

# MOAW: An Agile Visual Modeling and Exploration Tool for Irregularly Structured Data

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**Abstract:** The Mother of all Whiteboards (MOAW) is an innovative visual modeling and exploration tool for semi-structured information. It combines gesture-based user interaction with deep zooming, particle dynamics and the powerful data processing capabilities of SAP's newly developed Active Information Store. This application has been designed to convey complex information by easily created visual models which are backed by a formal representation and thus allow the fluid navigation to unlimited levels of detail and creation of different angles of view.

## 1 Background

In collaborative work, a common problem is the visual communication of complex situations, especially when large amounts of entities and relationships are involved. Common tools for visual communication are plain drawing boards (as e.g. embedded in online conferencing tools), slide presentation, diagramming or mind mapping applications.

Common to all these tools is the tradeoff between the effort needed to create the visualization and the expressive power of the model. For example, it is very easy to create visualizations in a plain drawing board or slide presentation application, but these visualizations usually only represent a very narrow view on the problem and need interpretation, which makes them easy to misunderstand. Often many different visualizations are created to illustrate different aspects of the same problem, but consistency between these cannot be ensured and navigation between them is one-dimensional (e.g. along a slide sequence).

Mind mapping and diagramming tools create more structured visualizations, but the price to pay is a much higher effort in the case of formal diagrams and a limited visual expressiveness in the case of mind mapping.

A new concept for visual modeling and user interaction has been developed which is implemented in the Mother of all Whiteboards (MOAW) prototype, based on the Active Information Store (AIS) [1] as the flexible data repository. The core of the prototype is the combination of modern user interaction paradigms like touch screens, gesture recognition, deep zooming and particle dynamics with the processing of semi-structured information, allowing the user to simultaneously create a visual model and a corresponding formal representation with very low effort.

The formal representation, consisting of Info Items with Attributes and Associations, ensures that the Visual Model is consistent and that the contents of the model can be processed with all the functionality we appreciate in databases: search, query, specific views, and analytics. However, the data model of the formal representation must correspond to the freedom of visual modeling offered by the Whiteboard-oriented UI. Hence, it must not confine the user to a predefined static schema, and nevertheless still convey a certain degree of semantics.

Therefore, the Active Information Store has been chosen as the underlying data persistence and processing layer. It provides a schema-flexible and scalable data management platform. Data can be stored in AIS without having to define a rigid database schema upfront. Rather, the schema of the data is derived automatically by the system based on the available data. Due to this flexibility data instances with highly irregular structure or heterogeneous data from different sources can be stored and processed efficiently. Most of the visual modeling and processing concepts map directly to corresponding concepts in the AIS data model and query language.

## **2 Applications**

The MOAW has been developed to capture project-relevant information (e.g. processes, system landscapes etc.) in customer workshops and to display, analyze, annotate and enrich this information through all phases of a project. The whiteboard at the same time serves as a visual knowledge map and as a database that can be queried to generate new views on the existing content.

Typically, the whiteboarding process starts with simple boxes representing various facts and issues in a sticky note style. In the course of a session, the actual meaning of those boxes is clarified; they can be cast into tasks, topics, requirements, boundary conditions etc. These entities can be associated to each other and tagged with attributes of predefined or user-defined types. Details can be exposed by zooming in and creating new structures within the boxes.

The objects created on the whiteboard (including associations and attributes) are stored together with master data about people, skills, products, projects in a common knowledge base. The mass data operations offered by the AIS, which are exposed by very simple, gesture-based interaction patterns, allow the quick exploration and generation of multiple views on all this content.

By blurring the borderlines between visual modeling, formal modeling and data exploration, the demonstrated technology also shows new ways for efficient user interaction in many other knowledge-intensive application areas, e.g. the collaborative discovery of trends from publicly available information and fraud detection.

### **3 Basic Interaction Types**

Almost all user interaction in the MOAW is based on:

- the ability to move and zoom in and out of the viewport very quickly,
- dragging of objects and
- drawing of gestures as temporary lines on the screen in order to interact with the visual content.

