H-Anim Motion Data Definition Updates

Web3D Korea Chapter Meeting

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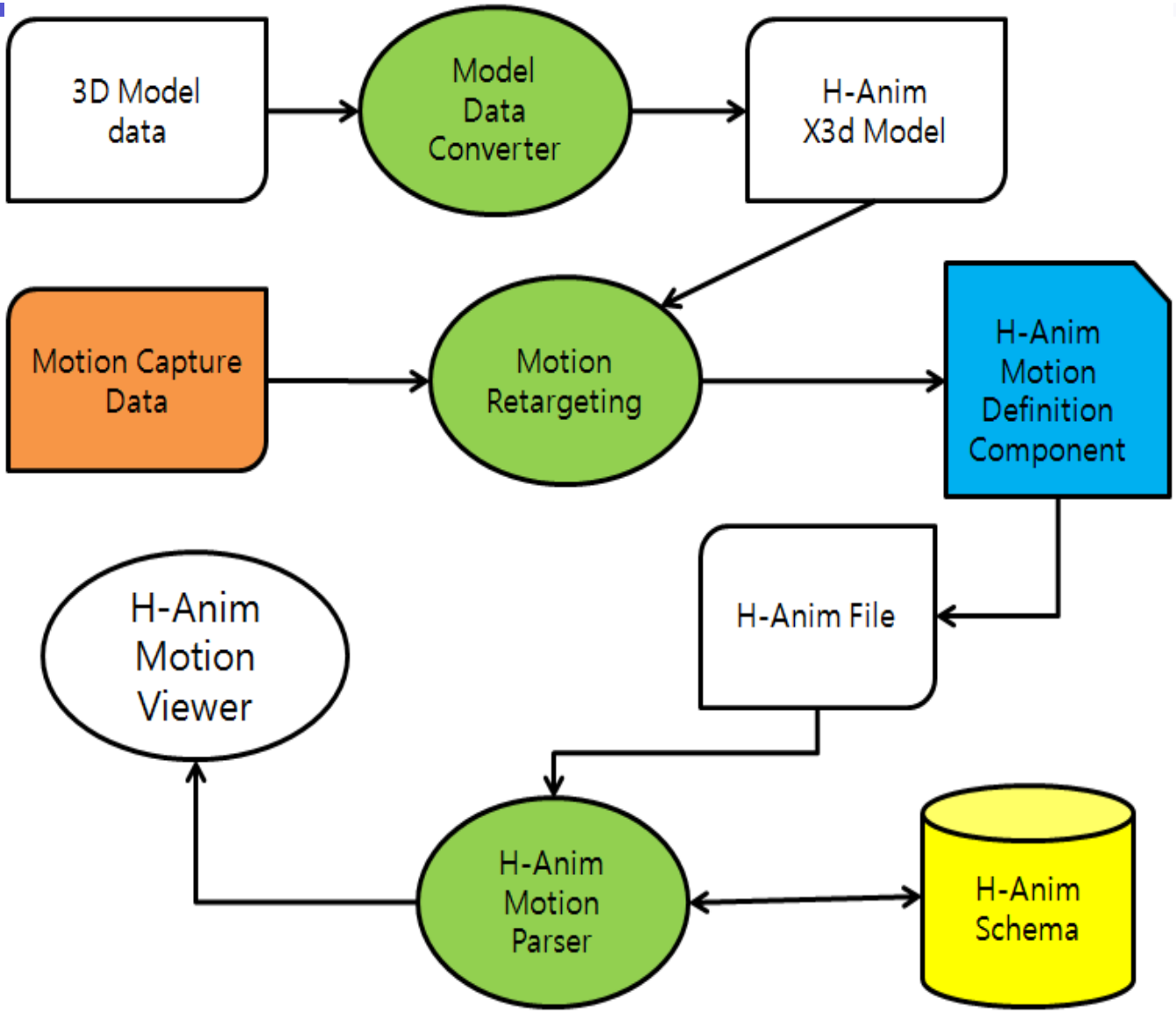
