1CE055P2 - SoNorA

O.5.6.2 – Intermodal routing tool: technical specification for reprogramming

Work Package	WP 5 –Activating services along itineraries				
Action	A5.6 – ICT development nodes				
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Version	Date	Status	Date	Status
1	23.06.2010	draft	8.10.2010	LP revised
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1 Executive Summary

One of the main objectives of this action is the further development of an existing IT-Tool, to extend this tool with an edit-function to edit terminals and networks. These functions are necessary to describe and to compare different scenarios with the default scenario and to publish the results. Therefore it also was necessary to elaborate the requirements and the necessary improvements to develop a convincing specification requirement. As result of the elaboration it turned out that two edit functions are necessary; firstly, a terminal edit-tool and secondly, a network edit-tool. This specification requirement handles the needs for the network edit-function. With this function it is possible to edit new networks, like street-, rail-, waterway-, sea- and ferry- network. To do this it also has to be possible to change parameters, information and other data of the networks. To publish the results for other users a publishing function is required.

2 Introduction

This document describes the functions of the INTERIM IT-Tool and provides an overview of the new functions which have to be implemented.

3 Context and objectives

SoNorA addresses the need for improved multimodal accessibility in Central Europe in South-North dimensions, its aim is to incisively bring forward the state of the art on the deployment of primary transport infrastructure and services, through transnational collaboration to prioritise: transport network development, removal of obstacles in the infrastructure realisation process, activation of services along itineraries. For example, the project will result in the development of transnational tools and guidelines from case studies and business case development for new logistics services.

The new evaluation tool for network supports the aim of work package 5 (activating of services along itineraries) by providing the user a strategic information and evaluation tool for changes of nodes in the

intermodal network in the whole of Europe. The user creates scenarios (by changing of the network of the default), shares and discusses them with other users and compares the scenarios with the default evaluating the changes.

The purpose of developing the technical specification is to describe the functionalities and the needed functions of the IT tool for the respective developer and user of this tool. It contains detailed description of all functions, specific requirements, the project scope and improvements of this tool. The effect of its utilization is to develop an IT tool which can used to simulate and describe different scenarios of logistics networks in Europe, to find new possibilities to improve the interaction between the transport and logistics administrators, public authorities, network operators and logistic service providers.

4 Scope of output

The document includes the requirement specification of this IT-Tool. The implementation of the new functions and check of functionality is content of the core output "O5.6.5 ICT development: evaluation tool for network".

5 Importance to the SoNorA Network

This technical specification is the basis for the new evaluation tool for network (O5.6.5) and describes the functions to be included. The new evaluation tool for network itself is important for the SoNorA project as all project partners can use this tool, e. g. for the evaluation of the effects of their developed business cases. Furthermore any network changes planned in the SoNorA network area can be evaluated by the tool.

6 Methodology and approach – methodological approach

Basis for the technical specification are the functions and description of the already existing interim IT tool that will be developed further. Details of the new functions for the new evaluation tool for network were worked out and described. With a questionnaire all SoNorA project partners were asked to give comments and ideas about the planned new functions. The answers were included in this technical specification.

There is a strong interlinkage with "O5.6.5 ICT development: evaluation tool for network" as this technical specification describes the new functions of the tool of output 5.6.5, it is the basis.

7 Users of the new evaluation tool for network

The following figure provides an overview of the main user groups:

- Adminstrations and agencies
- National, regional and local level representatives
- Network Operators

The following classification of logistics service providers will be considered:

- Providers of transport services on rail, inland waterways and short sea shipping
- Providers of transhipment services
- Intermodal terminal operators
- Hub operators
- Providers of additional logistics services

8 Aims and objectives of the developed system

The new evaluation tool for network consists of the already existing interim IT tool and additionally an edit function to edit network segments to create, describe and compare different scenarios with the default and to publish the results. With this function it is possible to add new network segments, delete existing segments and edit the parameters of segments. Furthermore, the creator of a scenario can upload files concerning the scenario (description, idea, etc) and publish all to other user for discussion. Additionally, the created scenario can be compared with the default to evaluate the changes in the network.

9 Scope / constraints of the developed output

9.1 Scope

SoNorA exerts the development of an intermodal South-North-Transport passage from the Baltic Sea to the Adriatic, as a base for the regional development in Central Europe.

The field of duties of the Technical University of Applied Sciences Wildau includes the creation of a feasibility analysis about the logistic services related infrastructure and ICT applications in the SoNorA-network.

This document contains the description of a toolset which can be used to change the intermodal transport network at the South-North-Axis and in the whole of Europe and evaluate it with the default.

9.2 Conceptual constraints

It is assumed that routes which are included in the timetable of regular traffic and traffic on demand in the context of intermodal transportation are deposited in the system. Special traffic or ad hoc traffic can not be considered in the system. In general the availability of data may be another conceptual constraint.

