

Dynamic XML Documents: Conception of Development and Application in Juridical Area

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Abstract¹

The conceptual questions of the development and using of hierarchical situational models in the XML environment are discussed. The conception of the dynamic XML documents is shown. The illustration of this approach is described on the theoretical level.

1. Introduction

A dynamic document is the document that contains a built-in dynamic model of its creation and use within the document circulation in the organizational system. A dynamic model belongs to the discrete event-based models class, and it can be realized as the transition diagrams, Petri nets, or hierarchical situational models [2].

A dynamic model defines both the set of states (or situations) and the sequence of possible transitions. The states characterize the processes of the document creation and use. The dynamic model consists of the submodels of document creation and using [2].

The dynamic document consists of two components:

- the document containing base (DCB), which is the sequence of data fragments (textual, graphics, multimedia, etc);
- the document dynamic model (DDM), which defines the set of possible document states, conditions of state transition execution, the limitations and requirements for the document containing base in the context of current state.

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XML – a markup language for the Web documents, supplemented by the complex of languages based on it (see, for example, [1,3]). The tree-like structure of the XML document perfectly suits the hierarchical structure of the dynamic model. This is one of the main reasons of using hierarchical situational models in the XML environment. Besides XML is one of the most popular technologies today. The XML document processing tools complete the functionality of the dynamic documents interpreter. So, in this case it's reasonable to speak about the dynamic XML document, which structure is the next continuation of the dynamic documents conception.

In this article the idea of the dynamic XML documents is put forward. In general the dynamic XML documents join together the advantages of the hierarchical situational models and all the forms of XML technologies. And at this point the paper discusses the handling of two main processors – the dynamic document interpreter and the XML processor.

2. The Dynamic XML Documents Conception

There are two main stages of the dynamic XML document applying. They are the development of this document and the direct working with it (Figure 1).

In the basis of using hierarchical situational models there are the main points of the considering subject area. By giving the concrete expression to the resolving problem the user appeals to the appropriate source document.

The subject area characteristics and the source document define the content of the dynamic XML document:

- source document text marked-up in the XML format. It forms the information supplement for the system. As we use XML then mark-up can be arbitrary, and the document structure is defined by developer;
- the results of the subject area analyses are reflected in the dynamic model structure, which is implemented in the hierarchical situational model. Here a dynamic model is the set of states (or situations), transitions execution conditions,

formatting instructions, and the references to the marked-up source document;

- in turn, the structure of the current state model is determined during the interpretation process. This structure describes the current state of the dynamic model.

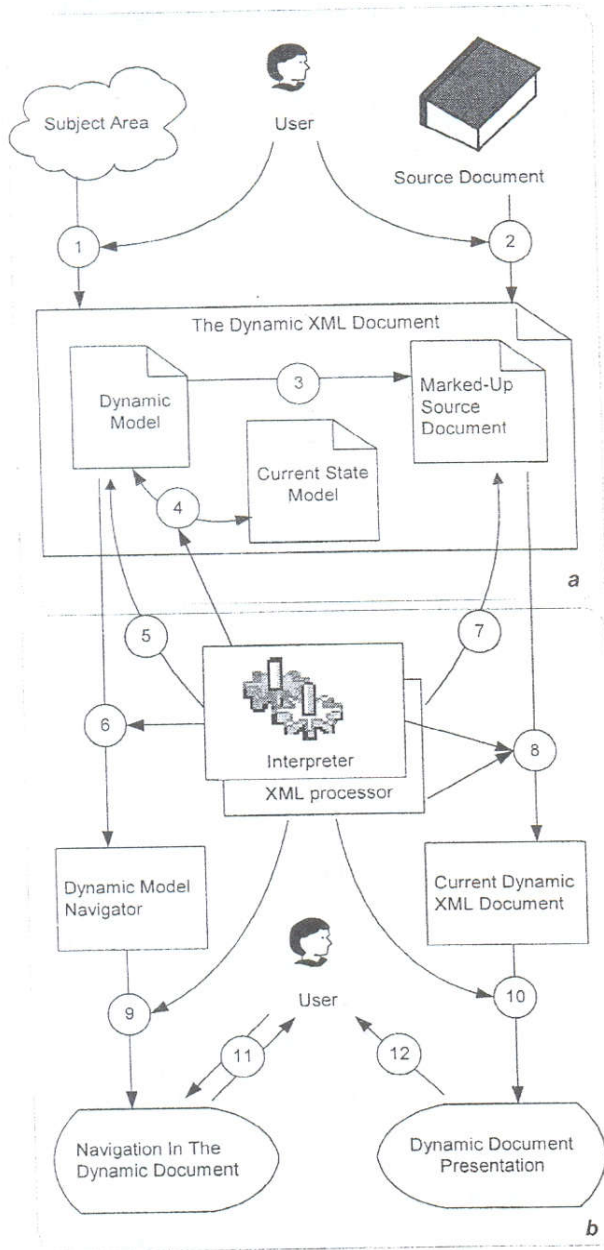


Figure 1. The Conception of Dynamic XML Documents: a — the designing of the Dynamic XML Document; b — the performing of the Dynamic XML Document

This is where the stage of the dynamic XML document development completes.

