A generic approach to improve navigational model usability based upon requirements and metrics

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Agenda

- Introduction
- Usability in navigational models
- Usability requirements for navigational models
- Metamodel extension for usability requirements
- Automatic support
- Conclusions and further work

Introduction

- Exponential increase in the number of WIS developed
- Appearance of numerous methodologies, languages, techniques, design patterns and tools specially focused on WIS development:
  - HDM, RMM, OOHDM, WebML, OO-H, MIDAS...
- However, they usually do not offer support to deal with usability requirements during the development process
  - Usability evaluation is delayed until the system has been completely developed

Introduction

- Tools called usability and accessibility validators (EvalIris, WebTango, WebXACT) has arisen:
  - Validate the HTML and CSS code of the WIS
  - The possibility of moving some of the validations towards the navigation or presentation models is not considered
- Gap between tools for automatic validation and methodologies for WIS development:
  - Usability validation processes not integrated within the methodologies
  - Usability validators not integrated within CASE development tools
- Considering usability requirements during WIS modeling we obtain the advantages of model-based usability evaluation
  - Improvement in quality of conceptual models will contribute to quality in the WIS finally developed

Introduction

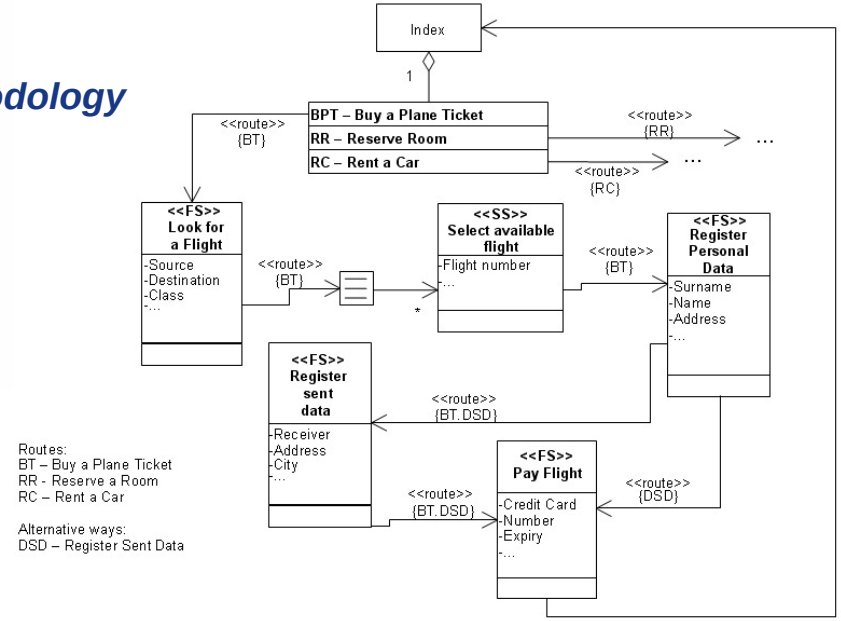
- We have developed an approach for considering usability requirements during WIS modeling
- Focused on navigational models and has the following features:
  - Identifies a set of usability requirements that could be validated over navigational models
  - Extends the metamodels used by WIS development methodologies with the aim of providing modelers capacity to reflect their own usability requirements
  - Proposes a set of metrics to help modellers to evaluate the quality of the WIS models
  - Offers a tool for supporting the approach

Usability in navigational models

- There exists different definitions
- Depends on numerous factors
- To improve WIS usability we must pay attention to multiple features:
  - Intuitive navigation
  - Simplicity to carry out tasks
  - Comfortable and attractive presentation
  - …
- Our proposal centeres on navigational models which model the interaction between users and the WIS

Usability in navigational models

Example extracted from MIDAS methodology



- Navigational models are usually composed by:
  - **Nodes:** used to represent a set of information or functionality
  - **Links:** used to join nodes, indicating the possibility of navigating from one node to another
  - Other navigation structures: menus, indexes…

Usability requirements for navigational models

- Identification of usability requirements over these models:
  - Related to the importance of the information
  - Related to connectivity between the elements in the model

- Modellers can divide the information and functionality of a WIS into many **levels of importance** depending on the main aim of the system

- Our proposal will permit modellers:
  - To define different importance levels to classify the information and functionality of a WIS
  - To label each node with one of the defined importance levels
  - To support a set of requirements related to information accessibility

