Advanced Extension Mechanisms for X3D to Define, Implement and Integrate New First-Class Nodes, Components, and Profiles

Adopting and Augmenting X3D for Efficient 3D Content Production: Concepts and Tools (Workshop at the Web3D 2003 Symposium)

Enrico Rukzio
Dresden University of Technology, Multimedia Technology Group

Outline

- Motivation and Vision
- Existing X3D Extension Mechanisms
  - Prototypes
  - Components & Profiles
- Advanced Extension Mechanisms
  - Architecture, Big Picture
  - Declaration of new Nodes and Components
  - Grammars and Usage
- Conclusion

Motivation and Vision

- X3D Modularization
  - Built-In Nodes
  - 24 Components
  - 5 Profiles
- X3D Extension Mechanisms
  - Spontaneous creation of new second-class nodes by prototype statements
  - Components and Profiles can be added by an formal registration process

Motivation and Vision

- Advanced Extension Mechanisms
  - Create first-class nodes on demand
  - New nodes may be organized into proprietary unregistered components or profiles → meet specific application needs
  - Define, implement and integrate new nodes, components and profiles on demand
  - Without a registration process
  - Based on XML Technologies

Extension: X3D Prototypes

```
<AnimateRotation key="0 1" value="1 0 0 -1.7, 1 0 0 0">
```

- ProtoDeclare: Definition of the new node type
- ExternProtoDeclare: Interface
- ProtoInstance: Usage of the new node type
  - Can not be instantiated like built-in nodes

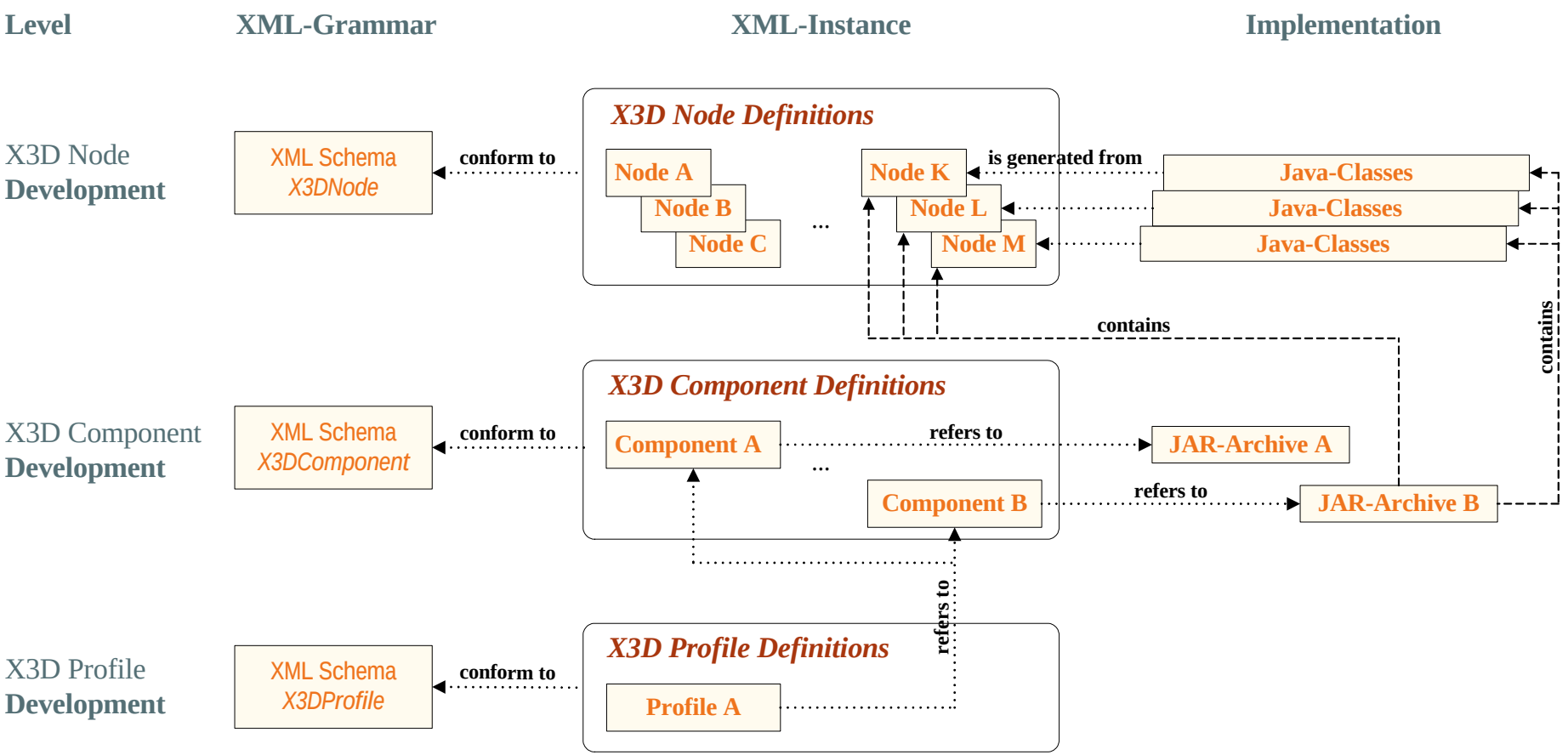
Extension: Components & Profiles

- Creation of a new Part of the intended International Standard or by the Registration of
  - New components
  - New levels within components
  - New profiles
- Formal Procedures of the ISO International Registration Authority for Graphical Items
- Current X3D specification describe conceptual, but no syntactical aspects