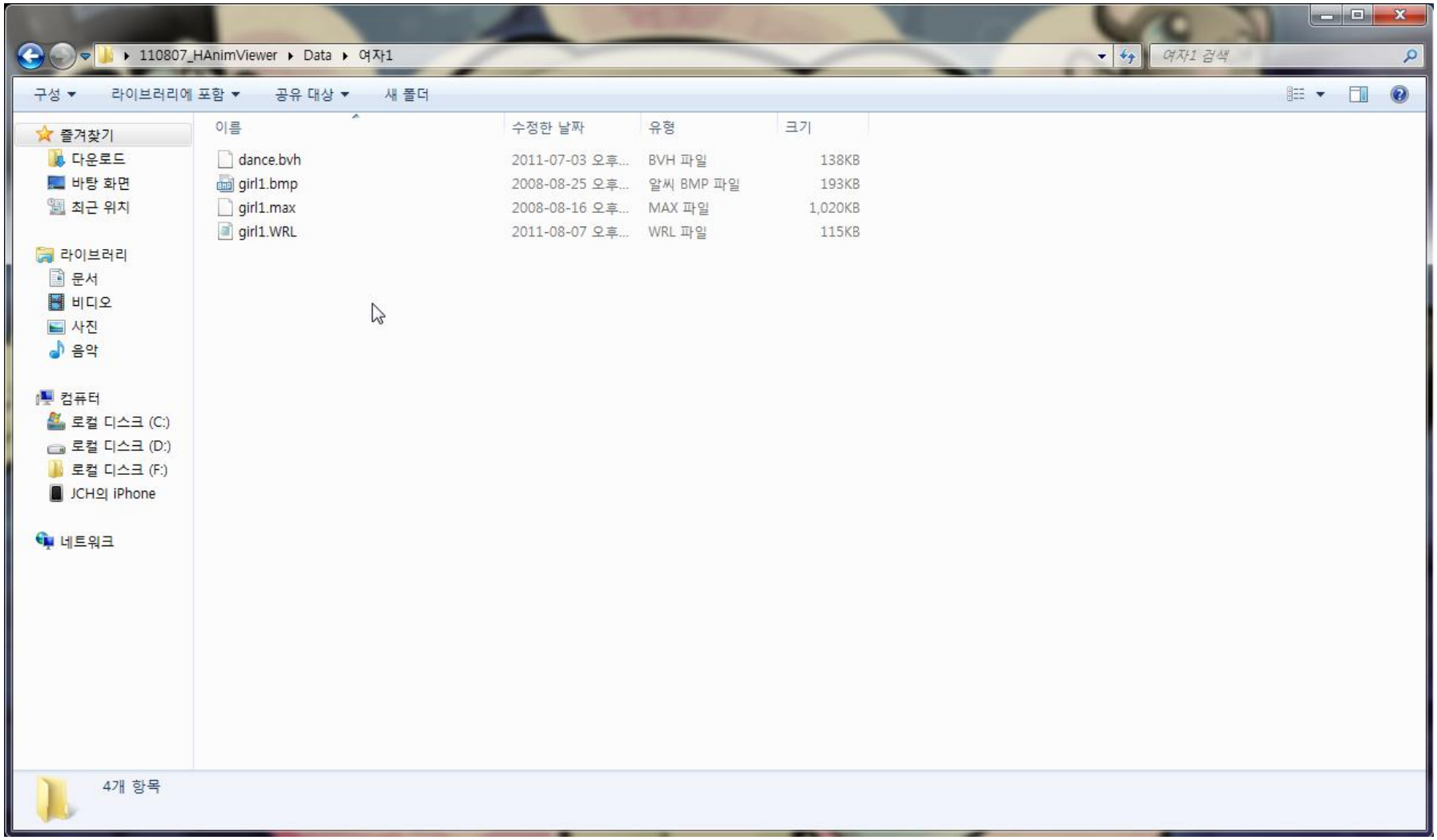
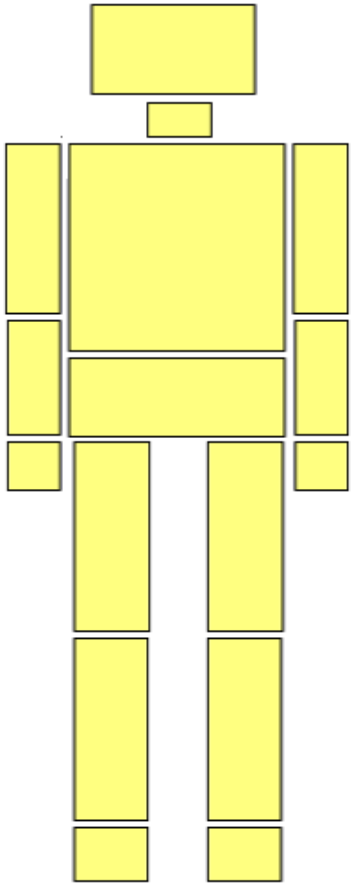
H-Anim Character Animation Generation