9.3 Geographical constraints

The tool covers not only the SoNorA project area, but almost the whole of Europe.

10 Requirements of the developed software tool

10.1 User interface requirements

- The tool should be developed with an English language user interface.
- To avoid barriers concerning the usage of the tool no submission of installation files or executable files to potential users are necessary.
- The GIS data for the tool have to be interactive (i.e. linking selected elements in tables with their display in maps and vice versa).
- The buttons, icons and fields of the tool contain an explanation of the context (e. g. activated when standing with the pointer for approx. 1 sec.). Most functions provided in the system are self explanatory, so that this user manual could be kept to a minimum. Nevertheless, online help should be offered for features that require some more explanations.

10.2 Security requirements

Security was taken as a very serious non-functional requirement so that the data and information of each user is protected from visibility and possible alteration by other users. The admission to the toolset will be given after filling in a registration form via the internet and its transmission to the administrator. Information like company / department name, contact person, address and e-mail are compulsory to get an account. It is intended to generate the password automatically which means that it will be transmitted automatically to the prospective user after the approval of the administrator. The administrator has to be informed via e-mail about a new request.

11 Output specific analytical work

No analytical work will be carried out to develop the new functions, all analytical work is already included in the existing interim IT tool.

12 Obstacles

For the elaboration of the technical specification questionnaires were sent to the project partners to get feedback, comments and ideas. Unfortunately only a few answers were received. Therefore only these few comments could be integrated.

13 Identification of next steps

Based on this technical specification the next step is the development of the tool which is foreseen in "O5.6.5 ICT development: evaluation tool for network" of SoNorA.

14 Results – software tool description and application

14.1 Product Features

The main purpose is the integration of an edit-function to add and change networks (edges) inside the INTERIM-toolset.

14.2 Operating Environment

The Service Provider is the Technical University of Applied Sciences Wildau (TH Wildau; PP 24), which is operating the system. The TH Wildau is authorized to run analyses on data in the system in order to optimize the provision and exchange of information.

14.3 Homepage of existing interim IT tool

The Interim IT tool can be used to evaluate logistics nodes and networks. Thereby the street-, rail-, short sea shipping-, inland waterway-, and ferry-networks are considered. The provision of comprehensive information of the terminals, such as number of handled units like gantry cranes or reach stackers, opening hours, special goods, container storage etc. is a further feature of this IT tool. Furthermore, it covers all European countries. The INTERIM IT tool is hosted on www.viom.de/interim. To get access to the IT tool you have to register. User name and password are to be asked to the administrator.

Following is the start page.

Figure 1 Starting page of Interim

Toolbar:

	previous map view / next map view
	Navigate to the map's origin

	Zoom in / Zoom out
	Zoom out for quick orientation
	Toggle pan mode on / off
	Distance measuring on / off
	Print map cut-out
	Maximize applet / reinsert into browser window
	3D-view
	Show / hide navigable overview window
	Zoom to selected local position

14.4 Calculation of a route – without fixed relations

14.4.1 From terminal to terminal

Selection of a terminal from the terminal list through one of the following options: - Filter by country-specific ISO code - Filter by city name - Filter by name - Filter by Zip code - Filter by street name - Filter by description With > it can be skipped to the next page of the list or >> to get to the end of the list The user can sort the table by Name, Description, Country, ZIP code, City name, Street name or Geo-code through clicking on the header of each column. The list will be sorted in alphabetic order or vice versa.	
By clicking on the blue "assign to start" button after the selection of a TSP the name of the assigned terminal will be indicated. The red star in the map turns into the "start icon".	
The user has to repeat the same procedure for the selection of the destination, by clicking on the blue "assign to destination" button the name of the assigned terminal will be indicated. The red star in the map turns into the "destination icon".	

Optional: The user can repeat the same procedure for the selection of one or two via-points and has to click on the blue ”assign to via1” / ”assign to via2” button (see more details at the end of this chapter) The user has to press the “Routing” button to get to the routing page	
On the following page the user can specify the query by selecting 1. “Optimization Mode” 2. “Allowed Modes” 3. “Transport Capacities by vehicle/train (TEU)” 4. “Transport Quantity (TEU)” 1. The “Optimization Mode” allows the determination of the fastest route (Duration), the cheapest route (Costs), the most energy-saving route (ECO) or the shortest route (Distance) 2. “Allowed Modes” allow the selection of one or more modes of transport for the routing 3. “Transport Capacities (TEU)” enables one to state maximum transport capacities for each mode of transport 4. In the field “Transport Quantity (TEU)” the user can enter the volume that shall be transported.	

