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# CapXML Design Goals

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## Overview

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## A Short History of *capella*

- Early *capella* Versions
  - *capella* 1.0 for DOS (1992)
  - *capella* 2.0 (1994, for Windows 3.1)
  - *capella* 2000 (Version 3.0, completely redesigned)
- Current Version: *capella* 2004 (version 5.1)
  - Programmable by embedded Python language
  - Binary file format replaced by **CapXML**
  - Many plugins developed by users
- More than 200,000 copies sold
  - Most successful notation program in Germany and other European countries

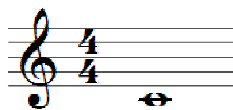
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## The *capella* Family

- **capella-software** GmbH
  - [www.capella.de](http://www.capella.de) (Company)
  - [www.capella-software.com](http://www.capella-software.com) (English Version)
- *capella*
  - Author: Hartmut Ring
- *capella-scan*
  - Authors: Bernd Jungmann, Hartmut Lemmel
  - Optical Note Recognition
- *capella-playAlong*
  - Author: Richard Koch
  - Makes accompaniment CDs from *capella* scores (more than 7500 *capella* scores available free of charge)

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## Example 1: "Hello World" in MusicXML and CapXML



CapXML

```

<?xml version="1.0" ...?>
<score xmlns="http://www.capella.de/CapXML/1.0">
  ...
  <voice>
    <noteObjects>
      <clefSign clef="treble"/>
      <timeSign time="4/4"/>
      <chord>
        <duration base="1/1"/>
        <heads>
          <head pitch="C5"/>
        </heads>
      </chord>
    </noteObjects>
  </voice>
  ...
</score>

```

MusicXML


```

<?xml version="1.0" ... ?>
...
<score-partwise>
  ...
  <measure number="1">
    <attributes>
      <divisions>1</divisions>
      <key>
        <fifths>0</fifths>
      </key>
      <time>
        <beats>4</beats>
        <beat-type>4</beat-type>
      </time>
      <clef>
        <sign>G</sign>
        <line>2</line>
      </clef>
    </attributes>
    <note>
      <pitch>
        <step>C</step>
        <octave>4</octave>
      </pitch>
      <duration>4</duration>
      <type>whole</type>
    </note>
  </measure>
  ...
</score-partwise>

```

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## Example 2: Chords in MusicXML and CapXML



CapXML

```

<score>
  <system>
    <staff>
      <voice>
        <chord>
          <duration base="1/8"/>
          <heads>
            <head pitch="C5"/>
            <head pitch="E5">
              <alter step="-1"/>
            </head>
            <head pitch="G5"/>
          </heads>
        </chord>
      </voice>
    </staff>
  </system>

```

MusicXML

```

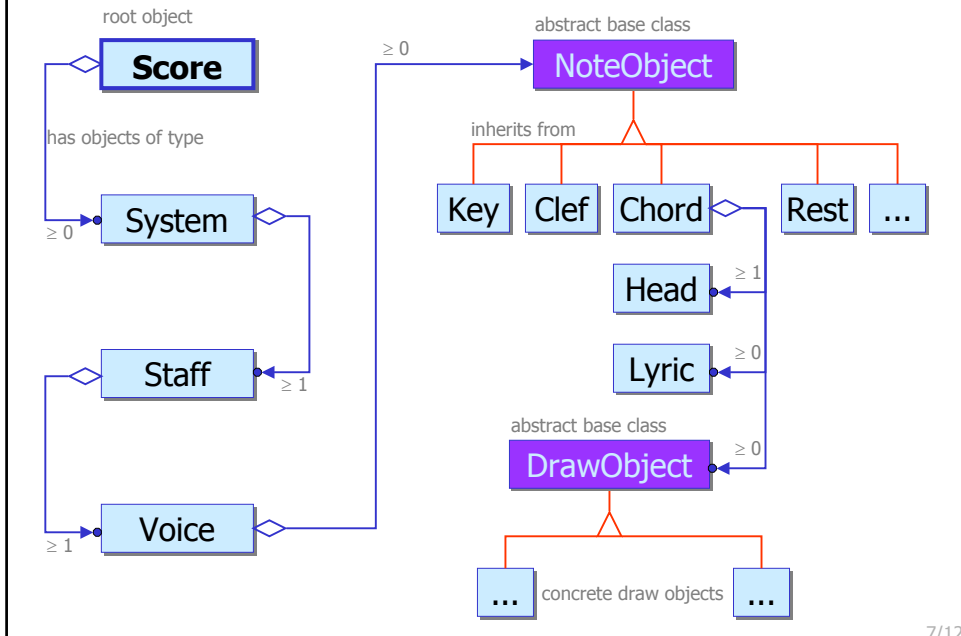
<note>
  <pitch>
    <step>C</step>
    <octave>4</octave>
  </pitch>
  <duration>4</duration>
  <voice>1</voice>
  <type>eighth</type>
  <stem>up</stem>
  <staff>1</staff>
  <beam number="1">begin</beam>
</note>

<note>
  <chord/>
  <pitch>
    <step>E</step>
    <alter>-1</alter>
    <octave>4</octave>
  </pitch>
  <duration>4</duration>
  <voice>1</voice>
  <type>eighth</type>
  <stem>up</stem>
  <staff>1</staff>
</note>

<note>
  <chord/>
  <pitch>
    <step>G</step>
    <octave>4</octave>
  </pitch>
  <duration>4</duration>
  <voice>1</voice>
  <type>eighth</type>
  <stem>up</stem>
  <staff>1</staff>
</note>

```

## A Part of the *capella* Object Hierachy



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## CapXML – Design Goals

- **Object Oriented**
  - The CapXML structure reflects the *capella* Object Hierachy
  - Objects serialize to and from corresponding XML elements.
- **Redundancy Free**
  - Objects use properties of objects containing them as default.
- **Efficient**
  - One pass serialization without restructuring.