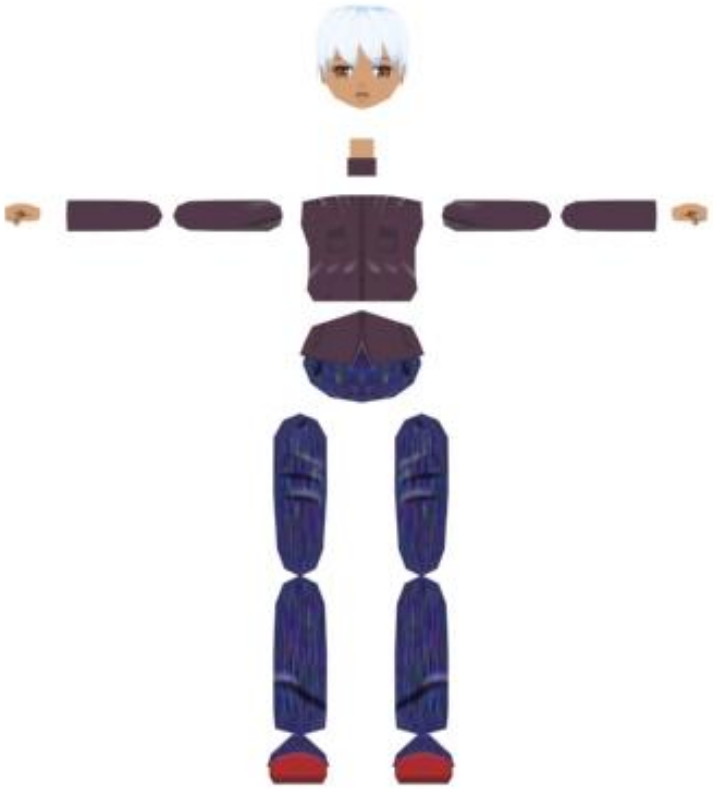


H-Anim Animation Generating Procedure



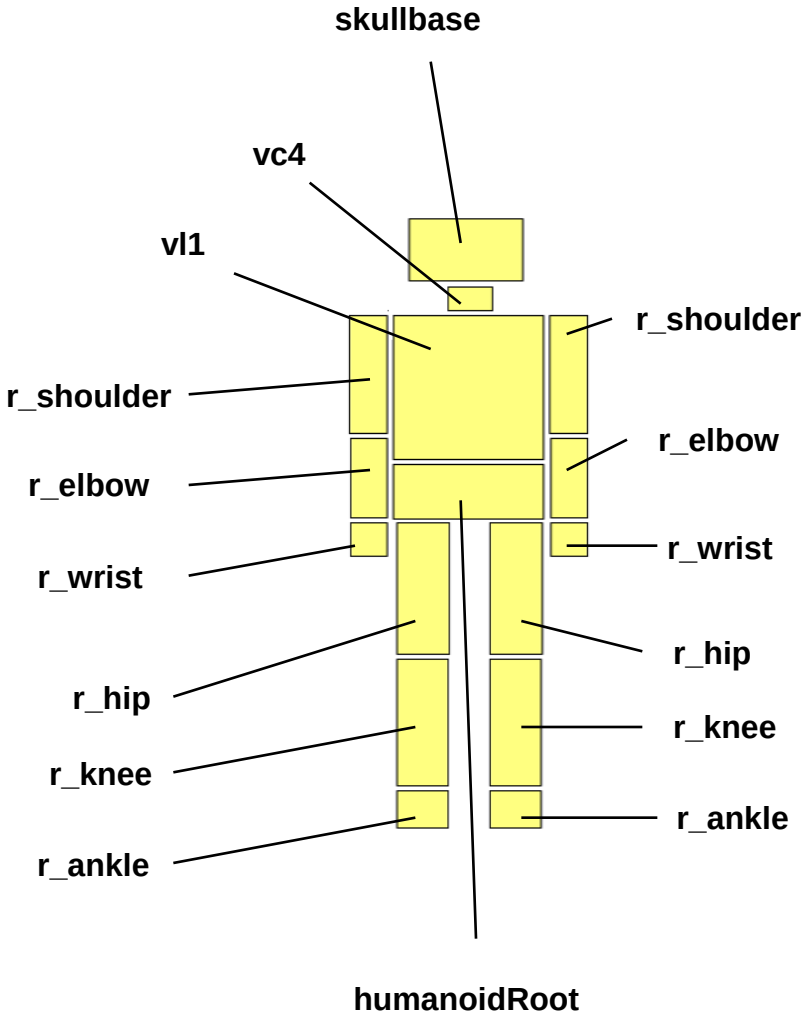
H-Anim Character Modeling (1)