Usability requirements for navigational models

- **R1. Maximum/minimum distance from the entry point to the WIS for each importance level:**
  - Modellers can establish that the nodes labeled with a level do not need more than X clicks from the entry point to the system and at least Y clicks from this entry point
  - Distances will be defined for each importance level
  - Possibility to detect nodes labeled as important far from the entry point and nodes labeled as less important excessively near

Usability requirements for navigational models

- **R2. Maximum/minimum distance from the entry point to the WIS for each node**
  - It is possible that a modeller wishes to label a node with a different max/min distance to the rest of nodes of its level
  - Maybe modellers do not want to use *importance levels* but establish distance requirements to individual nodes

- **R3. Distances between nodes**
  - If two nodes represent information or functionalities related to each other, modellers probably wish that they will be near
  - The capacity to express the maximum distance between a node and another related can be useful for modellers

Usability requirements for navigational models

- **R4. Average distances**
  - Navigational models can be analysed to obtain the average distances between the nodes of each level and the node that represents the entry point
  - This measure for each level can serve to detect shortfalls in the navigation design
    - For example, if the average distance for the nodes of a level is too high

- Other usability requirements could be related to the **necessity of interconnectivity** between the different elements in the WIS

Usability requirements for navigational models

- **R5&R6. Connectivity between nodes:**
  - It is useful to express the requirement that two nodes must be directly connected
  - The system checks that a link between nodes exists for all the nodes desired by the modeler
  - The requirement **can be generalized**: if we consider a node we may wish that a set of nodes can be reachable from it
  - Modellers will define the set of reachable nodes and the tool that support the proposal will check this reachability

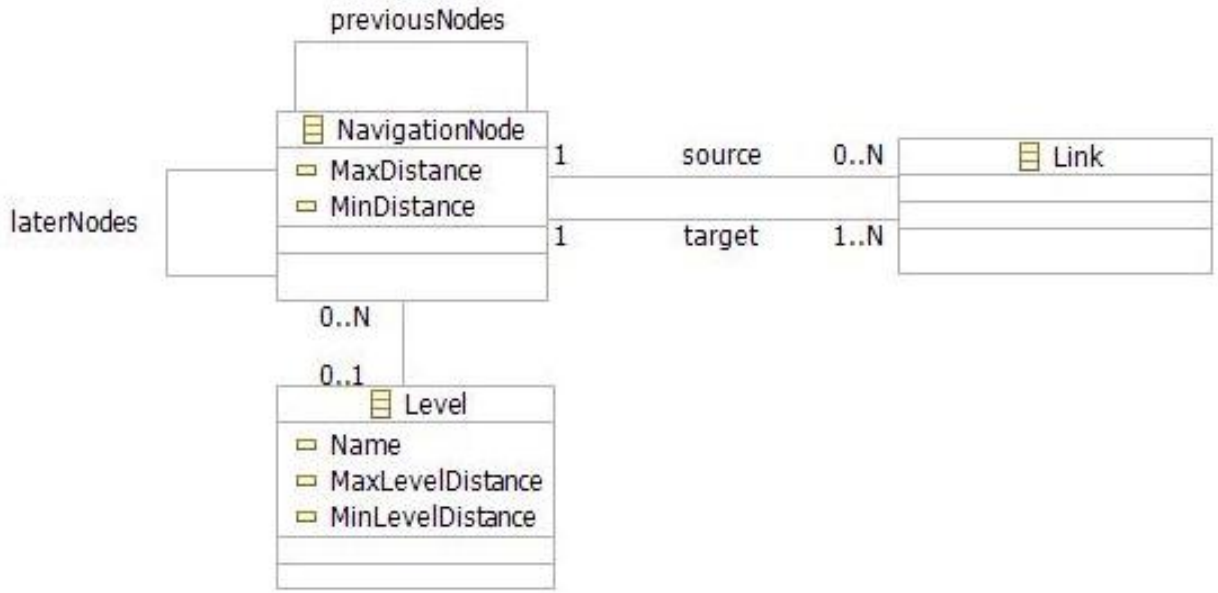
Usability requirements for navigational models

- **R7&R8. Requirements which establish constraints on the order in which tasks are carried out:**
  - **Obligation to previous crossing by a node**: we can define, for each node, a set of nodes that must be previously visited during the navigation through the system
  - **Obligation to later crossing by a node:** if a user carries out a task (that is, visit a node) he must then carry out other set of tasks (this is, to visit a set of nodes) before the overall task will be considered as finished