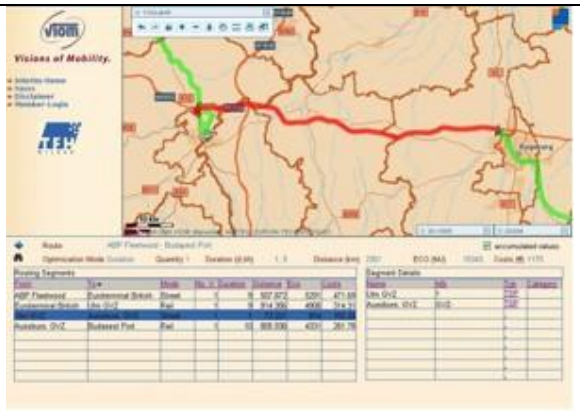
The user can press “Show routing points” in order to see in the map the area covered	
- If buttons are in coloured grey, no changes can be made - If changes concerning the selection of the terminals have to be done, the button “Terminals” can be used to get back to the terminal list - With the “Clear” button the terminal settings can be deleted - With the “Routing” button the user can get again to the routing page	
- The user has to press the “Start query” button to start the routing process - If a routing request has already been done, the last result can be displayed by pressing the button “Show last result”	

The next page shows the routing result based on the chosen optimization mode. The following information for the whole transport chain as well as for individual routing segments is available: - Quantity to be transported - Duration - Distance - Energy consumption - Costs A segment is a section from one TSP to another TSP without changing the mode of transport	
If changes e.g. concerning the selection of optimization mode, mode of transport or quantities etc. have to be made, the user can use the blue button “Back” to get back to the routing page	

Geographical details of the routing segments can be displayed in the map through the selection of an individual segment in table “Routing Segments”:

1. Click on routing segment
2. Map zooms to the segment
3. Chosen segment shows up in red
4. Segment details change (in the table “Segment Details”)

Geographical details of the TSP of the chosen routing segment can then be displayed through selection of a terminal name in the table “Segment Details” on the right side



Sequence of columns:

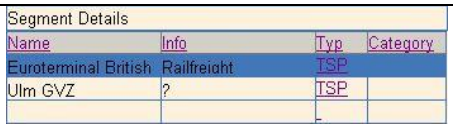
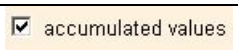
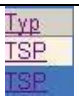
- Name of Start TSP of a segment
- Name of End TSP of a segment
- Mode of transport within the segment
- Number of vehicles / trains necessary
- Duration per segment
- Distance per segment
- Energy Consumption per segment
- Costs per segment

Routing Segments

From	To	Mode	No. V.	Duration	Distance	Eco	Costs
ABP Fleetwood	Euroterminal British	Street	1	9	507.872	5291	471.69
Euroterminal British	Ulm GVZ	Rail	1	9	914.356	4906	314.31
Ulm GVZ	Augsburg. GVZ	Street	1	1	73.221	814	102.24
Augsburg. GVZ	Budapest Port	Rail	1	10	805.936	4331	281.78

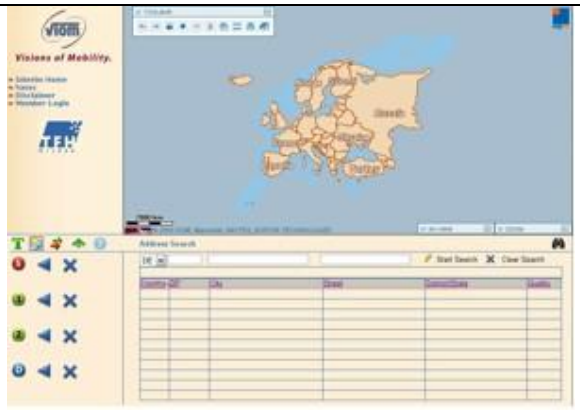
Sequence of row entries:

- From Start TSP to TSP (segment 1)
- From TSP to TSP (segment 2)
- From TSP to TSP (segment 3)
- From TSP to End TSP (segment 4)

Sequence of columns: - Name of TSP of chosen segment - Related Logistics Service Provider (LSP) - Type of terminal Sequence of row entries: - Start TSP of chosen segment - End TSP of chosen segment	
If the field "Accumulated values" is checked, the transport values for the total number of TEU will be evaluated	
The link in the Column "Type" leads to detailed information about the selected TSP	

14.4.2 From free address to free address

Beginning from the start page, the user has to click on the button "Address search"	

To search for an address there are several options. After the selection of the country-specific ISO code a.) Search by City name b.) Search by Zip code c.) Search by City name + Street name Example: selection by City name + Street name - Select e.g. “DE” and enter city name and street name.	
The user has to press the “Start search” button to start the query	
- The user has to click on the respective address line to choose as start. (With > the user can skip to the next page of the list) - The map zooms to the selected starting point and shows a red star at the local position of the address - The user has to click on the blue ”assign to start” button - The assigned address will be indicated. - The red star in the map turns into the “start icon”	
The can press the “Clear search” button in order to delete all filled in address fields	