Generic Extension Mechanism: Idea

- Java-like extension mechanisms
  - Standard Java distributions (e.g. J2SE, J2EE)
  - Huge set of open-source projects; Results as Java Archive (JAR)
  - Programs reach a mature state + useful → integration in the Java distribution
- Standardized set of nodes & components
  - Ad Hoc definition, implementation and integration of new first-class nodes, components, and profiles

Architecture



X3D-Node Definitions

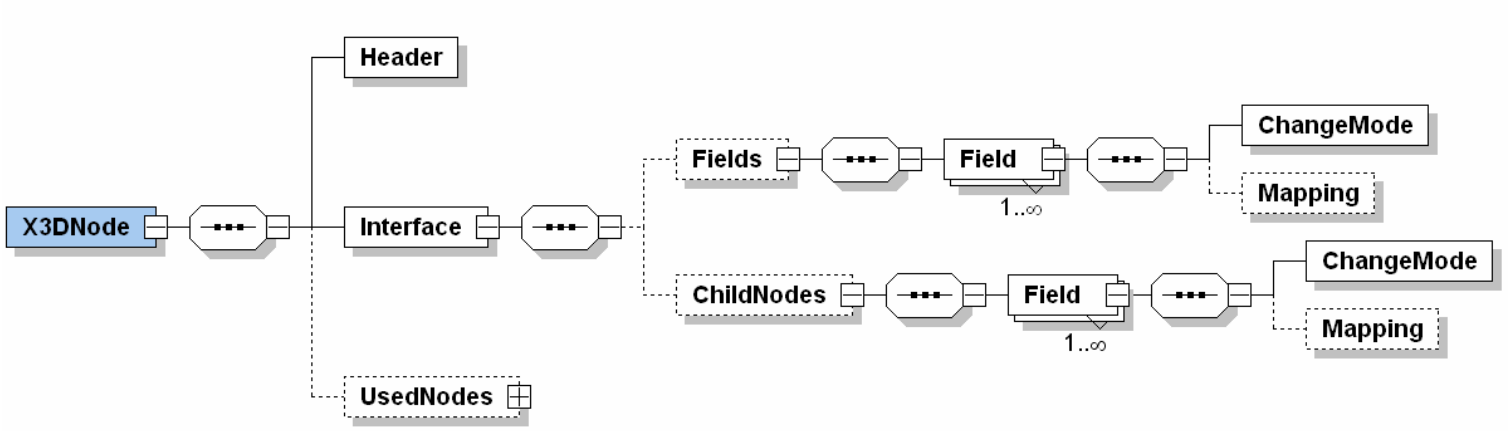
- Basic Node Concept

	Combinations			corresponds to X3D field access type
	configurable	*receives Events*	*generates Events*	
1	false	false	false	-
2	false	false	true	***outputOnly*** *(eventOut)*
3	false	true	false	***inputOnly*** *(eventIn)*
4	false	true	true	-
5	true	false	false	***initializeOnly*** *(field)*
6	true	false	true	-
7	true	true	false	-
8	true	true	true	***inputOutput*** *(exposedField)*

  - Improved field concept:
    name, type, possible default value, 3 change modes

X3D-Node Definitions

- Declaration of new X3D Nodes
  - XML Schema grammar *X3DNode*



  - Header: name, documentation
  - Fields: none-node datatypes (Color, Rotation)
  - ChildNodes: node datatypes (TimeBase)
  - UsedNodes: node composition

X3D-Node Definitions

- Instance of XML Schema *X3DNode*

```
<X3DNode>
  <Header name="SequentialStateMachine"/>
  <Interface nodeType="public" extends="TimeBaseMachine">
    <ChildNodes>
      <Field name="nextState" dataType="TimeBaseType">
        <ChangeMode minOccurs="0" configurable="false" receivesEvents="true"
            generatesEvents="false"/>
      </Field>
    </ChildNodes>
  </Interface>
</X3DNode>
```

X3D-Component Definitions

- Instance of XML Schema *X3DComponent*

```
<X3DComponent name="StateMachine">
  <Meta description="The nodes of this component allow the
    easy definition of state machines."/>
  <Level number="1" url="http://…/StateMachine1.jar">
    <X3DNode name="BaseStateMachine"/>
    <X3DNode name="SequentialStateMachine"/>
    <X3DNode name="StateMachine"/>
  </Level>
</X3DComponent>
```

