Embedding 3D Objects into NCL Multimedia Presentations

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Outline

• Introduction
• Embedding 3D Objects into NCL documents
• Implementation
• Examples
• Conclusions
• Future Work
Terrestrial Digital TV Systems
Terrestrial Digital TV Systems

About 600 millions of users
Terrestrial Digital TV Middlewares

- **J.200**: Worldwide common core – Application environment for digital interactive television services

- **J.201**: Harmonization of declarative content format for interactive TV applications

- **J.202**: Harmonization of procedural content formats for interactive TV applications

**System Architecture**

- **Europe (DVB)**: MHP 1.0, DVB - HTML
- **USA (ATSC)**: ACAP-J, ACAP-X
- **Japan (ARIB)**: ARIB-AE (STD-B23), BML (STD-B24)
- **Brasil (ISDB-TB)**: Ginga-J, Ginga-NCL
NCL – Nested Context Language

• An XML-based declarative language that supports:
  – Media Synchronization
  – Content and presentation adaptation
  – Multiple devices
    • Distributed Multimedia Presentation
  – Live editing commands
• And it is royalties-free!
NCL – Nested Context Language

Java

Lua

Start

onBegin

onEnd

Stop

Start

Stop

Start

onSelection

Stop

Start

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NCL – Nested Context Language

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NCL – Nested Context Language
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<?xml version="1.0" encoding="ISO-8859-1"?>
<ncl id="testHeightTop" xmlns="http://www.ncl.org.br/NCL3.0/EDTVProfile">
  <head> ...
  </head>
  <body>
    <port id="p1" component="mainVideo"/>

    <media id="mainVideo" src="media/mainVideo.mp4">
      <property name="width" value="100%"/>
      <property name="height" value="100%"/>
      <area id="firstTrack" begin="3s" end="20s"/>
    </media>

    <media id="img1" src="1.png">
      ...
    </media>

    <link id="firstLink" xconnector="onBeginStart">
      <bind role="onBegin" component="mainVideo"/>
      <bind role="start" component="img1"/>
    </link>

  </body>
</ncl>
Embedding 3D Objects into NCL
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Diagram showing the integration of 3D objects into NCL via Java and Lua programming languages.
Embedding 3D Objects into NCL Documents

• Simple 3D Objects
  – Unstructured Mesh-based
  – From the NCL point of view, we have no access to its internal structures
  – Example: Wavefront .OBJ file

• Composite 3D Objects
  – Usually scene-graph based
  – From the NCL, we can define content anchors and property anchors binding to its internal content (*e.g.* Nodes).
  – Examples: eXtensible 3D
Embedding X3D Objects into NCL Documents

- Content anchor definition:
  - Every node with a unique identifier in the X3D document is able to be accessed by content anchors from NCL.

(a) X3D Scene Graph (myScene.x3d)

```xml
1. <head>
2.  <meta name="title" content="myScene.x3d"/>
3. </head>
4. <Scene>
5.  <Transform translation='3.0 0.0 1.0'>
6.   <Shape DEF="mySphere">
7.    <Sphere radius='2.3'/>
8.     <Appearance>
9.      <Material diffuseColor='1.0 0.0 0.0'/>
10.    </Appearance>
11.   </Shape>
12. </Transform>
13. </Scene>
```

(b) NCL document defining

```xml
1. <media id="mySceneObj" src="myScene.x3d">
2.  <area id="mySphereAnchor" label="mySphere"/>
3. ...
4. </media>
```

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Embedding X3D Objects into NCL Documents

- Property anchors definition:
  - Allows us to bind internal property of an X3D object for NCL properties.

```xml
6. ...  
7. <Shape>  
6. <Sphere radius='2.3'/>  
7. <Appearance>  
8. <Material DEF="myMaterial" diffuseColor='1.0 0.0 0.0'/>  
10. </Appearance>  
11. </Shape>  
12. ...
```

(a) X3D document (myScene.x3d)

```xml
1. <media id="mySceneObj" src="myScene.x3d">  
2. <property name="myMaterial#diffuseColor" />  
3. ...  
4. </media>  
```

(b) NCL Document embedding X3D
Extending NCL Events

• Currently, events supported by NCL are:
  – Presentation
  – Selection
  – Attribution

• New 3D-Related events
  – Proximity
  – Collision
  – Visibility
Some Possibilities (1)

Scene graph object

onBegin

Start

A 2D Object
Scene graph object

A 2D Object

onBegin

Start

Some Possibilities (2)
Some Possibilities (3)

Scene graph object

onCollision

Start

A 2D Object

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Some Possibilities (3)

Scene graph object

onSelection

set
Some Possibilities (4)

Scene graph object

Scene graph object 2

set

onProximity

start

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Implementation

• Our current implementation is based on:
  – Ginga-NCL Reference Implementation (http://www.gingancl.org.br)

  – Simple 3D Objects:
    • We have developed our own Wavefront OBJ player

  – Composite 3D objects:
    • We have integrated FreeWRL (http://freewrl.sourceforge.net)
Implementation

- FreeWRL integration
  - A new player to Ginga-NCL that wraps FreeWRL to follow the Players APIs.
  - EAI (External Application Interface) to make the communication with internal structures of X3D.
Some working in progress...
Conclusions

• We can improve some kinds of Digital TV application by embedding 3D objects.
• Embedding X3D content into NCL allows us also to control the behavior of the whole X3D scene.
• Multiple devices integration is a good way to improve usability of the 3D applications for digital TV.
Future Work

- Usability tests with other inputs for TV.
- Finishing the integration of FreeWRL as secondary device.
- Integration of a BIFS player (also based on Scene Graph) as a new type of media supported.
- Comparison of the integration of NCL Links modules inside X3D, as an alternative to route graphs.
- We hope to help in the specification of the new NCL version (4.0).
Some Credits

• Ginga-NCL Community:  
  http://www.softwarepublico.gov.br

• FreeWRL Community:  
  http://freewrl.sourceforge.net

• Savage X3D Examples Archive:  
  https://savage.nps.edu/Savage/
Thank you!!

Any Question?

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