The user has to repeat the same procedure for the selection of the destination address and assign to destination NOTE: Free addresses can only be used as start or destination of a routing query. Therefore as via-points only TSP from the terminal list can be selected.	
The user has to press the "Routing" button to get to the routing page and continue as already described in the previous chapter	

14.5 Calculation of a route – with fixed relations

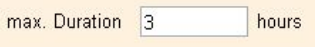
The INTERIM IT tool offers the possibility to include fixed relations in the routing process. Fixed relations are relations where intermodal service offers already exist and which will be run by a transport operator. The existing market offer will be taken into account and included as backbone. That means it serves as main leg to complete the routing process.

The calculation of a route with fix relations can be realised after the determination of a start and destination (either terminal and / or free address). After the assignment of a start and a destination as described in the previous chapters, the user has to press the button ”Fixed relations” 	
The user has to press the red button “Search fix relations between Start and Destination” NOTE: The default setting of the search for fix relations is within a radius of 300km from Start or Destination. If no values were found the user shall increase the radius.	
Results at radius 300km: The user has to select from the list a fixed relation by clicking on the relation. (With > the user can skip to the next page of the list). The selected fixed relation turns white.	

The user has to press the arrow "Assign fix relations between Start and Destination". The fix relation is assigned when it turns red. The name of the company (if available) which operates the chosen fix relation will be indicated.	
The links in the Column "Info" lead to detailed information about the fix relation	
An assigned fix relation can be removed by pressing the button "Clear fix relations between Start and Destination"	
The user has to press the button "Routing" to get to the routing page and continue as already described previously (individual settings)	
The user has to press the "Start search" button to start the query	
The chosen fix relation is considered in the further routing process	

14.6 Analysis of accessibility

The INTERIM IT tool offers the possibility to analyse the accessibility of intermodal transhipment points regarding criteria such as duration, distance, costs and energy consumption.

The accessibility analysis can be realised after the determination of a start (TSP). The additional selection of a destination is optional. After the assignment of a start (and optional of a destination) as described previously, the user has to press the button ”Region”	
By clicking the button “zoom to start” the user starts the accessibility analysis from start. By clicking the button “zoom to destination” the user starts the accessibility analysis from destination	
The user has to select an optimization mode: - Duration - Distance - Energy consumption (ECO) - Costs	
A maximum value has to be entered by the user as basis for the analysis	

The query can be started by the user. - NOTE: The higher the entered value, the longer the evaluation process takes (exponential progression)	
The next page lists the results of the accessibility analysis based on chosen optimization mode and maximum value. The map pictures the results as isolines: - - value of outer line = 100% - - value of middle line = 66% - - value of inner line = 33% All terminals will be indicated which can be reached within the requested time (or distance, costs or energy consumption)	
The user can press on the blue stars in the map in order to receive detailed TSP information	

14.7 New features

A main functionality has to be to describe new scenarios with new / different parameters and data, therefore it is necessary to extend the tool with some new functions.

The user should be able to create his own scenario with different parameters and data of the networks. To compare the scenarios and modifications with the default values it is necessary to integrate an automated comparison function.

One of these functions is a function to edit networks, with all respective data and parameters.

- Add segments
- Remove segments

- Edit segments
- Automated comparison of the effects of the changes

Networks:

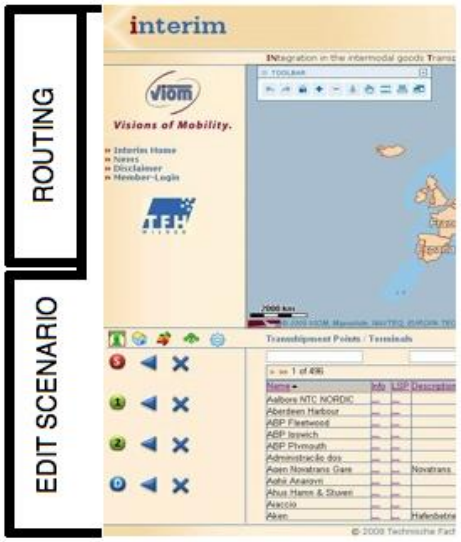
- Street
- Rail
- Water (inland water way)
- Sea (short sea shipping)
- Ferry

Further there are some improvements of the handling and the graphical user interface necessary.

The function is necessary to describe and to compare different scenarios with the default scenarios and to publish the results.