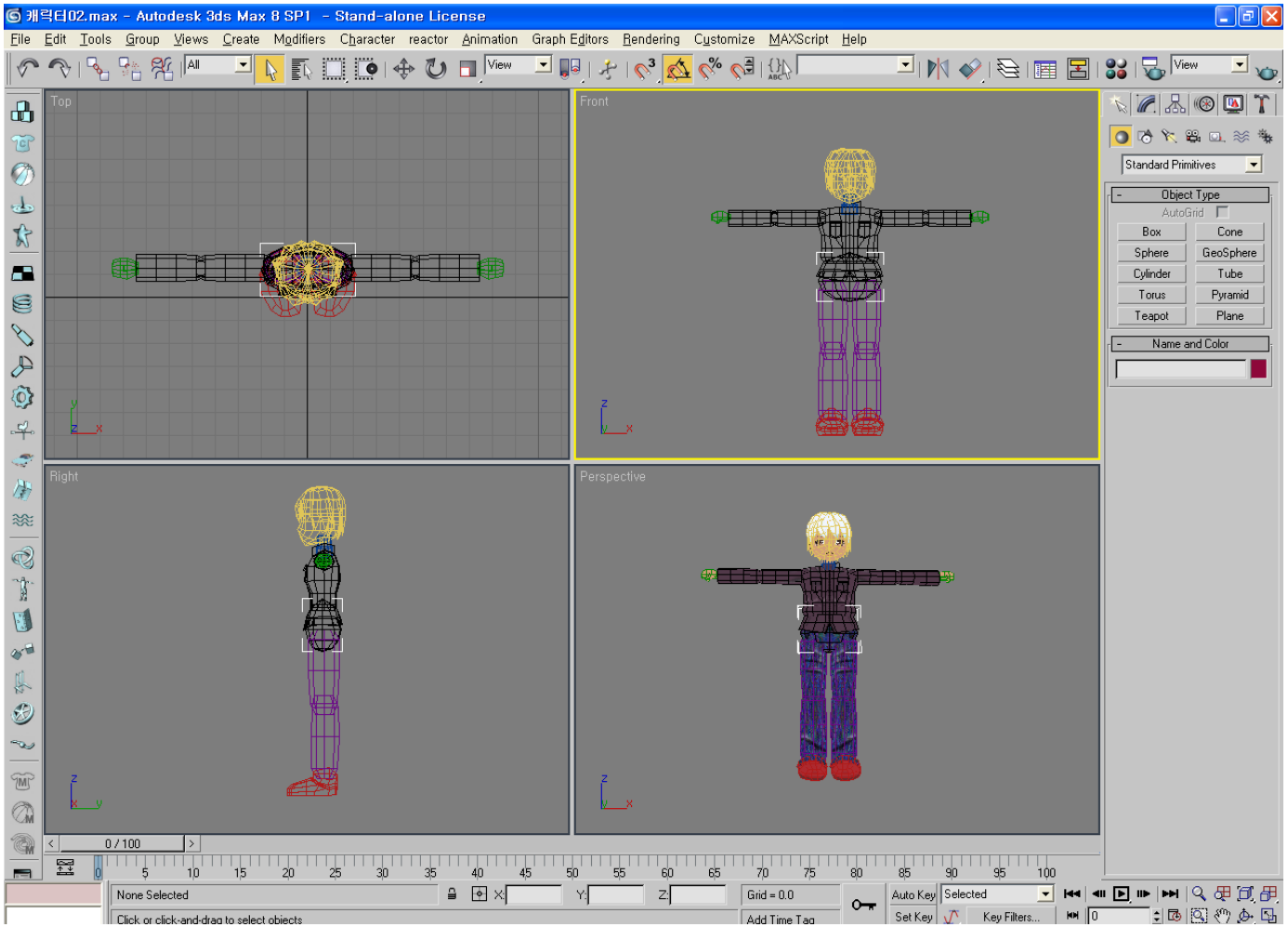


H-Anim Character Modeling (2)

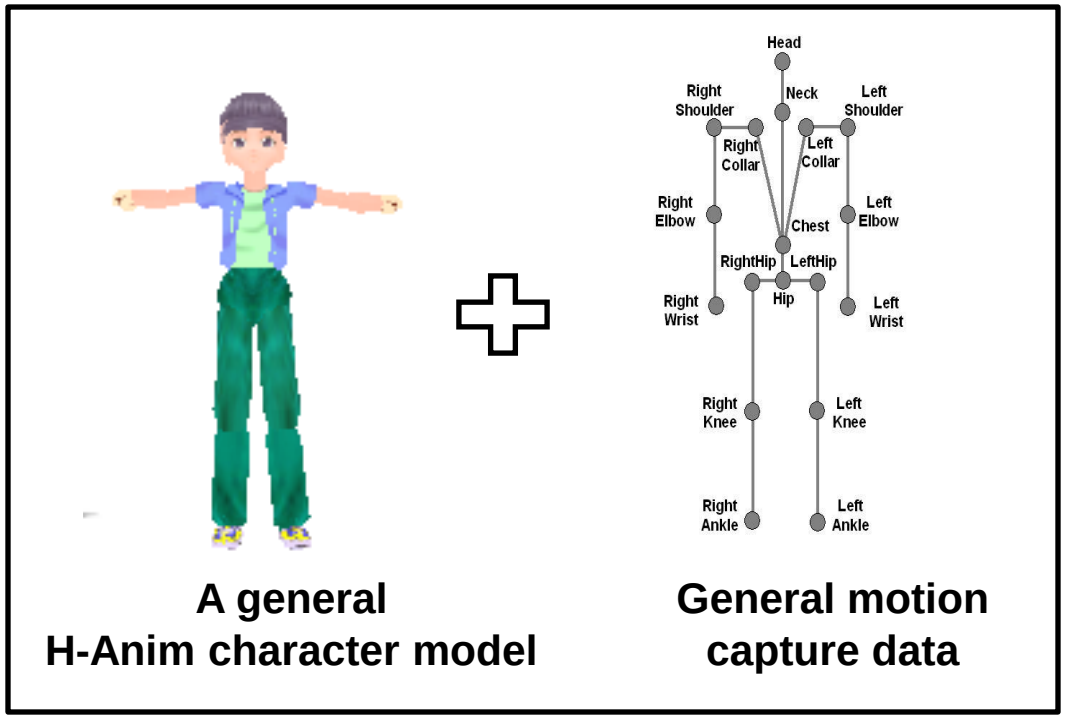
Body Segment Name
HumanoidRoot
l_hip
l_knee
l_ankle
r_hip
r_knee
r_ankle
vl1
l_shoulder
l_elbow
l_wrist
r_shoulder
r_elbow
r_wrist
vc4
skullbase



H-Anim Character Modeling By Any Tool



H-Anim Character and Motion Data



➔Exchangeable human model and motion definition

➔Re-use of any character with motion

H-Anim character animation

H-Anim Modeling (X3D)