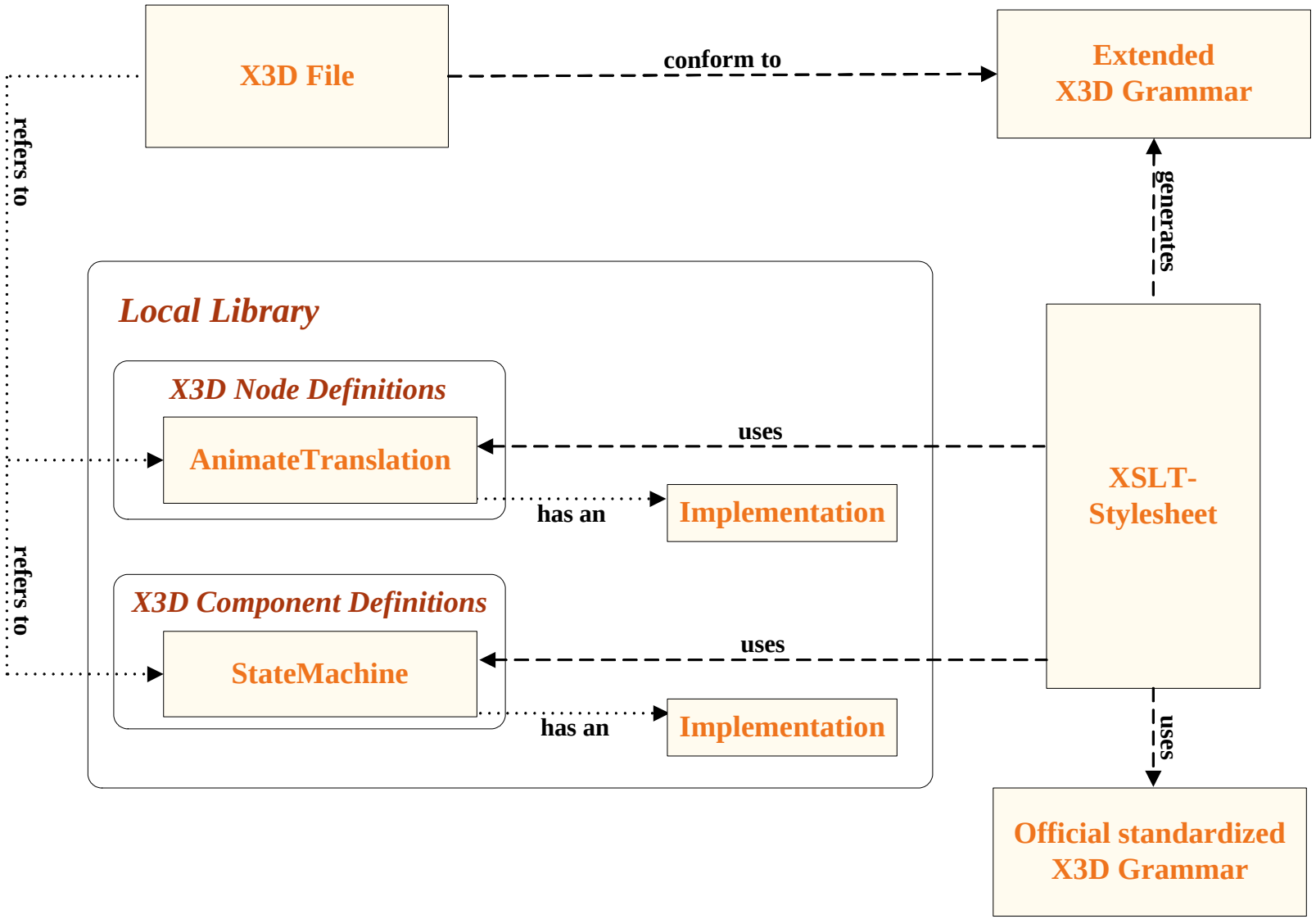
Usage of new Nodes & Components

- Instance of an XML Schema *X3DExtended*

```
<head>
  <profile name="Interactive"/>
  <component name="Sound" level="1"/>

  <component name="StateMachine" level="1"
                    url=" http://…/StateMachine1.jar"/>
  <node name="AnimateTranslation“
            url=“http://.../AnimateTranslation"/>
</head>
<Scene>
  <AnimateTranslation key="0 1" to="0 0 0, 0 0.05 0"/>
</Scene>
```

Extended X3D Grammar



Conclusion

- Definition of new first-class nodes, components, and profiles with the help of a three level architecture on demand
- Huge set of proprietary X3D nodes and components to fulfill the industrial and scientific requirements
- Decentralized and liberal procedure based on XML technologies (XML Schema, XSLT) without any registration process

Discussion

Thank you for your attention!

Contact: enrico@rukzio.de