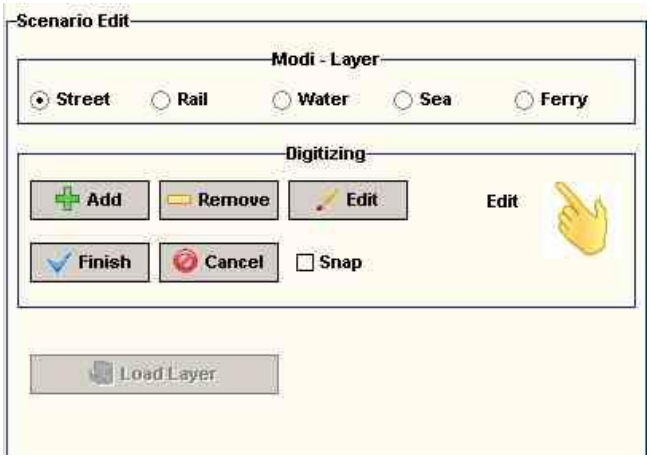
A scenario is a default interactive map including current terminals connected with the networks; e.g. rail, street, inland waterway, short-sea shipping and ferries. The special data (velocity, capacity, energy consumption, distance) of these networks have preset values which can be modified.

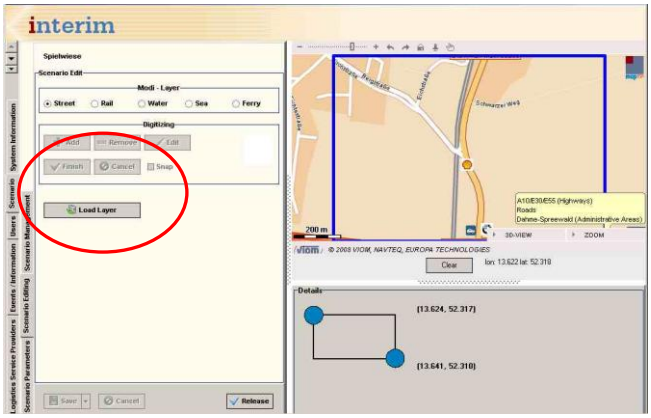
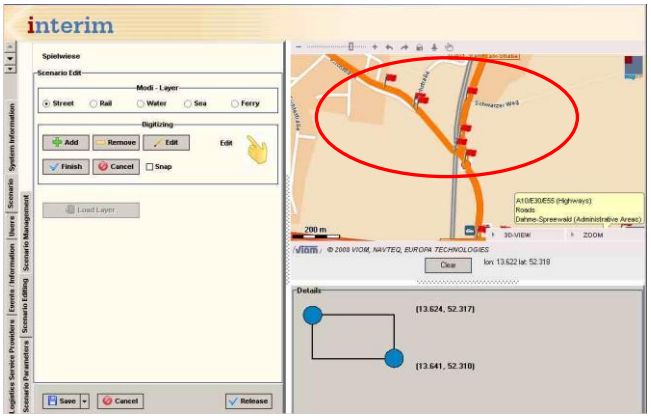
14.7.1 Edit Network

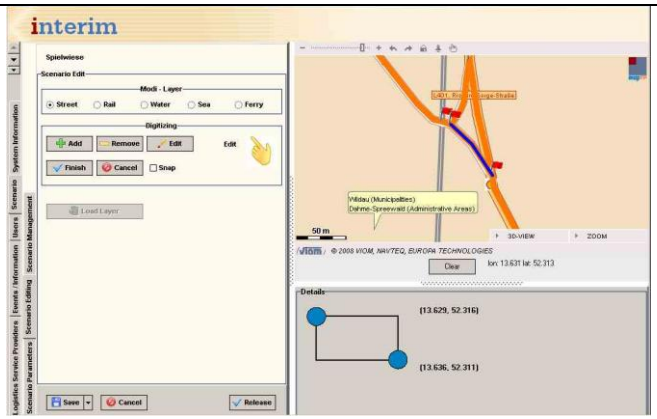
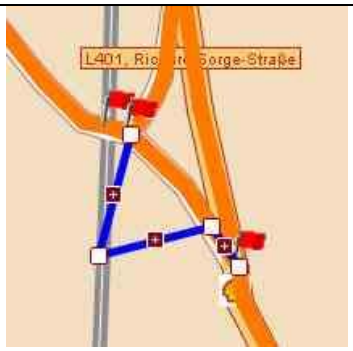
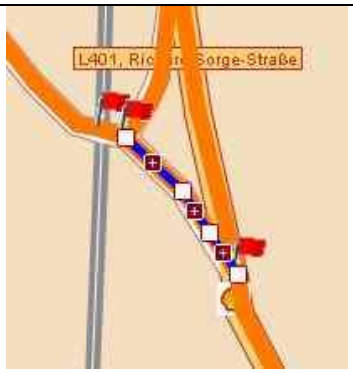
The new edit-function should be integrated into the INTERIM-tool. Appearing about two Tabs on the left side. – Scenario: the new functions – Routing: the existing functions To use the edit-function, it has to be necessary to assign every potential user a specific role. Specific roles are:	