Metamodel extension for usability requirements

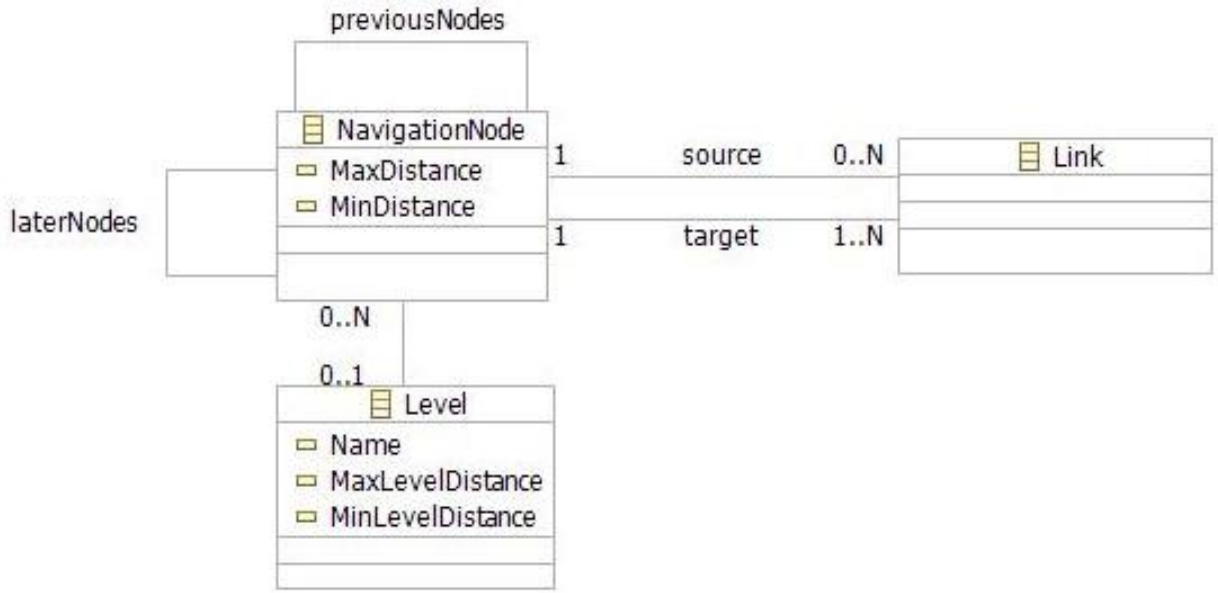
- We have defined an extension of the metamodel of navigational models
- This extension offers support for the expression of usability requirements over these models
- Our metamodel extension only show nodes and links:
  - Better understandability of our proposal
  - To show the generality of our proposal: nodes and links are presented in numerous methodologies and our approach could be integrated in any that includes these elements

Metamodel extension for usability requirements



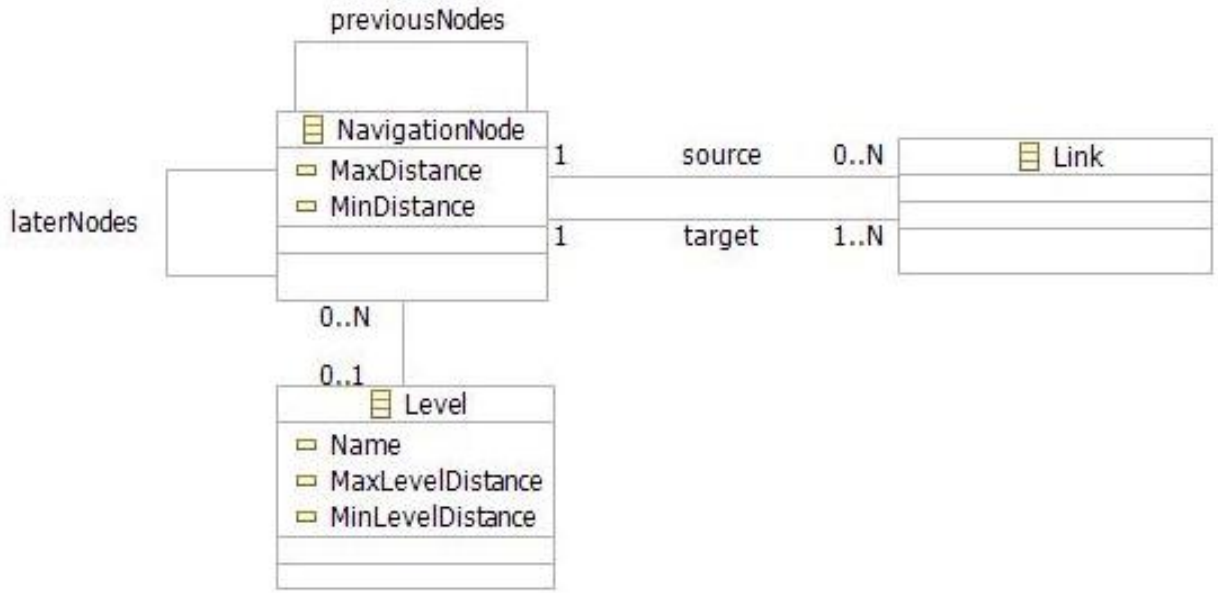
- Adding new attributes to the element **NavigationNode**:
  - Called **MaxDistance** and **MinDistance**
  - Useful to support requirements like *R2*: maximum and minimum distance from the entry point to the WIS for each node

