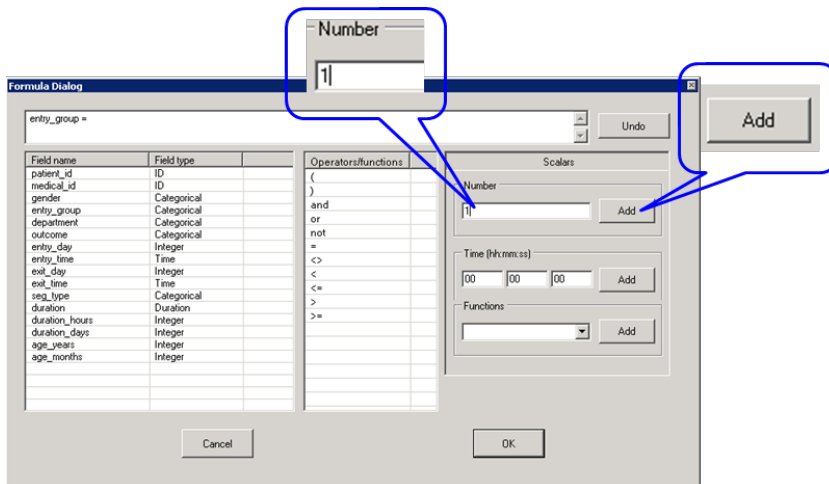
Select `entry_group` field in Field name list box.



Click on operator *equal* (=) in Operators/functions list box.



Write number 1 in text box in frame *Scalars* and click button [Add](#).



Formula Dialog

entry_group = 1 and duration_days < 30 and (department = 1 or department = 2)

Undo

Field name	Field type
patient_id	ID
medical_id	ID
gender	Categorical
entry_group	Categorical
department	Categorical
outcome	Categorical
entry_day	Integer
entry_time	Time
exit_day	Integer
exit_time	Time
seq_type	Categorical
duration	Duration
duration_hours	Integer
duration_days	Integer
age_years	Integer
age_months	Integer

Operators/functions
(
)
and
or
not
=
<>
<
>
<=
>=

Scalars

Number

Time (hh:mm:ss)

00 00 00 Add

Functions

Add

Cancel OK

5.2 Fill in formula: *entry_time* > 09:30:00

Select *entry_time* field in Field name list box. Click on operator *more* (>) in Operators/functions list box. Fill in time 09:30:00 in text box in frame *Time (hh:mm:ss)* and click button [Add](#).

Formula Dialog

entry_time >

Undo

Field name	Field type
patient_id	ID
medical_id	ID
gender	Categorical
entry_group	Categorical
department	Categorical
outcome	Categorical
entry_day	Integer
entry_time	Time
exit_day	Integer
exit_time	Time
seq_type	Categorical
duration	Duration
duration_hours	Integer
duration_days	Integer
age_years	Integer
age_months	Integer

Operators/functions
(
)
and
or
not
=
<>
<
>
<=
>=

Scalars

Number

Time (hh:mm:ss)

09 30 00 Add

Functions

Add

Cancel OK

5.3 Fill in formula: *log* (*duration*)

Select *log* in combo box in frame *Functions* and click button [Add](#).

Formula Dialog

Undo

Field name	Field type
patient_id	ID
medical_id	ID
gender	Categorical
entry_group	Categorical
department	Categorical
outcome	Categorical
entry_day	Integer
entry_time	Time
exit_day	Integer
exit_time	Time
seq_type	Categorical
duration	Duration
duration_hours	Integer
duration_days	Integer
age_years	Integer
age_months	Integer

Operators/functions
(
)
and
or
not
=
<>
<
>
<=
>=

Scalars

Number

Time (hh:mm:ss)