– normal user without access to the edit function – advanced user with access to the edit function – test user with temporary access	
After choosing the edit tab the user should see an option window. There the user can choose between two options: – Add / Change Terminals – Add / Change Networks	

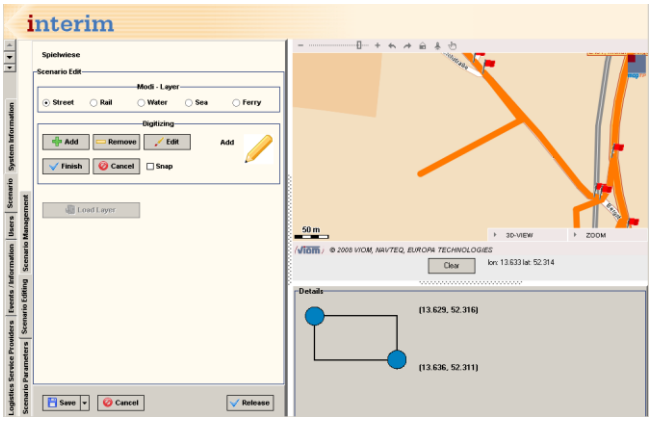
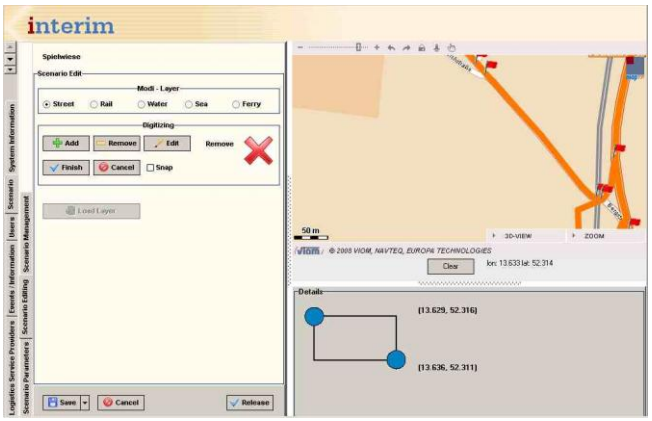
14.7.2 Change Network

By choosing Add / Change Network, the following options will be available: – Add segments – Remove segments – Edit segments – Finish – Cancel Furthermore the user will choose the respective network he will change or edit:	

– Street – Rail – Water (Inland Waterway) – Sea (Short Sea Shipping) – Ferry	
To add or change a segment, first the user has to determine an area where the route exists or will be inserted, doing by a selection window. After the selection of the area, the user has to load the network by pressing the load network button.	
The user should see the respective network in the selected window. The little flags on the segments mark the detailed routes.	
By clicking on a route, the segment will be highlighted.	

	
By a second click on the segment the user will see two different styles of marking. – a white square – a red square with a plus	
By clicking on the white squares the user can change the pathway of the segment by shifting.	
By clicking on the squares with a plus, the user can add new square markings to change the pathway or the position of the segment more exactly.	

14.7.3 Add / delete network

To add a new segment the user has to select the area of the new segment and press the Add-button. After clicking on the new position, the new segment should be connected with the nearest point.	
To delete a segment the user has to select the area of the respective segment and press the Remove-button. Then the user can click on a segment you he wants to delete, and it will be removed automatically.	
Now the user will be able to save these changes with the save-button. It is also possible to cancel all modifications with the cancel-button.	

14.7.4 Edit of information of the segments

The information of the segments has to be changeable. For example, by double-clicking on a segment, a	– Speed parameters – Cost parameters

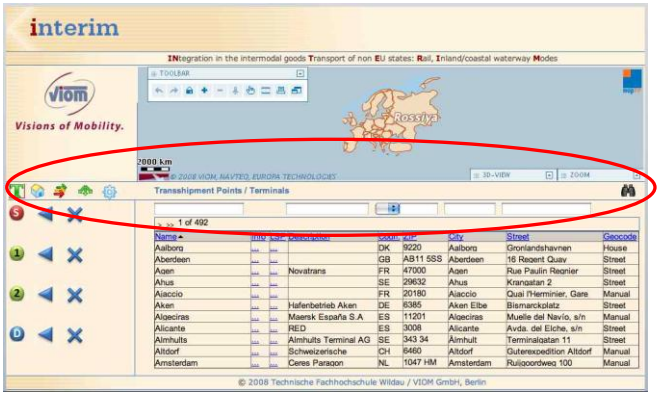
new window with the possibilities of modification should be opened.	– ECO parameters – Transhipment point parameters