Metamodel extension for usability requirements



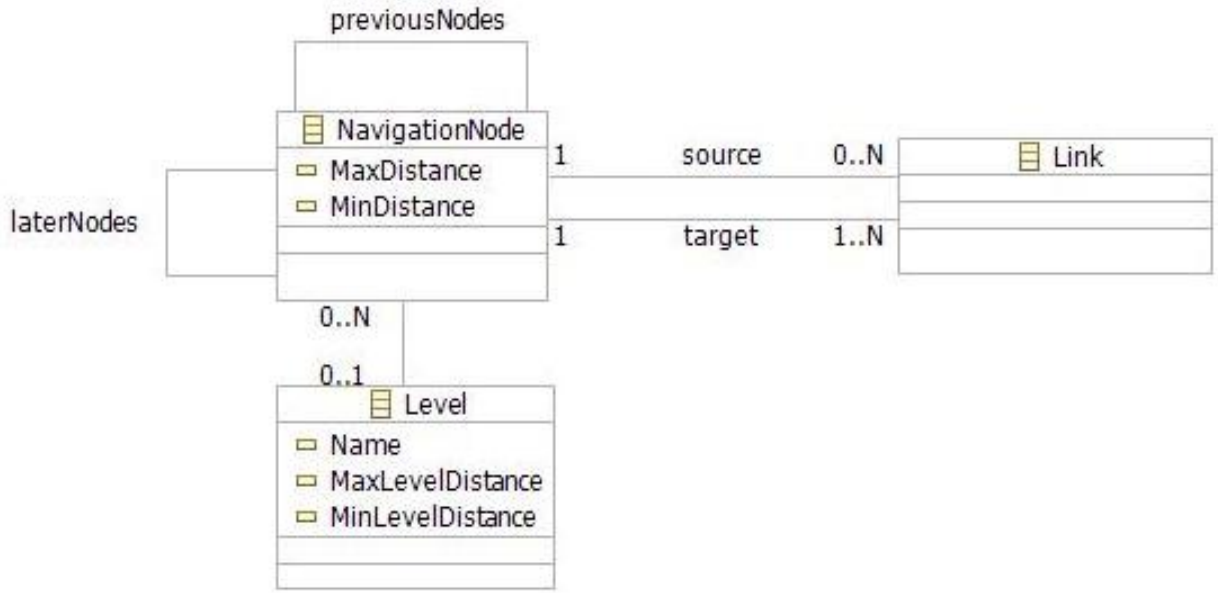
- Adding new links to the element **NavigationNode**:
  - Called **previousNodes** and **laterNodes**
  - Represent, for each node, a list of previous and later nodes that a user must visit if he visits the node (lists can be empty)
  - Useful to support requirements like R7 and R8: obligation to previous/later crossing by a node

Metamodel extension for usability requirements



- Adding new elements:
  - The entity **Level** represents the concept of **importance of a node**
  - Used to support the requirements related to the importance of the functionality and information
  - The link between **NavigationNode** and **Level** permits modelers to label each node with an importance level