The performing of created dynamic XML document is based on using the interpreter and XML processor. The interpreter performs the logical processing of the

dynamic model and generates the current state model (arrows 4, 5 on the Figure 1). XML processor checks the dynamic XML document for validation and makes the necessary transformations (arrows 7, 8 on the Figure 1).

During the work with the dynamic XML document the interpreter processes the dynamic model (arrow 5 on the Figure 1). It performs the improvement of the current state models contents (arrow 4 on the Figure 1) according to the user-made changes. In turn the current state model data influence on procedure of the dynamic model processing.

Each dynamic model element (submodel, state, jump, etc) refers to the appropriate fragment of the marked-up source document. For that reason the dynamic model has so called elements-references, which contain an XPath-expression to obtain the fragment. During the processing of the dynamic model (arrow 5 on the Figure 1) the interpreter finds the reference and looks for the suitable source document text fragment according to it (arrow 3 on the Figure 1).

The current state is defined by the user via the interface of navigation in the dynamic XML document. The navigation tool is formed by the interpreter during the processing of dynamic model (arrow 6 on the Figure 1). The dynamic model navigator is marked-up in the XML format, that's why it is processed by the XML processor. This tool represents XML data in the more suitable for user format (arrow 9 on the Figure 1).

As it has been already mentioned each dynamic model element refers to the appropriate fragment of marked-up source document. And this also takes place in the user interface. Marked-up in the XML format source document fragment is processed by the XML processor, which represents this data, for example, in the HTML format (arrow 10 on the Figure 1).

So, the applying of the dynamic XML document for the user is shown as the following. Firstly, via the navigation tool the user chooses one of the states (or situations) (arrow 11 on the Figure 1). As a result the source document fragment appears on the screen. So, the user can see both the elements of the dynamic model and the source document text, which is generated on the basis of chosen current state.

3. The Dynamic XML Document Structure

The structure of the dynamic XML document can be divided into three main parts:

- the marked-up source document;
- the dynamic model;
- the current state model.

The dynamic model consists of the hierarchical set of states, transitions between them, and also a number of additional instructions