- H-Anim file example

```
<Scene>
<HAnimHumanoid DEF="sample" name="humanoid" version="1.1">
        <HAnimJoint DEF="hanim_HumanoidRoot" center="0 -0.9232 -82.4" containerField="skeleton" name="HumanoidRoot">
                <HAnimJoint DEF="hanim_sacroiliac" center="0 -3.596 -91.49" name="sacroiliac" containerField="children">
                <HAnimSegment DEF="hanim_pelvis" name="pelvis" containerField="children">
                <Transform translation="-7.927 75.275 9.033">
                <Shape>
                <IndexedFaceSet coordIndex="0, 1, 2, -1, 2, 3, 4, -1"  creaseAngle="1.14">
                <Coordinate point="-10.56 -10.15 0.8157, 5.137 -10.15 2.444, -10.07 -10.15 -4.413, 5.137 -10.15 -2.444"/>
                </IndexedFaceSet>
                <Appearance>
                <Material diffuseColor="0.3412 0.8784 0.5608"/>
                </Appearance>
                </Shape>
                </Transform>
                </HAnimSegment>
                        <HAnimJoint DEF="hanim_l_hip" center="9.61 -0.01 -91.24" name="l_hip" containerField="children">
                        <HAnimSegment DEF="hanim_l_thigh" name="l_thigh">
                        <Transform translation="4.586 74.82 20.263">
                        <Shape>
                        <IndexedFaceSet coordIndex="2, 0, 3, -1, 1, 3, 0, -1, 9, 8, 11, -1, 10, 11, 8, -1,
```

A Motion Capture File (BVH)

Header

- Hierarchical structure, Initial position, Number of channels

```
HIERARCHY
ROOT Hips
{
  OFFSET 0.000000 0.000000 0.000000
  CHANNELS 6 Xposition Yposition Zposition Zrotation
  JOINT Chest
  {
    OFFSET 0.000000 5.613096 0.000000
    CHANNELS 3 Zrotation Xrotation Yrotation
    JOINT LeftCollar
    {
      OFFSET 0.003804 10.354579 1.025227
      CHANNELS 3 Zrotation Xrotation Yrotation
      JOINT LeftShoulder
      {
        OFFSET 3.922637 0.000000 0.000000
        CHANNELS 3 Zrotation Xrotation Yrotation
```

Data

- Number of frames, Frame time, Rotation info

```
MOTION
Frames: 482
Frame Time: 0.016667
1.662 31.427 60.304  -1.249 -4.859 -3.582  4.463 1.354 0.075
1.659 31.427 60.307  -1.268 -4.835 -3.588  4.487 1.352 0.080
1.657 31.428 60.310  -1.287 -4.811 -3.594  4.512 1.349 0.085
1.654 31.428 60.313  -1.306 -4.787 -3.599  4.536 1.347 0.090
1.652 31.428 60.316  -1.324 -4.764 -3.605  4.560 1.345 0.095
1.649 31.428 60.319  -1.343 -4.740 -3.611  4.584 1.343 0.100
1.647 31.428 60.322  -1.362 -4.716 -3.616  4.609 1.341 0.105
1.645 31.428 60.324  -1.381 -4.693 -3.622  4.633 1.339 0.111
1.642 31.428 60.327  -1.400 -4.669 -3.628  4.657 1.337 0.116
1.640 31.428 60.330  -1.419 -4.646 -3.634  4.682 1.336 0.121
1.637 31.428 60.333  -1.438 -4.622 -3.639  4.706 1.334 0.127
1.635 31.428 60.336  -1.457 -4.599 -3.645  4.730 1.333 0.132
1.633 31.428 60.339  -1.476 -4.575 -3.651  4.755 1.332 0.138
1.630 31.428 60.342  -1.495 -4.552 -3.656  4.779 1.331 0.144
1.628 31.428 60.345  -1.514 -4.528 -3.660  4.804 1.330 0.149
```

Motion Data Definition

- Definition of a Motion Data Component
  - Joint node (update)
    - Define additional fields for motion parameters
  - Motion node
    - Define motion captured data for an H-Anim character model
    - Define the motion node after adjusting the center of each joint to the H-Anim character model

Joint Node Update

```
Interface Joint {
// the same as the existing joint node
float[3] bboxCenter 0 0 0
float[3] bboxSize -1 -1 -1
float[3] center 0 0 0
sequence<Object> children []
sequence<Object> displacers []
sequence<float[3]> llimit []
float[4] limitOrientation 0 0 1 0
string name ""
float[4] rotation 0 0 1 0
float[3] scale 1 1 1
float[4] scaleOrientation 0 0 1 0
float[3] translation 0 0 0
sequence<float[3]> ulimit []

// define additional fields
int[2] ChannelsNumber
sequence<string> Channels
float[3] Offset
}
```

```
HIERARCHY
ROOT Hips
{
 OFFSET 0.000000 0.000000 0.000000
 CHANNELS 6 Xposition Yposition Zposition Zrotation
 JOINT Chest
 {
  OFFSET 0.000000 5.613096 0.000000
  CHANNELS 3 Zrotation Xrotation Yrotation
  JOINT LeftCollar
  {
   OFFSET 0.003804 10.354579 1.025227
   CHANNELS 3 Zrotation Xrotation Yrotation
   JOINT LeftShoulder
   {
    OFFSET 3.922637 0.000000 0.000000
    CHANNELS 3 Zrotation Xrotation Yrotation
```