Metamodel extension for usability requirements

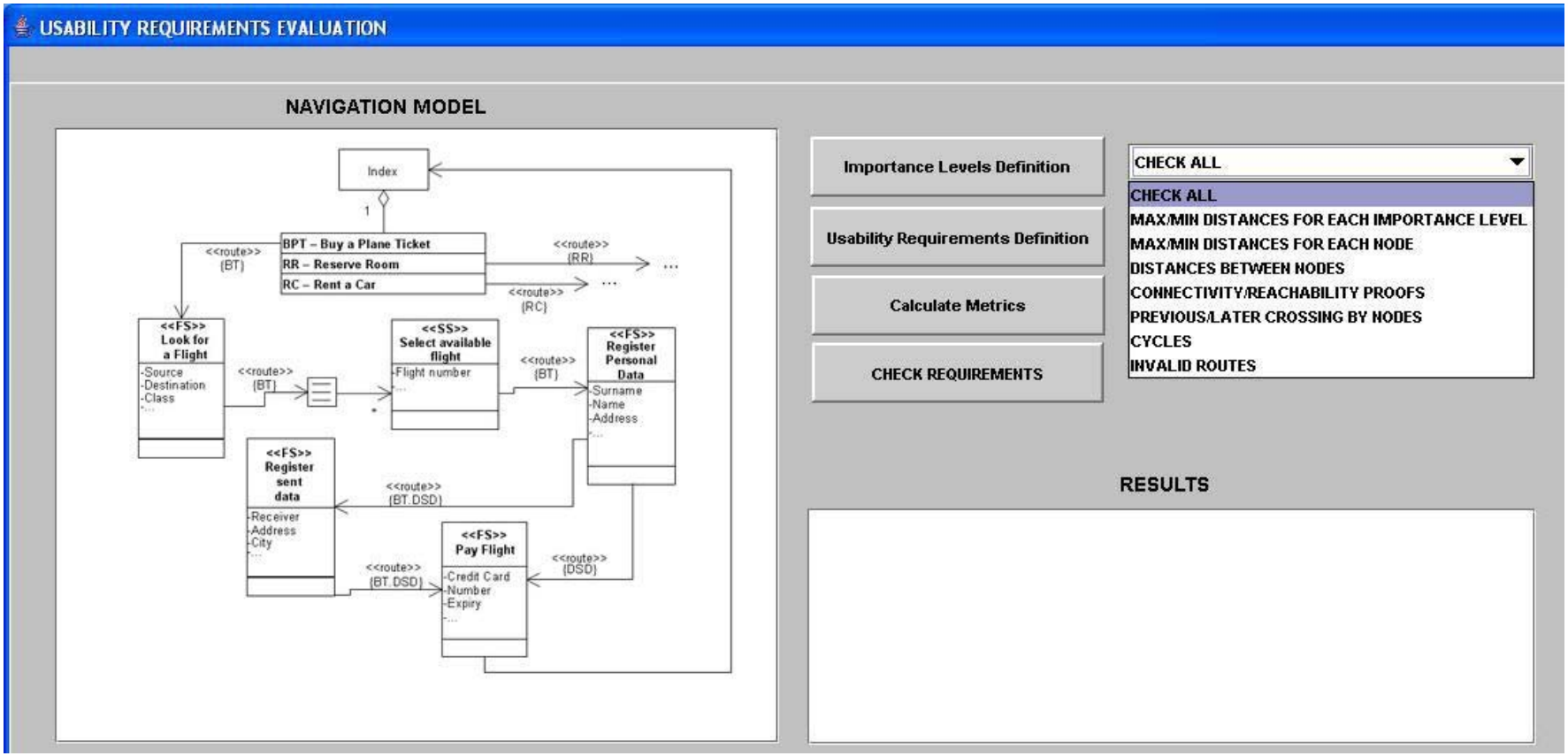


- The entity **Level** has three attributes :
  - The name that identifies each importance level
  - The minimum and maximum distance between the nodes labeled with this degree of importance and the node that represents the entry point to the WIS