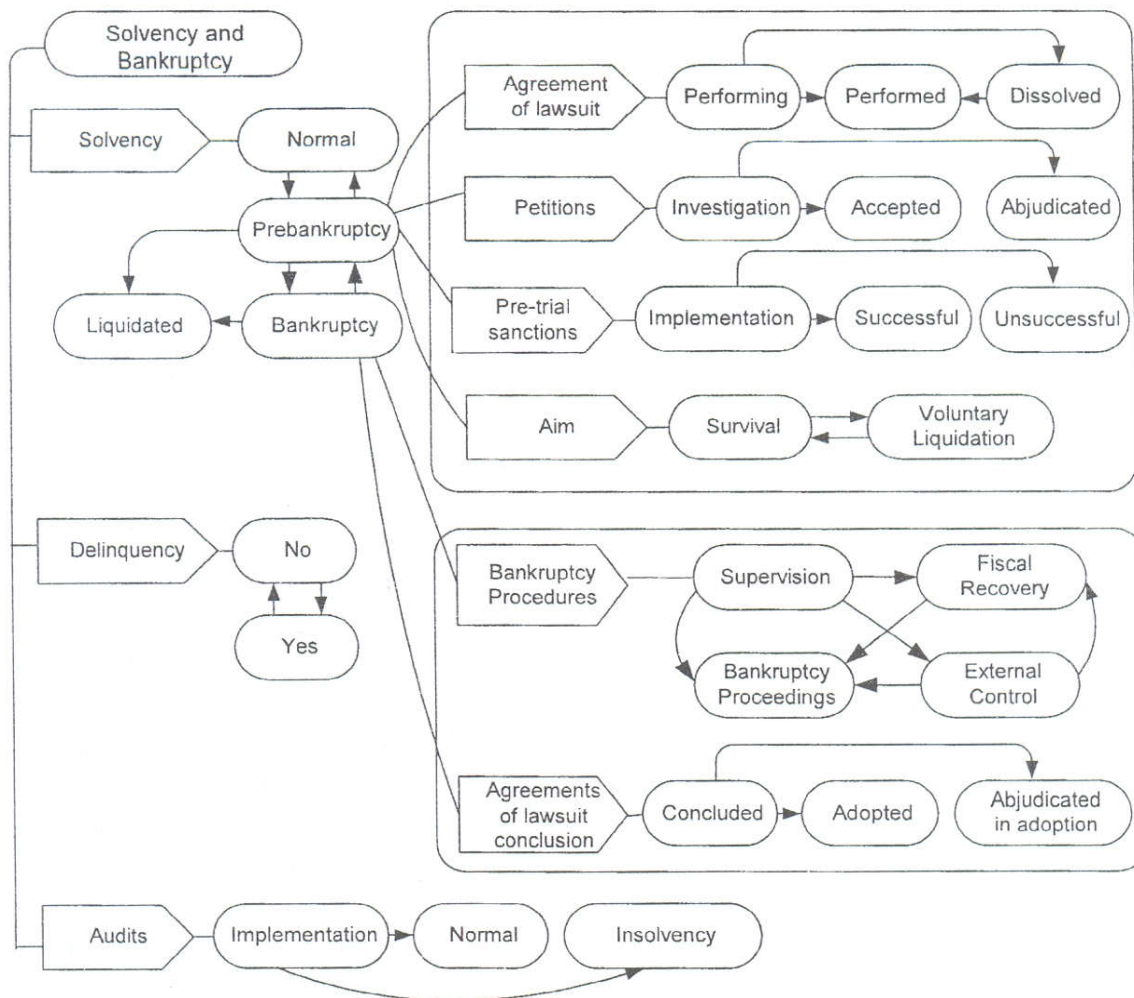


Figure 2. General Model of the Enterprise Solvency and Bankruptcy

The developer strictly defines only the structure of the reserved elements, such as «SubModel», «State», «Jump», «Ref», etc. These elements belong to the namespace *hsm* which is defined within the document.

As it has already been mentioned each dynamic model element refers to the fragment of the source document marked-up text. For that reason in such an element one or more elements of «Ref» type are used. They also belong to the namespace *hsm*. As one document fragment can be referred by a number of elements, then the model also includes the formatting instructions. They allow representing the same text differently depending on the element this text associated with.

So, the element of «SubModel» type can include one or more child elements of «State» type, and also some additional data. Next, the element of «State» type besides the elements-references and formatting instructions can include one or more «Jump» type elements. These elements characterize transitions from one state to another.

«Jump» type element contains references, formatting instructions, and «target» attribute, which defines the transition direction.

Finally, the current state model is based on the dynamic model structure. This model contains the data about the state, which is active on the moment of observation.

4. The Applying of the Dynamic XML Documents

The practical illustration of using the dynamic XML documents is connected, for example, with the federal law about the insolvency (bankruptcy). The bankruptcy procedure on the basis of law content can be represented as the hierarchical situational model. Picked our macrostates are shown on the generalized model of the enterprise solvency and bankruptcy (Figure 2). And here these macrostates are intended to characterize the features of the bankruptcy procedure.

