

# XML suite for Isar

Vesna Pavlović

Faculty of Mathematics, University of Belgrade, Serbia

[www.matf.bg.ac.yu/~vesnap](http://www.matf.bg.ac.yu/~vesnap)

Workshop on Formal and Automated Theorem Proving and Applications  
Belgrade, Serbia, January 31, 2009.

## Motivation

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- First Workshop on Formal Theorem Proving
  - Isabelle tutorial given by prof. Ballarin
- PhD course “XML technologies”
- Isar enables a user to write formal proofs that are human-readable
- Using XML makes complex data easily readable

## Our Goal

- To develop an XML format for storing proofs in Isar-style syntax (i.e. formal proofs given in human-readable way)
- We used it for representing a class of geometrical statements and their formal proofs in Isar language

## Agenda

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- Motivation and Our Goals
- Isabelle/Isar Basics
- XML Format for Isar
- Corresponding Suite of XML Tools
- Conclusions and Future Work

## Isabelle/Isar basics

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- In recent years great attention is directed towards developing theorem proving systems, such as:
  - Coq
  - HOL
  - Isabelle (<http://isabelle.in.tum.de/>)
- **Isar** (Intelligible semi-automated reasoning), built on top of Isabelle, is designed to bridge the gap between concepts used within today's state-of-the-art theorem provers and concepts that are easily understandable by humans

## Using XML

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- Why XML?
  - Makes complex data easily understandable
  - It uses human language; it is extensible
  - Enables different sorts of processing and rendering
- Technology used:
  - DTD – for defining document's structure
  - XSLT – for transforming XML documents
  - XPath – for selecting nodes in XML document

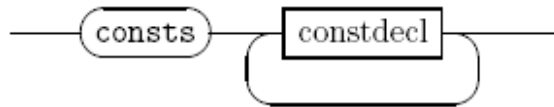
## XML format for Isar

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- XML format follows syntax of Isabelle/Isar documents (given in “The Isabelle/Isar Reference Manual”)
- A corresponding DTD was constructed using syntax diagrams given within
  - basic token classes (ident, nat, var, ...),
  - basic syntactic entities (name, text, ...),
  - theory commands (theory, theorems, lemmas, ...),
  - proof commands (fix, assumes, shows, ...), ...

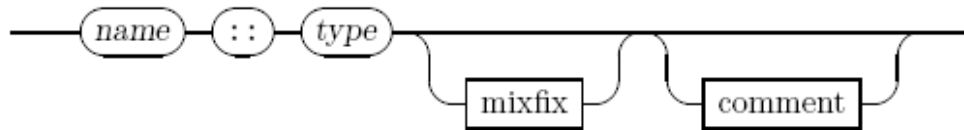
## XML format for Isar (example)

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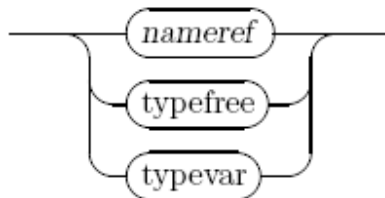
<!ELEMENT consts (constdecl+)>

*constdecl*



<!ELEMENT constdecl (name, type, mixfix?, comment?)>

*type*



<!ELEMENT type ((nameref|typefree|typevar))>



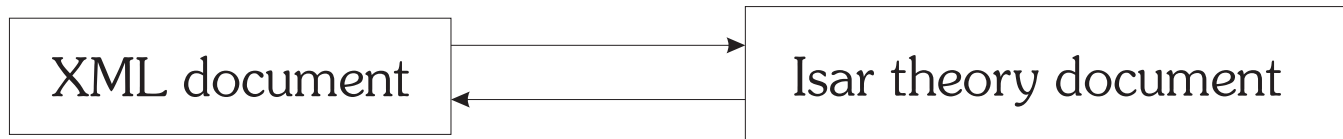
## XML format for Isar (example)

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```
<consts>
  <constdecl>
    <name>
      <!-- Incidency relation -->
      <ident>incident</ident>
    </name>
    <type>
      <nameref>
        <name>
          <ident>Point => Line => bool</ident>
        </name>
      </nameref>
    </type>
  </constdecl>
</consts>
```

## Corresponding suite of XML tools

- Original idea: to make **bidirectional conversion** between an XML document and corresponding Isar program



- Concrete task: to do just one direction, **from left to right**

## Corresponding suite of XML tools(2)

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- XSLT document for conversion XML document into:
  - corresponding **Isabelle theory document**
  - corresponding **HTML document**

## Corresponding suite of XML tools (input&output fragments)

Input:

```
<consts>
  <constdecl>
    <name>
      <!-- Incidency relation -->
      <ident>incident</ident>
    </name>
    <type>
      <nameref>
        <name>
          <ident>Point => Line => bool</ident>
        </name>
      </nameref>
    </type>
  </constdecl>
</consts>
```

Output:

```
consts incident :: "Point => Line => bool"
```

## Corresponding suite of XML tools (.xsl document)

```
<!-- Primitive relations and their types -->
<xsl:template match="consts">
<P>
  <xsl:for-each select="constdecl">
    consts
    <xsl:value-of select="//name/ident"/> ::
      "<xsl:value-of select="//type//ident"/>"
    <BR/>
  </xsl:for-each>
</P>
</xsl:template>
```

## Corresponding suite of XML tools (3)

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- Additional task: to create **simple graphical illustrations** of geometrical statements we proved formally
- For this purpose we used SVG (Scalable Vector Graphics)
- Graphical illustrations created by SVG are easy to embed in XML document

## Corresponding suite of XML tools (.xsl document)

```
<xsl:template match="theorem1//fix/vars">
  <text x="5" y="5"
        style="font-family:sans-serif; fill:goldenrod; font-size:5pt">
    <xsl:value-of select="ancestor::theorem1/theorem//ident"/>
  </text>
  <xsl:if test="type/ident='Point'">
    <circle r="2" cx="{90-position()*25}" cy="{90-position()*25}"
           style="stroke:royalblue; stroke-width:1"/>
    <text x="{95-position()*25}" y="{95-position()*25}"
          style="font-family:sans-serif; fill:blue; font-size:6pt">
      <xsl:value-of select="name/ident"/>
    </text>
  </xsl:if>
  ...
</xsl:template>
```

## Corresponding suite of XML tools (.html document)

- Resulting HTML document:

[http://www.matf.bg.ac.yu/~vesnap/xml\\_suite\\_for\\_isar.html](http://www.matf.bg.ac.yu/~vesnap/xml_suite_for_isar.html)

- It is still under development



## Conclusions and Future Work

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- This work represents a small technical contribution to Isabelle/Isar system
- It is still work in progress
- Future improvements:
  - Generating illustrations should be carried out more thoroughly
  - Conversion from an Isar program into a corresponding XML document is to be done
  - Developing an XML support for the prover that is going to be presented in the next talk