A chord is an object containing single notes, not a sequence of events.  
The duration is a property of the chord, not of the notes.

Bar lines are set automatically when the bar is filled. Only explicit bar lines are notated.

Eighth notes (quavers) have black heads and one flag or beam unless explicitly stated otherwise.

A stem direction is notated only when it doesn't conform to the rule of the containing voice.

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## CapXML – Design Goals (continued)

### ■ Simple

- *capella* is affordable and homogeneous since it is developed by one person only.
- Basic notation is restricted to traditional western symbolic music representations.

### ■ Extensible

- Nonstandard notation is achieved by graphics objects attached to note objects, controlled by Python scripts.
- Examples of script solutions: Braille notation, several tablatures.

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## DTD vs. Schema

### MusicXML

```
<note>
  <pitch>
    <step>C</step>
    <octave>4</octave>
  </pitch>
  ...
</note>
```

### DTD

```
<!ELEMENT pitch (step, alter?, octave)>
<!ELEMENT step (#PCDATA)>
<!ELEMENT octave (#PCDATA)>
```

### CapXML

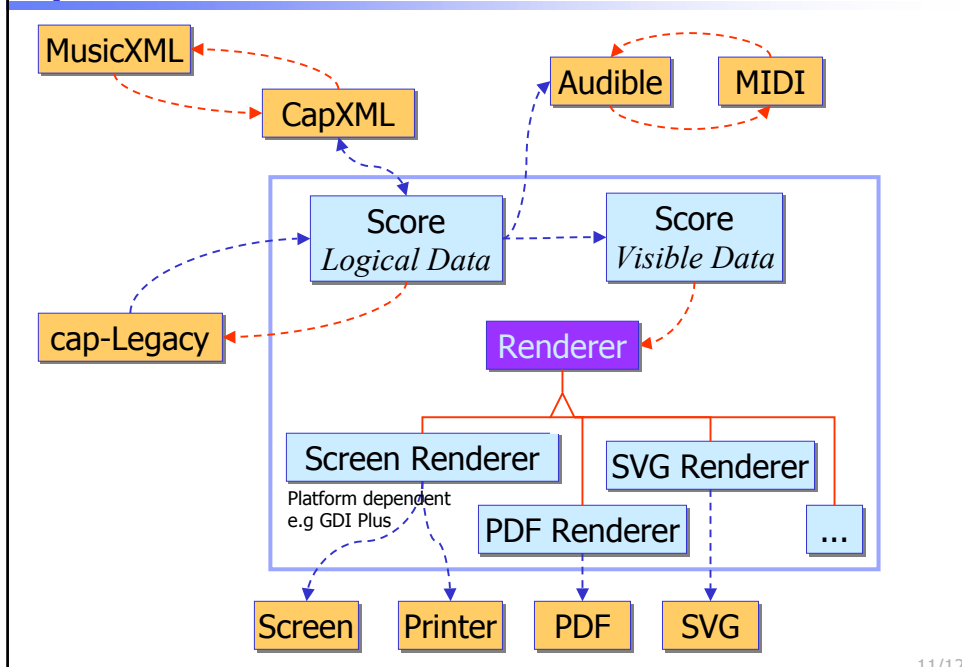
```
<head pitch="C5" />
```

### Schema Definition

```
<xsd:complexType name="Head">
  <xsd:sequence>
    ...
  </xsd:sequence>
  <xsd:attribute name="pitch" use="required">
    <xsd:simpleType>
      <xsd:annotation><xsd:documentation>
        absolute diatonic pitch<br/>
        middle C (c'): "C5"
      </xsd:documentation></xsd:annotation>
      <xsd:restriction base="xsd:string">
        <xsd:pattern value="[A-G][0-9]" />
      </xsd:restriction>
    </xsd:simpleType>
  </xsd:attribute>
  ...
</xsd:complexType>
```

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## capella 6 – Architecture



## Links

- [www.capella.de](http://www.capella.de)
  - capella-software home page
- [www.capella-software.com](http://www.capella-software.com)
  - Home page for the US capella version
  - capella 2004 will be available within a few weeks
- This presentation
  - [www.math.uni-siegen.de/ring/barcelona.pdf](http://www.math.uni-siegen.de/ring/barcelona.pdf)
  - [www.math.uni-siegen.de/ring/barcelona.ppt](http://www.math.uni-siegen.de/ring/barcelona.ppt)