00 00 00 Add

Functions

log
exp
log

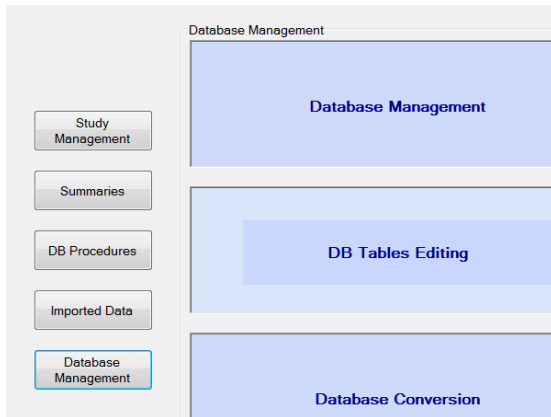
Add

Cancel OK

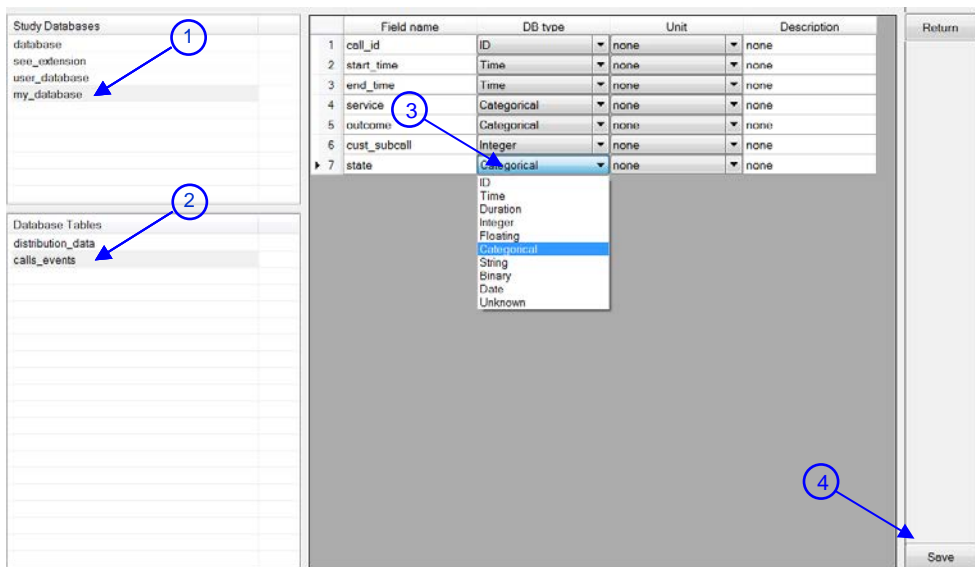
Click on operator *left bracket* (() in Operators/functions list box. Select *duration* field in Field name list box and click on operator *right bracket* ())

Appendix 6 How to change type of field

Click *Main->Data Management->Database Management-> DB Tables Editing*



Select study (if needed).



- (1) Select database
- (2) Select database table
- (3) Click on DB type and change DB type
- (4) Click Save Button

Appendix 7 Calculations (DRAFT)

State Animation:

Calculate instants (moment of time) counts in time interval from start_time to end_time for **current** event.

Hybrid Animation:

Compute instants (moment of time) counts in time interval from start_time of **current event** to start_time for **next event**.

Instants calculation

Compute instants (moment of time) counts in time interval from start_time to end_time.

Define:

- **Discrete scale of time:** 24 hours of day divided into 86400 one second length time intervals.

- m_j – moment of time j , or second $_j$; $j=1, 2, \dots, nt$;
 nt – length of time interval or number of moments of time;

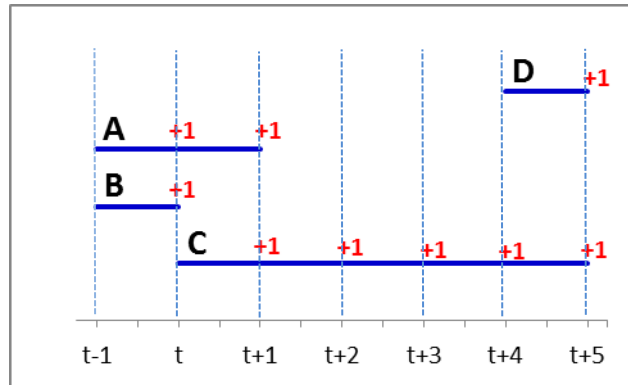
$$nt = end_time - start_time + 1$$

- x_i – event i (for example call waited in queue or patient gets treatment in ED);
 $i=1, 2, \dots, n$;
 n – total number of events
- x_{iopen} – “open” event i at moment of time, so that event start $>$ start_time and event end \leq end_time
- $N_{at\ moment\ i}$ – number of “open” events at moment of time i

$$N_{at\ moment\ i} = \sum_i^n x_{iopen}$$

Events A, B, C, D were observed at time interval from $t-1$ to $t+5$. Event start time and event end time known.

event	event start	event end
A	$t-1$	$t+1$
B	$t-1$	t
C	t	$t+5$
D	$t+4$	$t+5$



+1 – add “open” event at moment of time

Questions: How many “open” events were at every moment of time in defined interval?

Let see the sample:

$$n = 4$$

$$start_time = t-1$$

$$end_time = t+5$$

$$nt = t+5 - (t-1) + 1 = 7 \text{ moments of time}$$

j	m_j	$N_{at\ moment\ i}$	x_{iopen}
1	$t-1$	0	
2	t	2	A, B
3	$t+1$	2	A, C
4	$t+2$	1	C
5	$t+3$	1	C
6	$t+4$	1	C
7	$t+5$	2	C, D

