Center for Teaching and Learning

Technical Report

SimSYS Game Specification

By

Hemalochane Jayaraj
Riddhi Raiker
Kendra Cooper
The University of Texas at Dallas
C. Shaun Longstreet
Marquette University

Working Paper MU-CTL-01-14

MARQUETTE
UNIVERSITY

Table of Contents

1. Introduction

SimSYS game development platform

Architecture figure (Figure 1)

Description xxx

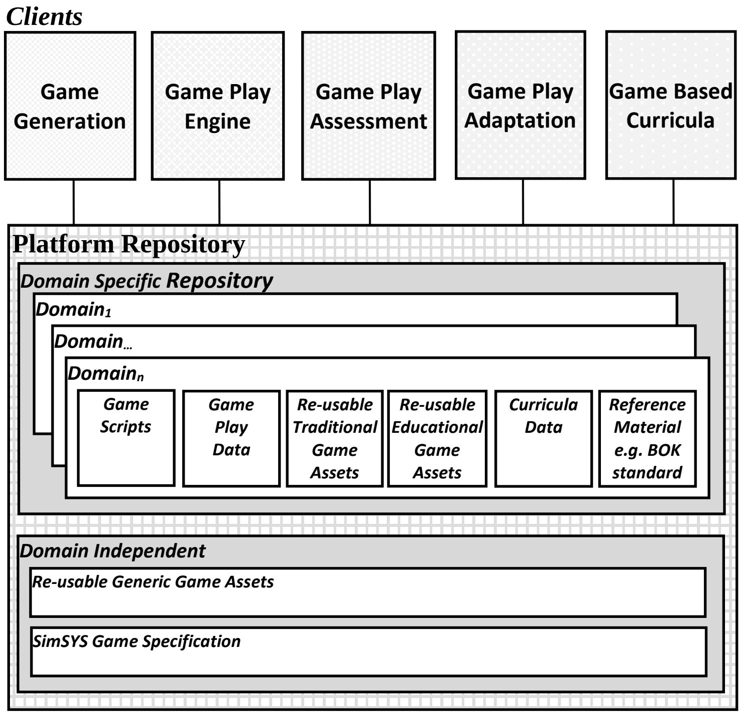


Figure 1. Overall Architecture for the SimSYS Game Development Platform

Focus on the game specification in this report

Secton 2 – informal specification

Section 3 - semi-formal, visual specification

Section 4 – formal specification (XSD)

Section 5 – mapping

Section 6 sample game (xml)

Section 7 – sample code, screenshots

Section 8 – conclusions and future work

2. Informal SimSYS Game Specification

Xxx

A Game has a purpose (education topic/domain, target player, target difficulty) and one or more learning objectives (e.g. SWEBOK design); each learning objective has one or more learning taxonomy category (e.g., Bloom's understanding).

A Game has one or more Characters.

A Game has one or more Acts.
Each act has zero or more learning objectives (e.g. SWEBOK design); each learning objective has one or more learning taxonomy category (e.g., Bloom's understanding).

An Act has one or more Scenes.
Each Scene has zero or more learning objectives (e.g. SWEBOK design); each learning objective has one or more learning taxonomy category (e.g., Bloom's understanding).

A Scene has one or more Screens.
Each Screen has zero or more learning objectives (e.g. SWEBOK design); each learning objective has one or more learning taxonomy category (e.g., Bloom's understanding).

A Screen has zero or more Challenges.
Each Challenge has zero or more learning objectives (e.g. SWEBOK design); each learning objective has learning taxonomy category (e.g., Bloom's understanding).

One kind of a Challenge is a multiple choice quiz. A quiz is optionally timed; a quiz is optionally competitive (in other words, player vs. one or more non-player characters).

Learning objectives and their learning taxonomy categories are traced from the Game, Acts, Scenes, Screens, and Challenges.

In multiple choice quizzes, learning objectives and their taxonomy categories are traced from the Challenge to the items in the quiz.

One transitions or cut is defined from Act to Act, Scene to Scene, Screen to Screen. Transitions and cuts have a type and duration. The default is a straight cut, MEDIUM duration.

Transitions:
- Fade in
- Fade out
- Dissolve
- Wipe
- Morph

Cuts:
- Straight Cut
- Contrast Cut
- L Cut
- Form Cut

Match Cut
Parallel Editing Cut
Jump Cut

Transition and cut durations are SLOW, MEDIUM, and FAST.
The sequencing of Acts, Scenes, Screens, Challenges is explicitly specified.
For example, at the end of Screen 1, the following can be specified:

If condition 1, then proceed with Screen 2.
If condition 2, then proceed with Screen 3.
…
If condition n, then proceed to Screen x.