- Fields for receiving motion capture data
  - ChannelsNumber
  - Channels
  - Offset

Joint Node Update

- Define additional fields: Offset, Channels, ChannelsNumber (new fields)

```
Interface Joint {
   …
   float[3]              Offset
   int[2]                ChannelsNumber
   sequence<string>   Channels
}
```

  - Offset: the center of a joint
  - ChannelsNumber: Number of channels at a joint
  - Channels: Identifiers for channels

- Example

```
Joint {
…
Offset                [ 1, 3 ]
ChannelsNumber    [ 1, 3 ]
Channels             “ Xrotate    Yrotate   Zrotate”
}
```

Motion Node

- Definition of Motion Node (a new node)
  - Define fields of Frames, FrameTime, transformation Channels

```
Interface Motion {
   int                  Frames
   float                FrameTime
   sequence<float>   Transformation
}
```

  - Frames: Number of frames for an animation sequence
  - FrameTime: Specifies a sampling rate
  - Transformation: Transformation values of a joint for each frame

- Example

```
Motion {
Frames              601
Frametime           0.033333
transformation      [ 11.623, 31.312, 64.121, -0.700, -4.023, ……
                    11.616, 31.313, 64.107, -0.696, -3.954, ……
                    …… ]
}
```

NewHanim.hanim – Modeling Part

```
<Scene>
<NavigationInfo speed="1.5" type='"EXAMINE" "ANY"'/>
<HAnimHumanoid DEF="girl1" name="girl1" version="1.1"/>

<HAnimJoint DEF="hanim_HumanoidRoot" center="0.0 0.0 0.0"
containerField="skeleton" name="HumanoidRoot"/>

<HAnimJoint DEF="hanim_sacroiliac" center="0.0 0.0 0.0" name="sacroiliac"
containerField="children"
Offset="0.000000 0.000000 0.000000"
Channels="6, Xposition, Yposition, Zposition, Zrotation, Xrotation, Yrotation" />

<HAnimSegment DEF="hanim_pelvis" name="pelvis" containerField="children"/>
<Transform translation="0.0 0.0 0.0"  rotation="0 0 0 0"  scale="0.0 0.0 0.0"
scaleOrientation="0 0 0 0">

<Appearance>
<Material diffuseColor="0.537300 0.196100 0.196100"/>
<ImageTexture url="girl1.bmp"/>
</Appearance>
```

NewHanim.hanim – Motion Part

```
</Shape>
</Transform>
</HAnimSegment>
…
…
<HAnimMotion>
<FrameInformation frames ="392" frametime = "0.033333">
<SegmentTransform transform = "
196.1625 71.7332 -58.9121 25.9900 9.3900 -76.6700 29.9100 -61.7800 39.3900
0.1500 30.8300 -
…
…
0.3300 -14.2200 -0.2300 2.1900 -4.9100 -21.1400 -5.5400 8.5100 13.4900 -
10.7700 ">
</HAnimMotion>
</Scene>
</X3D>
```

Schema Extension for H-Anim Character Animation (1)

1. Schema definition for Motion data

```
<xs:group name="ChildContentModelHumanoidAnimation">
 <xs:annotation>
  <xs:appinfo>Child-node content model corresponding to X3DChildNode for HumanoidAnimation component.</xs:appinfo>
        <xs:documentation source="http://www.web3d.org/x3d/specifications/ISO-IEC-FDIS-19775-1.2-X3D-AbstractSpecification/Part01/components/hanim.html"/>
 </xs:annotation>
 <xs:choice>
        <xs:element ref="HAnimHumanoid"/>
        <xs:element ref="HAnimJoint"/>
        <xs:element ref="HAnimSegment"/>
        <xs:element ref="HAnimSite"/>
<!-- added -->
        <xs:element ref="HAnimMotion"/>
<!-- added -->
 </xs:choice>
</xs:group>
```

Schema Extension for H-Anim Character Animation (2)

2. Schema definition for the updated Joint node

```
<xs:element name="HAnimJoint">
  <xs:annotation>
     <xs:appinfo/>
        <xs:documentation     source="http://www.web3d.org/x3d/specifications/ISO-IEC-
FDIS-19775-1.2-X3D-AbstractSpecification/Part01/components/
hanim.html#HAnimJoint"/>
     </xs:annotation>
     <xs:complexType mixed="false">
     <xs:complexContent mixed="false">
     <xs:extension base="X3DGroupingNode">
              <xs:attribute name="name" type="jointName"/>
             <xs:attribute name="center" type="SFVec3f" default="0 0 0"/>
             <xs:attribute name="rotation" type="SFRotation" default="0 0 1 0"/>
             <xs:attribute name="scale" type="SFVec3f" default="1 1 1"/>
             <xs:attribute name="scaleOrientation" type="SFRotation" default="0 0 1 0"/>
             <xs:attribute name="translation" type="SFVec3f" default="0 0 0"/>
             <xs:attribute name="skinCoordIndex" type="MFInt32"/>
```