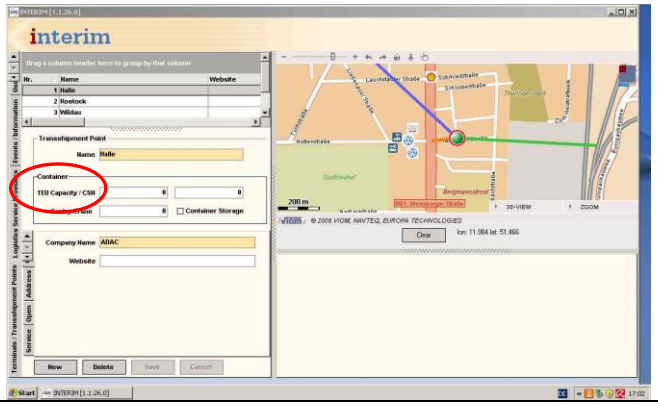
14.8 Other improvements of the system

14.8.1 Ease of operation

The handling of the site has to be improved, buttons and tabs larger.	
A log-out-function has to be integrated.	

14.8.2 Modifications of the graphical user interface

The site has to be adjusted so as to have a better display on widescreen monitors, as the lower frame covers the upper frame, so that the map is not completely displayed. Relief could be gained by a switch-function between table and map. Another option is a shift-function for the table, to shift the upper border up and down.	

The label “Container” has to be replaced with the label “Units”, because in there are not only parameters / information of containers are listed.	

14.8.3 Calculating Time

Under certain circumstances, the calculating time is too long. Improve by using another algorithm e.g. A*, to decrease the calculating time, could be advisable.

14.9 Automated comparison of the effects of the changes

It is necessary to compare the modifications with the starting values because every modification can have an effect on the scenario. The user is able to create his own scenario with different parameters and data of the terminals and the networks.

The changes have to be compared automatically by choosing the tab “Automated comparison”.

After choosing this tab the user sees a window with three options:

- Transit
- Internal accessibility
- External accessibility

On every comparison it is firstly necessary to determine an area where the respective terminals or networks are situated, by a selection window.

Therefore it is important to choose an area with a minimum of four and a maximum of ten terminals.

The selection window has to cover an area of 400 km^2 at most.

It should be possible to specify the query by selecting

- "Optimization mode"
- "Allowed modes"
- "Transport capacities (TEU)"
- "Transport quantity (TEU)"

1. The "Optimization mode" allows the determination of the fastest route (duration), the cheapest route (costs), the most energy-saving route (ECO) or the shortest route (distance)

2. "Allowed modes" allow the selection of one or more mode of transport for the routing

3. "Transport capacities (TEU)" allows one to state maximum transport capacities for each mode of transport

4. In the field "Transport quantity (TEU)" the user can enter the transport volume

14.9.1 Transit

This will be a function to test the transit through the area which was modified, to compare the effects onto the different Option Modes:

- fastest route (duration)
- cheapest route (costs)
- most energy-saving route (ECO)
- shortest route (distance)

Therefore it is necessary to route from the points (1-8) on the edge of the map to other respective points.

These points are reference points of the window, while no reference on the same side and reference of the same edge will be considered.

For example (coloured arrows):

1-4,1-5,1-6, (1st routing)

2-4, 2-5, 2-6, 2-7, 2-8 (2nd routing)

3-6, 3-7, 3-8 (3rd routing)

4-6, 4-7, 4-8, 4-1, 4-2 (4th routing)

and so forth

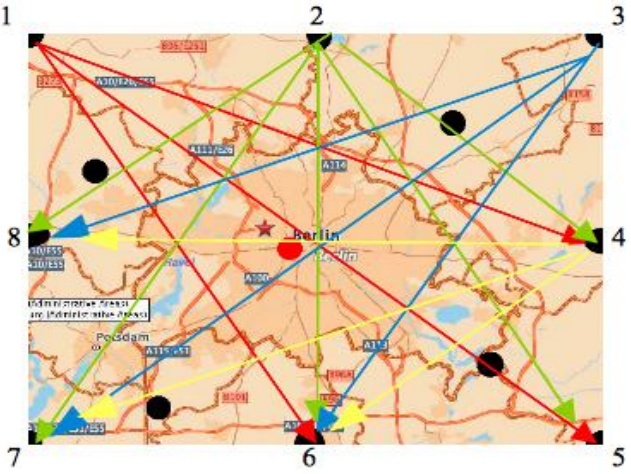
5-8, 5-1, 5-2 (5th routing)

6-8, 6-1, 6-2, 6-3, 6-4 (6th routing)

7-2, 7-3, 7-4 (7th routing)

8-2, 8-3, 8-4, 8-5, 8-6 (8th routing)

Repeating with the default parameters and data, to compare with the new scenario.



