

XML-Constraints with Scheme

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Abstract

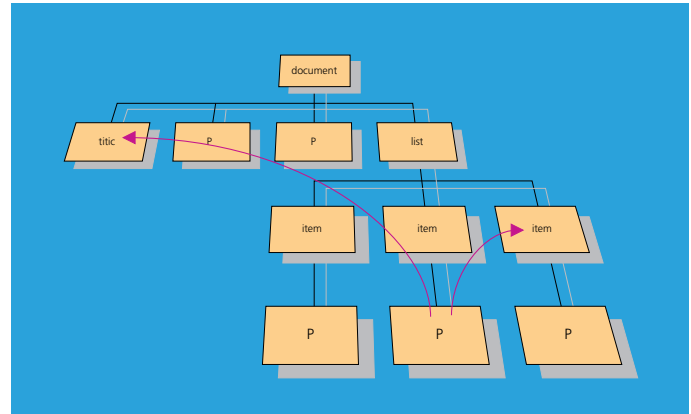
In complex authoring environments, the use of XML with its richer structure is a real advantage. But there is an almost infinite number of possibilities for our structure. If we add a DTD (like in SGML) to our XML environment, we can control the almost infinite number of possibilities. The author of our multimedia documents can then only build multimedia documents belonging to one DTD by paying attention to their rules. But sometimes there are more complex rules for our multimedia documents which we cannot describe in the DTD. But the ability to describe more complex rules is lacking. Therefore, we built a graphic interactive system to describe such rules of the logical structure and the content of the element structure in a XML-web with additional multimedia content.

This work is closely related to the DFG (DFG - Deutsche Forschungsgemeinschaft) »Madeira« project.

Motivation

In a complex authoring environment, the use of XML is a real advantage. The multimedia documents can have a richer structure than in a traditional text editor (a.o.) or publishing system. This is

Figure 2:
Graphical representation of constraint relationships in the xml structure



because we can have a free hierarchical structure in the multimedia documents.

Furthermore, we can describe rules for the structure. If we add a DTD (like in SGML) to our XML environment, we can control the almost infinite number of possibilities. The author of the multimedia documents can then only build multimedia documents belonging to one DTD by paying attention to their rules. He can only insert elements and attributes defined in this DTD and he is responsible for making sure that these elements are in the defined order and hierarchy of the DTD.

But sometimes there are rules for our multimedia documents that we cannot describe in the

DTD. For example, there is no way to describe that the attribute of a given element has a value that is greater than the value of the same attribute of the parent element. And we cannot check whether the number of chapters is the same as the number of authors in the author attribute.

There is a need for more complex rules to describe such constraints. If we think about the complex world of an XML-web with several different multimedia entities authored and maintained from a distributed authoring team, we see a lot of these constraints behind this XML-web, but today there is no general way to describe these constraints.

Therefore, we built a graphic interactive system to describe the constraints of the logical structure and the content of the element structure. In these constraints, we can use the names of the elements, their structure, their attributes, and the content of the element like text or multimedia entities.

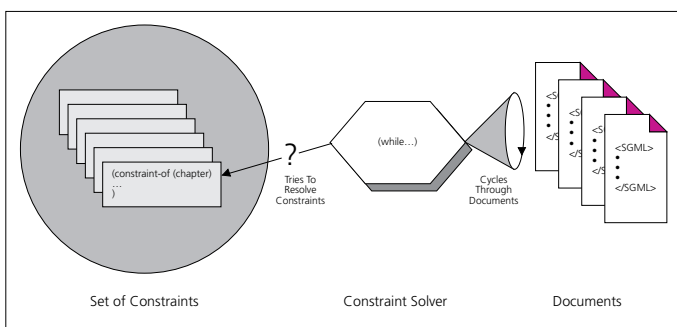


Figure 1:
The constraint solver checks all constraints in all related documents

To handle these constraints, it is necessary to integrate an extension in a number of tools. At first we need an integration in the authoring tool. The XML editor must watch over our constraints and trigger some actions if the constraints are violated. This can be done during editing time or while saving the multimedia document. These actions can include sending an e-mail to another author or sending a workflow event to the workflow management system. Therefore, an integration of web services like e-mailing or web document creation is useful. Then the editing process can be spread over the intra-/Internet.

Another useful tool for constraint watching is the multimedia document database. The database can allow only the check-in of correct multimedia documents. If a time-based constraint is violated, the database can trigger a complex workflow action. This is interesting for distributed cooperative work. Other authors working on the same project instantly get messages about new authoring tasks depending on the work of other authors.

Some goals for such a constraint system are:

- Consistency of multimedia documents and their document parts in a set of documents
- More quality in and between related multimedia documents. This means, for example, correct linking in and between document parts and multimedia objects that can be integrated with special behavior depending on their object type
- Aspects of integration between different tools in an authoring environment
- Workflow, triggered by multimedia documents and their multimedia document parts, can be used to control the authoring environment. The document can control, with an integrated behavior, the authoring process of itself and of other, related documents.

Constraints and Constraint Solver

The constraint solver cycles through the document looking for violated constraints. Each constraint has an action assigned. This action is performed if the constraint is violated.

The (XML-) document-tree contains each document object. In the case of XML, these are the

XML elements. Between these elements, the constraints build some relationships. These relationships can be graphically represented.

[GRUBOLS1] Thomas R. Gruber and Gregory R. Olsen, Theory PARAMETRIC-CONSTRAINTS, <http://www-ksl.stanford.edu/people/brauch/demo/parametric-constraints/index.html>

[GRUBOLS2] Thomas R. Gruber and Gregory R. Olsen, Theory COMPONENTS-WITH-CONSTRAINTS, <http://www-ksl.stanford.edu/people/brauch/demo/components-with-constraints/index.html>

[IBMOCL] IBM, The object Constraint Language, <http://www.software.ibm.com/ad/ocl/>

[SCED] Sced: Constraint Based Scene Design, <http://gd.tuwien.ac.at/graphics/sced/sced.html>

[POUCLP] Pountain, D., Constraint Logic Programming, <http://www.byte.com/art/9502/sec13/art3.htm>

[BOLIMA] Borning, A., Lin, R., Marriott, K., Constraints for the Web, ACM Multimedia 97 – Electronic Proceedings, <http://www.acm.org/sigmm/MM97/papers/borning/constraints.html>

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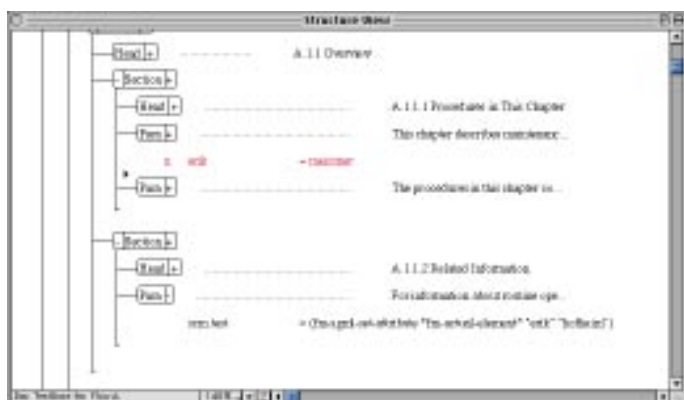


Figure 3: Our demonstrator checks constraints in the FrameMaker+SGML environment