Schema Extension for H-Anim Character Animation (3)

```
            <xs:attribute name="skinCoordWeight" type="MFFloat"/>
            <xs:attribute name="llimit" type="MFFloat"/>
            <xs:attribute name="ulimit" type="MFFloat"/>
            <xs:attribute name="limitOrientation" type="SFRotation" default="0 0 1 0"/>
            <xs:attribute name="stiffness" type="MFFloat" default="0 0 0"/>
<!- added -->
            <xs:attribute name="Offset" type="SFVec3f"/>
            <xs:attribute name="ChannelsNumber" type="MFInt32"/>
            <xs:attribute name="Channels" type="MFString"/>
<!- added -->
        </xs:extension>
      </xs:complexContent>
   </xs:complexType>
</xs:element>
```

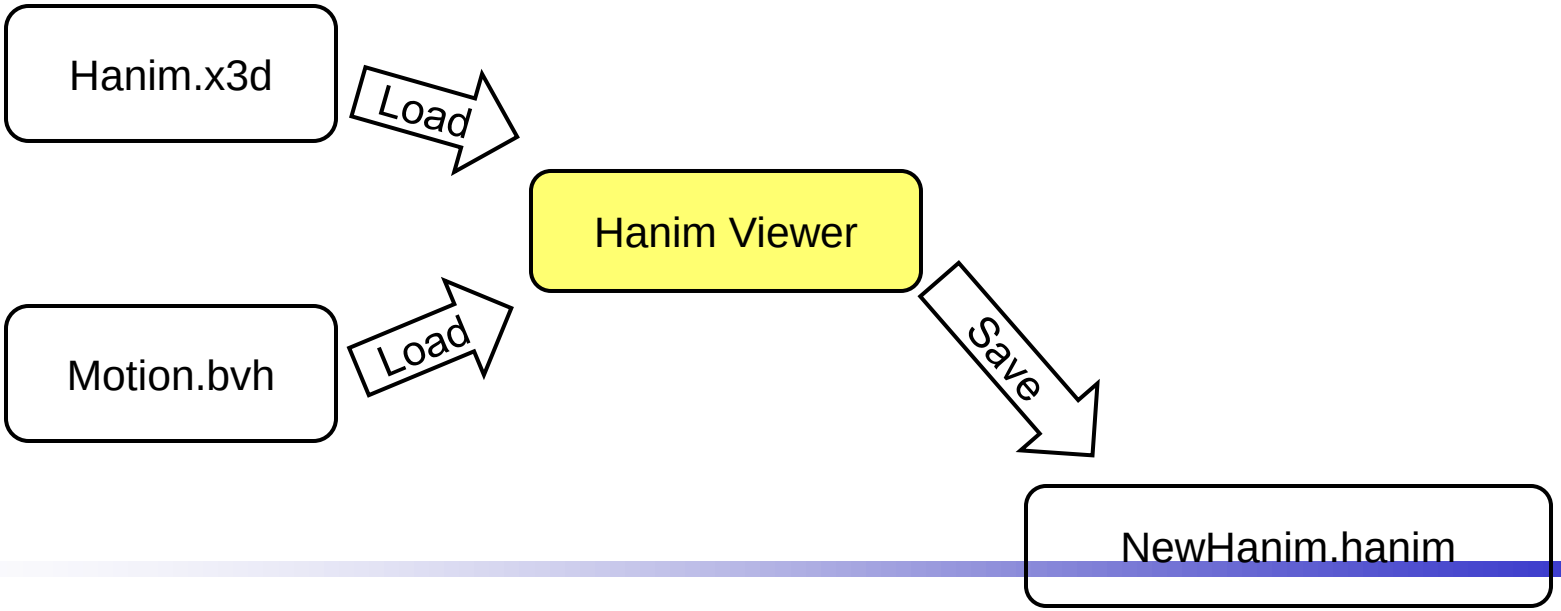
Schema Extension for H-Anim Character Animation (4)

3. Schema definition for the Motion node

```
<!- added -->
<xs:element name="HAnimMotion">
   <xs:annotation>
       <xs:appinfo/>
            <xs:documentation source="..."/>
   </xs:annotation>
   <xs:complexType>
            <xs:attribute name="DEF" type="xs:ID" use="required"/>
            <xs:attribute name="Frames" type="SFInt32" use="required"/>
            <xs:attribute name="Frametime" type="SFFloat" use="required"/>
            <xs:attribute name="Transformation" type="MFVec3f" use="required"/>
<!--        <xs:attribute name="Transformation" type="MFRotation" use="required"/>-->
    </xs:complexType>
 </xs:element>
```