One transitions or cut is defined from Act to Act, Scene to Scene, Screen to Screen. Transitions and cuts have a type and duration. The default is a straight cut, MEDIUM duration.

A Scene has one backdrop.

A Scene has zero or one background music (music can be played throughout a scene).

A Screen has game elements.

A Screen has zero or one background music (music can be played on a screen by screen basis). The screen's background music has priority over the scene's background music.

Game elements are characters and props.
A game element has one name, one location, one size, and zero or one hints.
Hints can be presented/hidden to/from the player upon request from the player or after a specified amount of time.

The location can be in absolute co-ordinates (x,y,z) or in stage directions.
Stage directions:

B	backdrop
C	center
U	up
D	down
R	right
L	left
O	off

Backdrop						
OSR	UUR	UURC	UUC	UULC	UUL	OSL
	UR	URC	UC	ULC	UL	
	R	RC	C	LC	L	
	DR	DRC	DC	DLC	DL	
	DDR	DDRC	DDC	DDLC	DDL	
	Apron					

The size can be a pre-defined scale (small, medium, large), where medium is the default size of the image in the repository or a percentage scale in x%, y%.

Characters are either a player character or a non-player character.
A Game has one player character; zero or more non-player characters.

The character has:

- name
- location
- size
- optional hint
- type // one of
  - protagonist
  - antagonist
  - interlocutor
  - director
  - constructor
  - trickster
  - prop
- pose, expression
- profile
  - resume image
  - education list (subject, degree, school)
  - title
  - level (e.g., junior, intermediate, senior)
  - number of years of work experience
  - skills (e.g. requirements engineer, architect, tester, manager)
- rewards
  - points
  - trophies
  - certificates
  - promotion/demotion
- behavior
  - level of engagement (very positive, positive, neutral, negative, very negative)

The character profile, rewards, and behavior persist throughout the game. If the profile, rewards, or behavior are being displayed to the player when their values are changed, then the updated values are presented to the player.

The profile can be displayed/hidden to/from the player.
The rewards can be displayed/hidden to/from the player.
The behavior can be displayed/hidden to/from the player.

There are three kinds of props: generic interaction elements (information boxes, information bubbles, buttons, conversation bubbles); education interaction elements (blackboard, whiteboard, projection screen, PC/laptop/ tablet/ phone screen); and domain specific props (desks, chairs, podium, tables), also called set decorations.

A multiple choice quiz has zero or one introductions, one or more items (questions), and zero or one summaries.

Each item is one type (interactive dialogue, deliberation, or composition).
Each item has one or more learning objectives; each learning objective has one or more learning

taxonomy categories.
Each item has a stem and two or more options (answers). The stem has zero or one text (description or vignette), zero or more images, and a question.
The stem text has zero or one hint.
The stem question has zero or one hint.

Each option has an assessment (correct, incorrect, or partially correct).
Each option has zero or one hint.
Each option has a reward.
Each option has feedback.

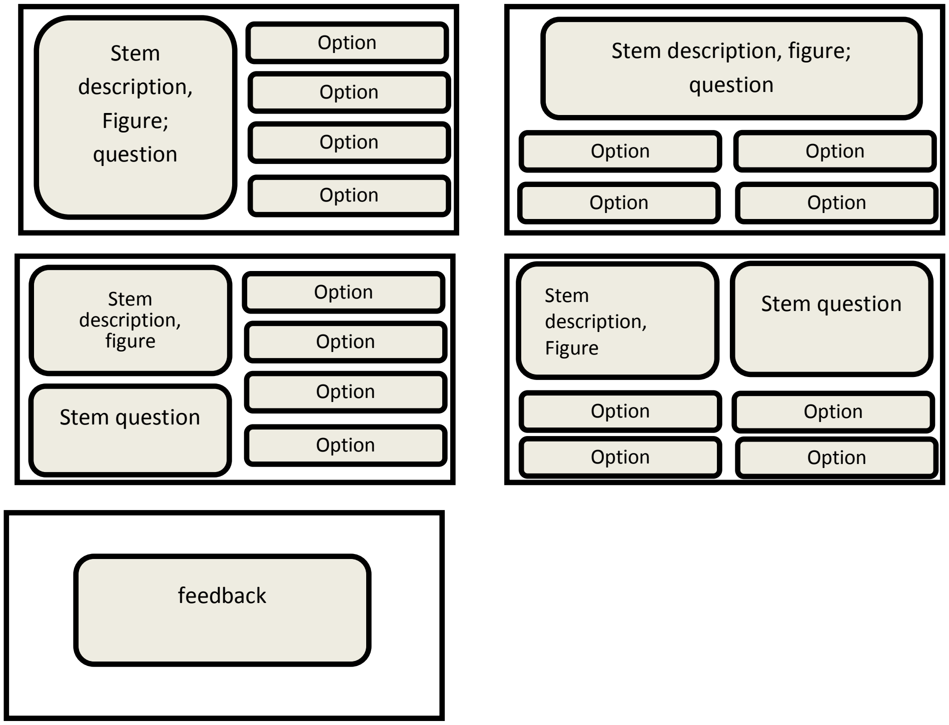
Each item has zero or one follow-up question.