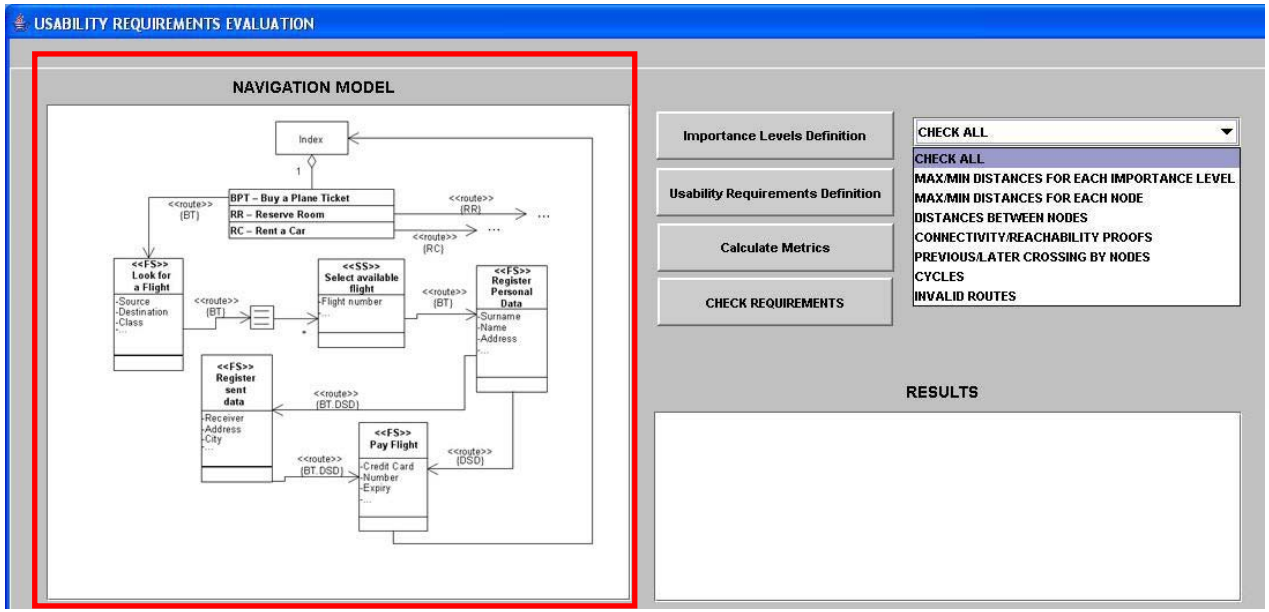
Automatic support

- Our next aim was the design of an automatic support for our approach
  - That will allow modellers to evaluate and to improve the quality for their navigational models in a comfortable way
- This tool supports the specification of the requirements previously shown and it permits their verification on navigational models
- Our aim is not to design an isolated tool for usability evaluation but a tool that will be integrated in the CASE tools used for WIS development methodologies