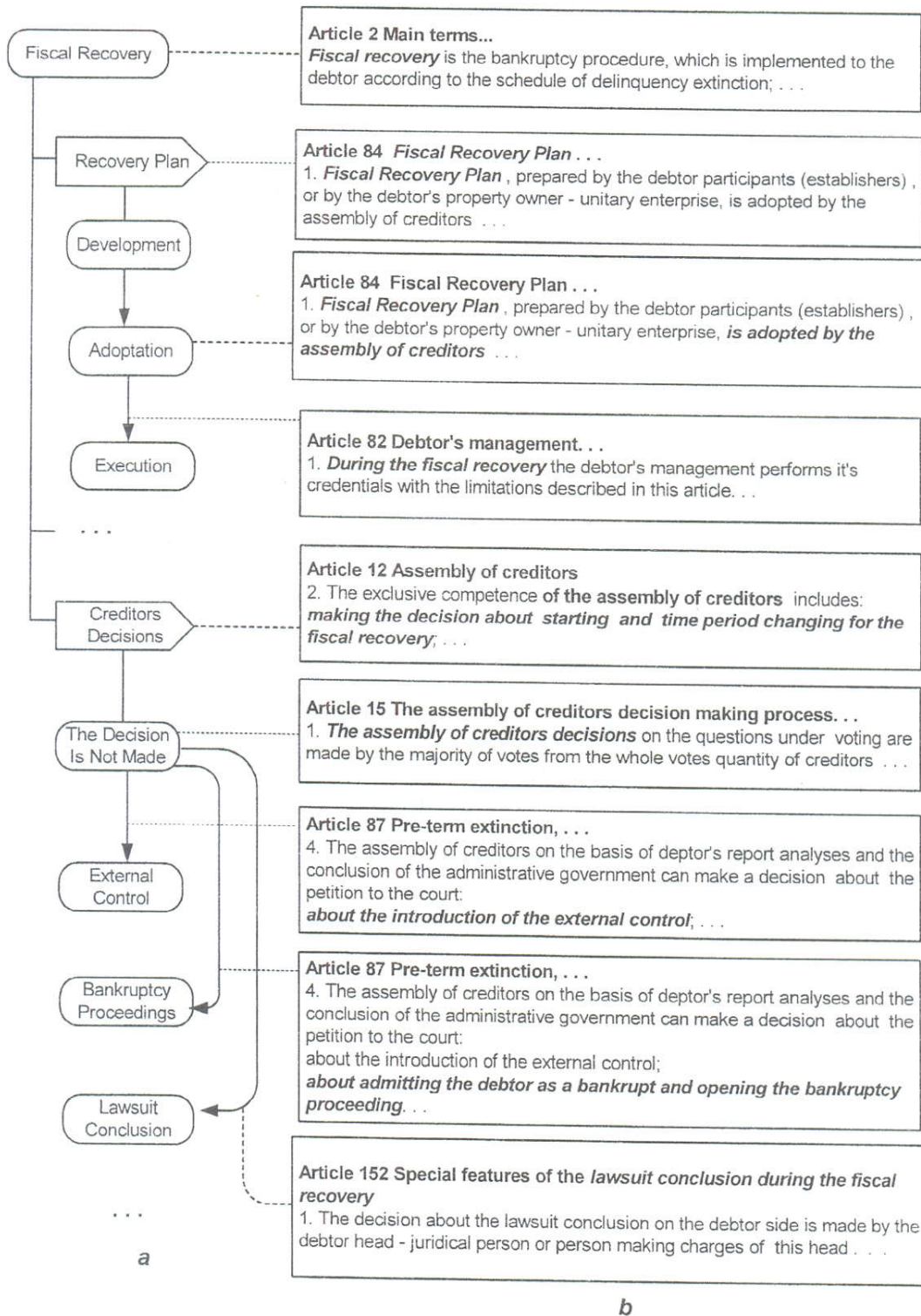


Figure 3. The Current Fragments Example of the Document "The Federal Law about the Insolvency (Bankruptcy)": *a* — the Dynamic Model Fragment with the Current State «Fiscal Recovery»; *b* — the Dynamic Document Fragments Associated with the Current Dynamic Model State

At this point it's worth to outline that the macrostates are the results of the analyses of the federal law text.

This model consists of three submodels of the top hierarchy level. They are «Solvency», «Delinquency» and «Audits». Here the state «Fiscal Recovery» is considered. According to the federal legislation, the fiscal recovery is the bankruptcy procedure, which is implemented to the debtor according to the schedule of delinquency extinction.

The debtor participants (establishers) are to apply with a petition for executing the fiscal recovery. Here they in particular have to give the fiscal recovery plan and the schedule of delinquency extinction confirmed by the arbitration court. On the basis of the fiscal recovery results the assembly of creditors or the arbitration court make a decision about the introduction of the external control or about admitting the debtor as a bankrupt and opening the bankruptcy proceeding.

The structure of the state «Fiscal Recovery» consists of four submodels, which represent the preparation, the implementation of the fiscal recovery procedure, and also the decisions of the assembly of creditors and the arbitration court on this procedure. These determines the structure of the dynamic model, which is the part of the dynamic XML document in the system.

Each submodel, state, jump, etc. of the dynamic model refers to one or more fragments of the federal law about the bankruptcy. To realize such a consistency the text of the federal law is marked-up in the XML format. It is another component of the dynamic XML document.

The information about the current state of the dynamic model is stored in the current state model, which contains the data about the current submodel and situation.

The fragment of the conceptual model of organization the federal law current fragment is represented on the Figure 3.

As it's shown on the figure, the user has an access not only to the law fragment associated with current

submodel, state or transition, but also to the text referred by the parent elements.

In addition each law reference in the dynamic model includes the formatting instructions which allow interpreting the same text fragments in a different way, depending on the elements they are referred by.

The transitions (states and jumps) between the submodels and states are performed, when the user chooses the appropriate elements of the navigation system.

5. Conclusions

- The dynamic XML documents put together the main features of using the hierarchical situational models and XML technologies.
- The applying of the dynamic XML documents consists of two stages. They are the development and the direct performing.
- The structure of the dynamic XML document includes three main components: the marked-up source document, the dynamic model, and the current state model.
- An example of using the dynamic XML documents here is concerned with the system based on the federal law about the bankruptcy. This system represents the law fragments associated with the chosen dynamic model element.

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