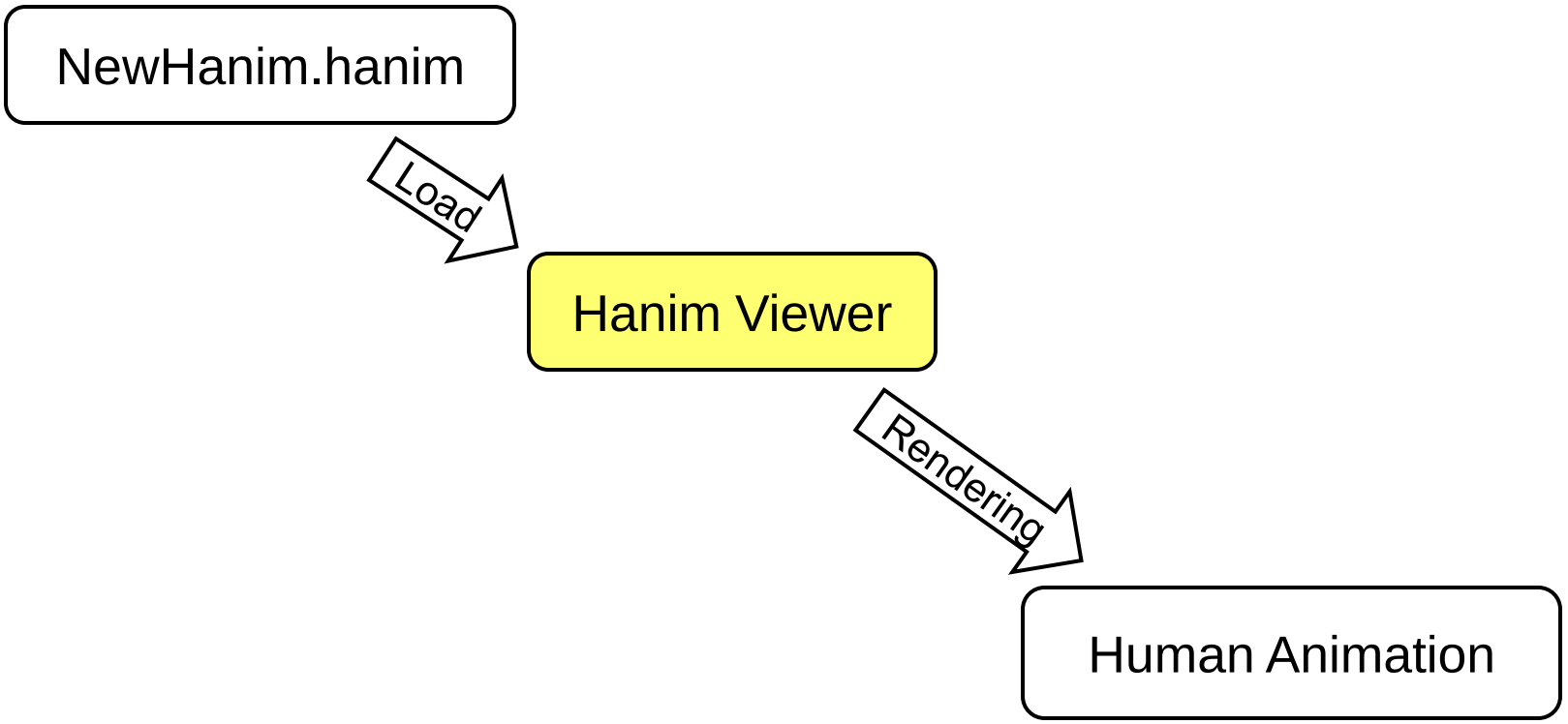
H-Anim Animation File Generation

- H-Anim Viewer
  - Read an H-Anim character model and motion captured data
  - Adjust segment lengths of the mocap character to the H-Anim character
  - Generate and display the motion captured animation for the H-Anim character
  - Generate an H-Anim animation file including the H-Anim character model with the motion captured data

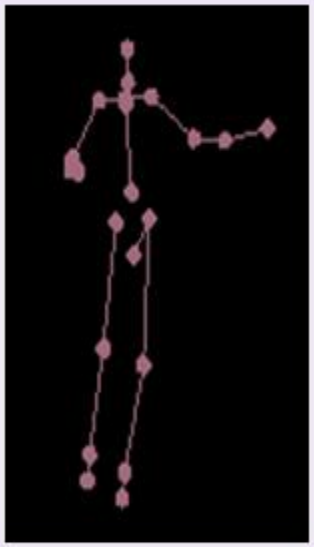
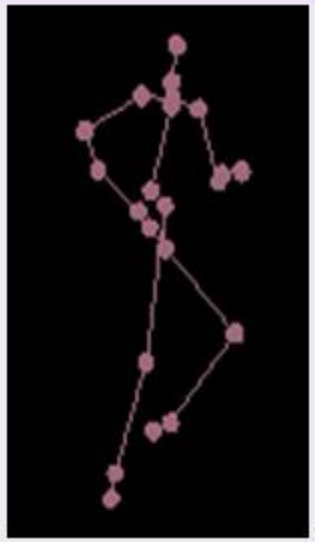


Re-use of an H-Anim Animation File

- Generation, storage, and re-use of 3D character animation



H-Anim Chracter Animation Example

Motion Capture (BVH)				
H-Anim Animation				

Conclusions

- H-Anim character animation generating procedure
- H-Anim motion data definition
  - Additional fields definition for Joint node
  - Definition of a new Motion node
- H-Anim schema extension for the motion data definition
- An H-Anim motion viewer