Automatic support

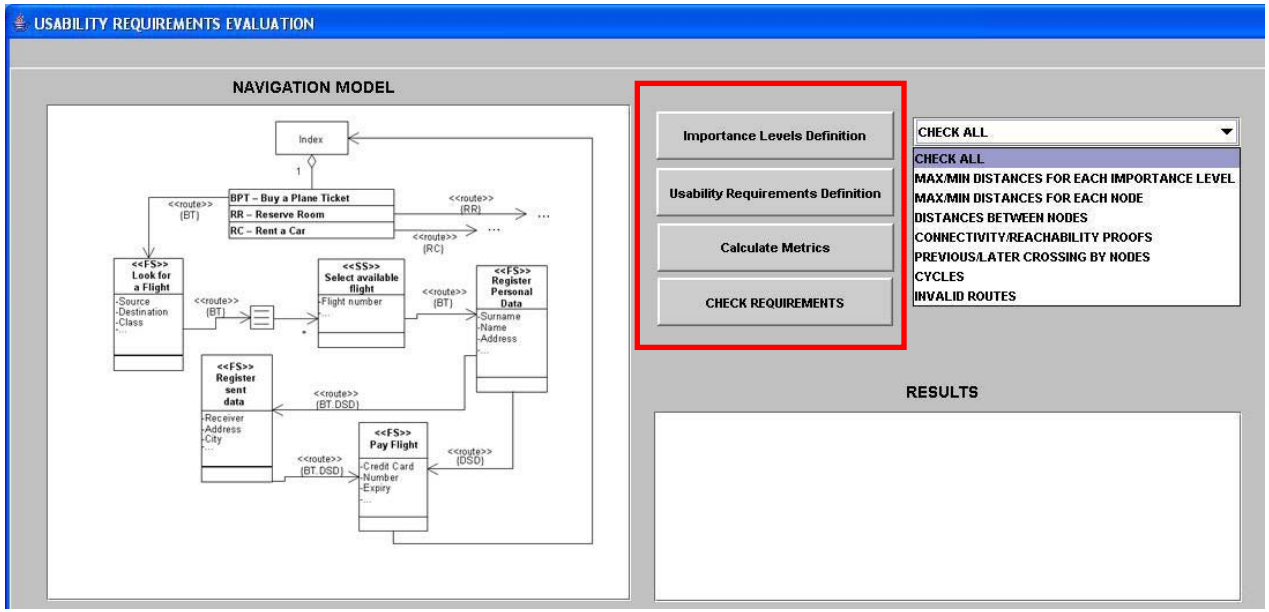


Automatic support



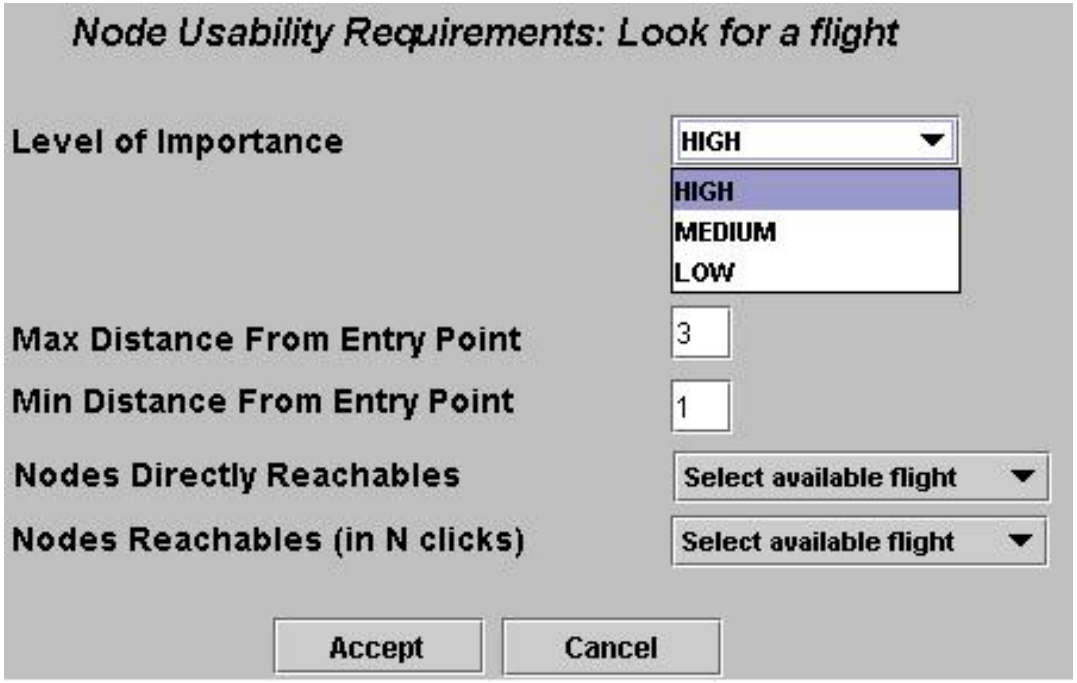
- In the left part, we can observe a navigational model on which the modeller is working
- The tool can load models represented in XMI format
  - In this way, our tool can work with navigational models created by any CASE tool that supports XMI

Automatic support



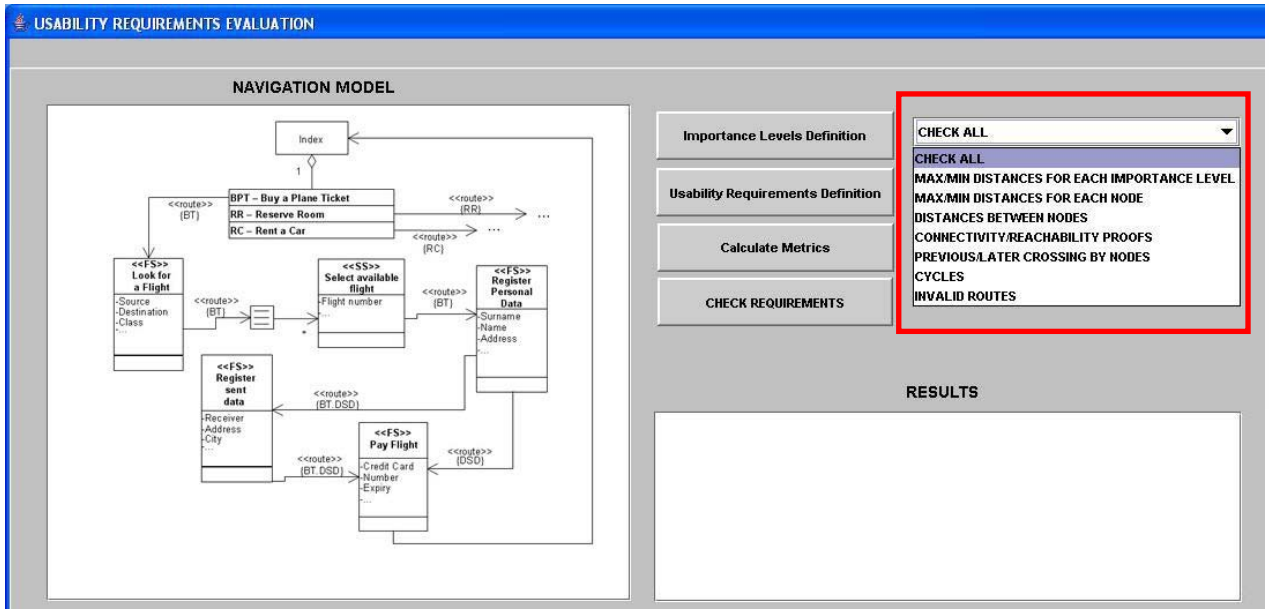
- In the right part, the tool presents an easy buttons structure which permits users to carry out the tasks related to usability:
  - Definition of importance levels and labeling the navigation nodes in the models with these levels
  - Definition of maximun and minimun distances and obtaining of metrics for their models