The output of this function are tables of:

- Default scenarios
- Scenario scenarios
- Difference scenarios

with the data of:

- Duration

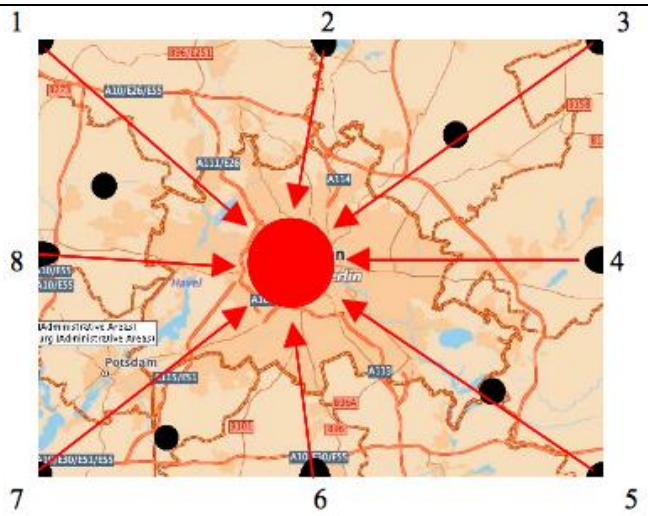
Default Terminals

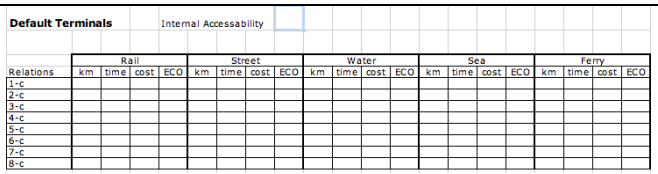
Relations	Rail				Street				Water				Sea				Ferry			
	km	time	cost	ECO	km	time	cost	ECO	km	time	cost	ECO	km	time	cost	ECO	km	time	cost	ECO
1-4																				
1-5																				
1-6																				
2-4																				
2-5																				
2-6																				
2-7																				
2-8																				
3-6																				
3-7																				
3-8																				
4-6																				
4-7																				
4-8																				
5-8																				
6-8																				

A second routing with the default values have to start also, to generate the default table as a comparison table.

– Costs – Time – ECO	

14.9.2 Internal accessibility

To test the internal accessibility from the border of the area the tool will route from the points (1-8) of the edge of the map to the centre terminal, calculated on the default and the scenario with modifications, after the changes to compare them. Comparing the effects onto the different option modes: – fastest route (duration) – cheapest route (costs) – most energy-saving route (ECO) – shortest route (distance)	

The output of this function are tables of: – Default terminals – Scenario terminals – Difference terminals with the data of: – Duration – Costs – Time – ECO	 **Default Terminals** Internal Accessability Rail / Street / Water / Sea / Ferry × km, time, cost, ECO Relations 1-c … 8-c

14.9.3 External accessibility

A function to test the external accessibility from the centre of the area with modifications out to the environment, after the changes. Comparing the effects onto the different option modes: – fastest route (duration) – cheapest route (costs) – most energy-saving route (ECO) – shortest route (distance)	
Additional to the graphical output there is a table with the terminals and the respective data of the selected area.	**Default Terminals** External Accessability Rail / Street / Water / Sea / Ferry × km, time, cost, ECO Relations 1-c … 8-c

14.10 Public scenarios

The user needs a function to publish the changed scenarios and the respective data and information on the website, available for other users.

The function should start by pressing the “publish” button. After pressing the button the user will come to a display window where a password can be set and other important information entered like:

- short description
- which changes have made
- screenshots
- tables
- maps
- upload of documents and pictures only in pdf or jpg format
- secure the information with password is possible but not mandatory.

15 Added value and expected benefits

The developing of multimodal infrastructure and services in the Central Europe area is the main objective of the SoNorA project. In particular, work package 5 attends to the chance to activate services along the Baltic-Adriatic axis by also analyzing innovative logistics solutions relevant for the network area. The development of this IT tool will bring together public authorities and logistics service providers with the aim to strengthen the logistics supply of the south - north axis.

16 Evaluation criteria for successful implementation of output

The tool offers the possibility to use new ways of transportation, furthermore, the scenario comparing function offers the opportunity to improve environmental quality by ”greener” transportation and logistic services. The output is successfully implemented when the functions are implemented in the IT tool as described above.

17 Abbreviations / glossary

TSP	TransShipment Point
LSP	Logistics Service Provider
Scenario	A test situation with stated parameters and data of the terminals and networks, to compare with the starting situation
Relation	Point of reference / a relation in mathematics is defined as an object that has its existence as such within a definite context or setting.
Routing	Routing is the process of selecting paths in a network along which to send network traffic. Routing is performed for many kinds of networks, including the telephone network, electronic data networks and transportation networks.
Network	In graph theory a network is a digraph with weighted edges.
Segment	A segment is a section from one TSP to another TSP without changing the mode of transport