The fluent deep zooming in combination with a Level of Detail (LOD) mechanism allows the user to navigate from a high-level overview to the finest details in seconds and without any hard context changes.

Drag and drop operations are used to move visual objects into and out of sets and the drawn gestures are an extremely fast and yet intuitive way of invoking more complex interactions like creating objects and object sets and of performing queries.

#### **3.1 Creation of Objects and Associations**

Objects are created by simply drawing a contour on the screen, where the type of the contour corresponds to the type of object. By typing the caption of a newly created visual object, the user determines whether a new data object (Info Item) is created or whether the visual object is mapped to an existing Info Item in the AIS. In the latter case all the properties (attributes and associations with other Info Items) of the Info Item can be shown in a property sheet and selectively integrated into the visual model. New properties of an Info Item can be added or removed flexibly at any point in time.

Associations between Info Items can be created by drawing a line between the corresponding visual objects. The type of the association is inferred from metadata attached to the Info Item types. If no such metadata exists, the item types themselves are used as association types. These can be changed at any time in the property sheet.

#### **3.2 Mass Manipulation of Objects**

Sets of objects can be selected by drawing an ellipse around them or created by using a gesture-based query mechanism. These visual item sets correspond to the concept of Info Item Sets in AIS and for every operation the AIS offers for such sets, a corresponding gesture is implemented:

- A set of common properties for all set elements can be defined (e.g. an association with a certain person as displayed in Fig 1). Consequently, moving visual items into or out of the set's contour will change the corresponding Info Item's properties in the AIS.

- A query is performed by drawing a line from the outside to the inside of a set with specified common properties. All Info Items matching these properties will be retrieved from the Active Information Store, and corresponding visual items will be generated in the visual item set if they are not already there.
- The AIS offers the ability to derive the common properties for a given set of Info Items. Correspondingly, opening the property sheet for a selection of objects will invoke this function and display the extracted properties.

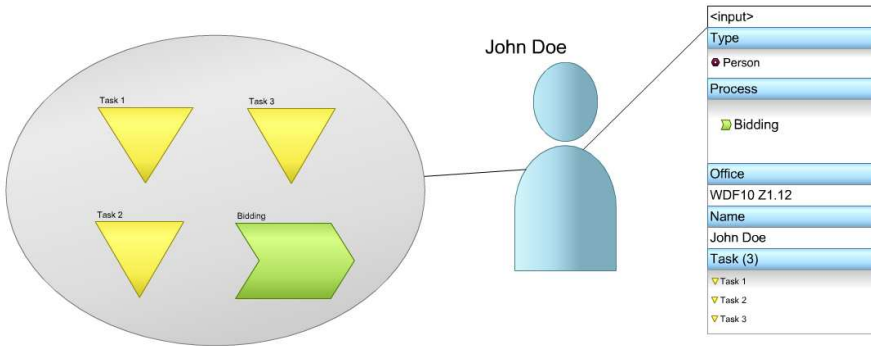


Fig 1: Association of multiple objects to a person and their reflection in a property sheet.

## 4 Demo

The demo will show the visual modeling of a consulting project with the MOAW and explain how the corresponding Info Items are created, maintained and processed in AIS.

Starting with an empty screen, visual objects for the project itself and several sub-topics, process steps, tasks, people etc. will be created by gestures and then partly bound to existing Info Items by means of an autosuggest feature.

The association of single tasks with process steps and people by gestures and the specification of further properties in a property sheet will be shown. Then the selection and association of whole sets of tasks with people will be demonstrated, as well as the subsequent maintenance of priorities for sets of tasks.

Then, a set of people will be selected, and the set of common properties (skills, location) will be extracted by a gesture. A subsequent query gesture will find additional people with the same properties, some of which are then added to the project by drag and drop.

## References

[1] "Active Information Store – A Repository for Flexible Information Management, Exploration, and Analysis", C. Bornhoevd et al., SIGMOD 2011, submitted