Automatic support



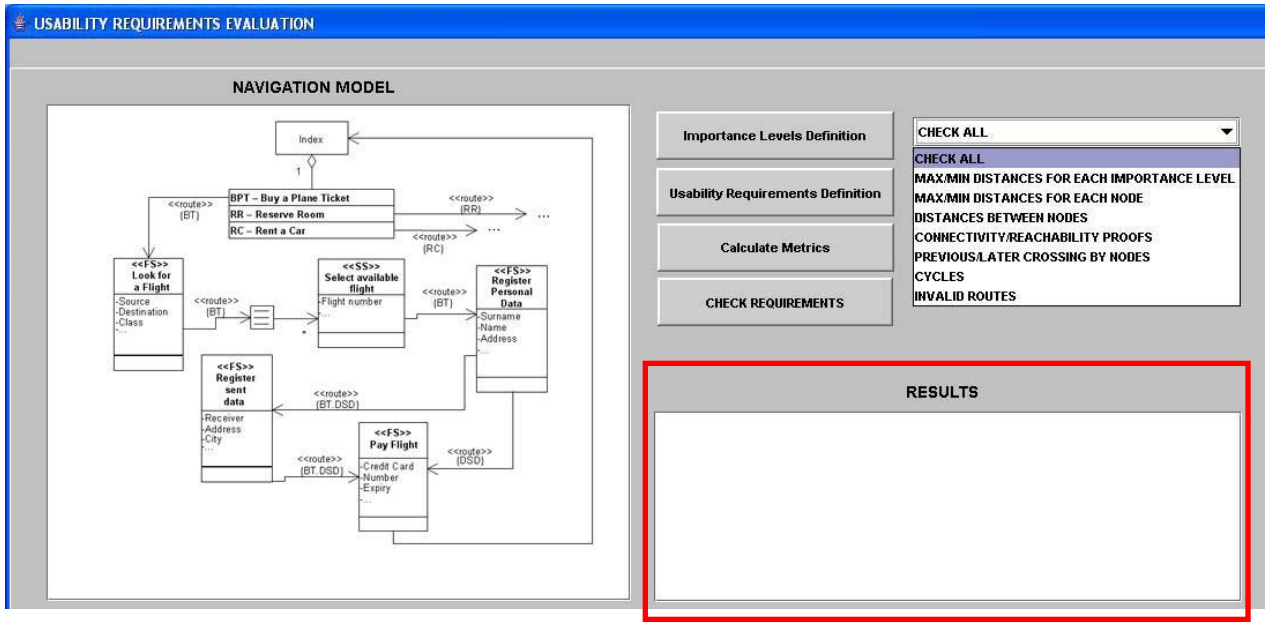
- Definition of usability requirements for a node:
  - Importance level
  - Maximun and minimun distances
  - Reachability properties

Automatic support



- Offers a list of requirements and verification proofs that can be executed over the models:
  - These proofs verify the fulfillment of these requirements and determine the quality of the navigational models
  - The proofs are related to the requirements as reachability between nodes or maximum/minimum distances

Automatic support



- When the tool executes these proofs, information about the fulfillment of the usability and accessibility requirements defined is shown at the bottom
- This information can be used by the modellers to improve their models

Conclusions

- The approach shows the viability of considering usability requirements in the first stages of WIS development
- Identification of a set of requirements that can be considered in navigational models
- Developing of an extension of navigation metamodels to illustrate the approach
- The automatic support that has been developed so that modelers can obtain benefits easily have been also shown

Further work

- Look for new requirements that should be expressed and validated in the models used in WIS development
- Extension of the metamodels and the automatic support for our proposal to support these new requirements
- Defining transformations that automatically improve the quality of models designed from the results obtained in the requirements validation process
- Integration of the tool support for our approach in CASE tools for WIS development

Thanks for your attention

Questions?

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