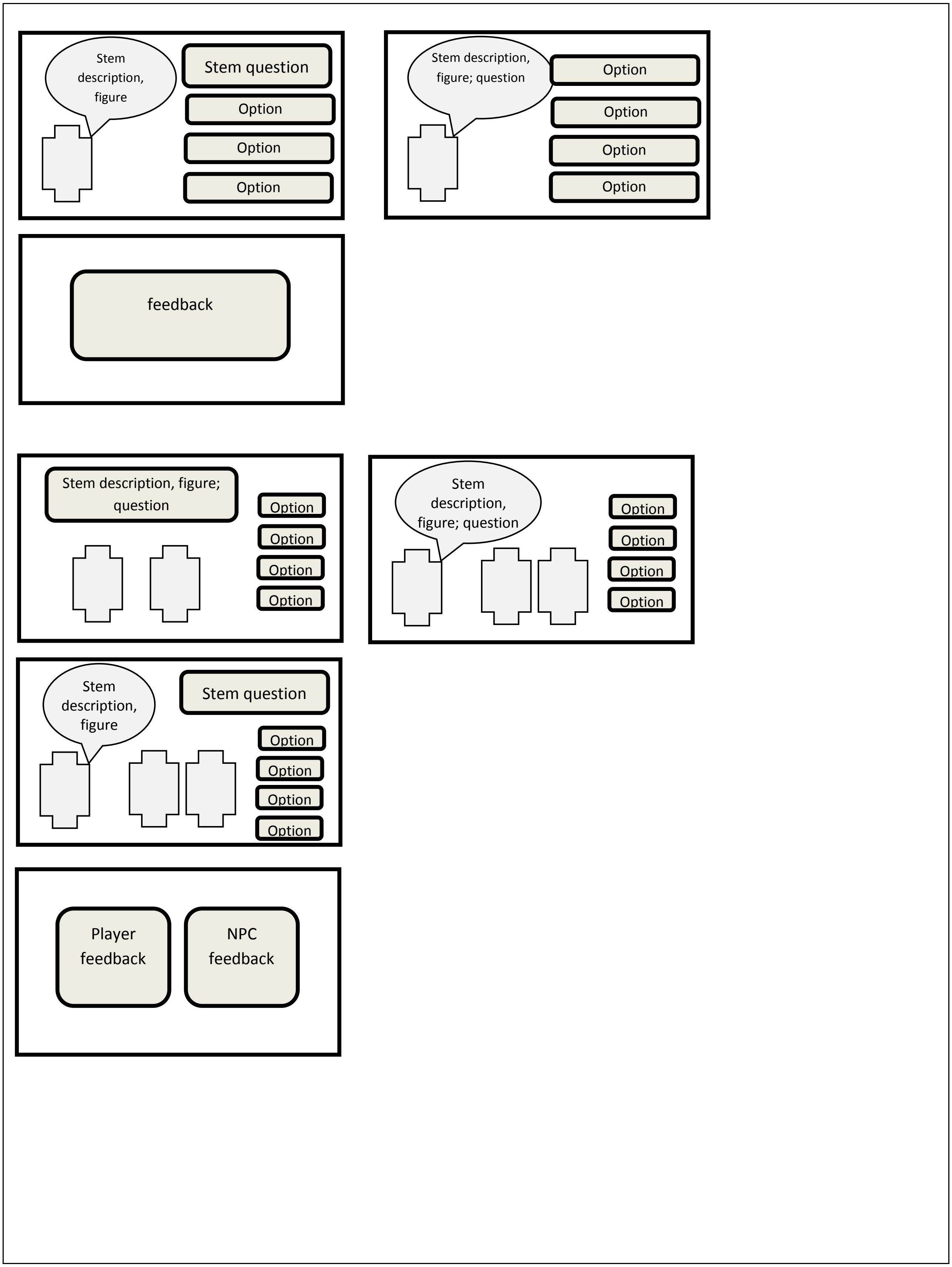
The sequencing of items is explicitly specified.
For example, at the end of item 1, the following can be specified:
    If condition 1, then proceed with item 2.
    If condition 2, then proceed with item 3.
    …
    If condition n, then proceed to item x.

Hints can be presented/hidden to/from the player upon request from the player or after a specified amount of time.

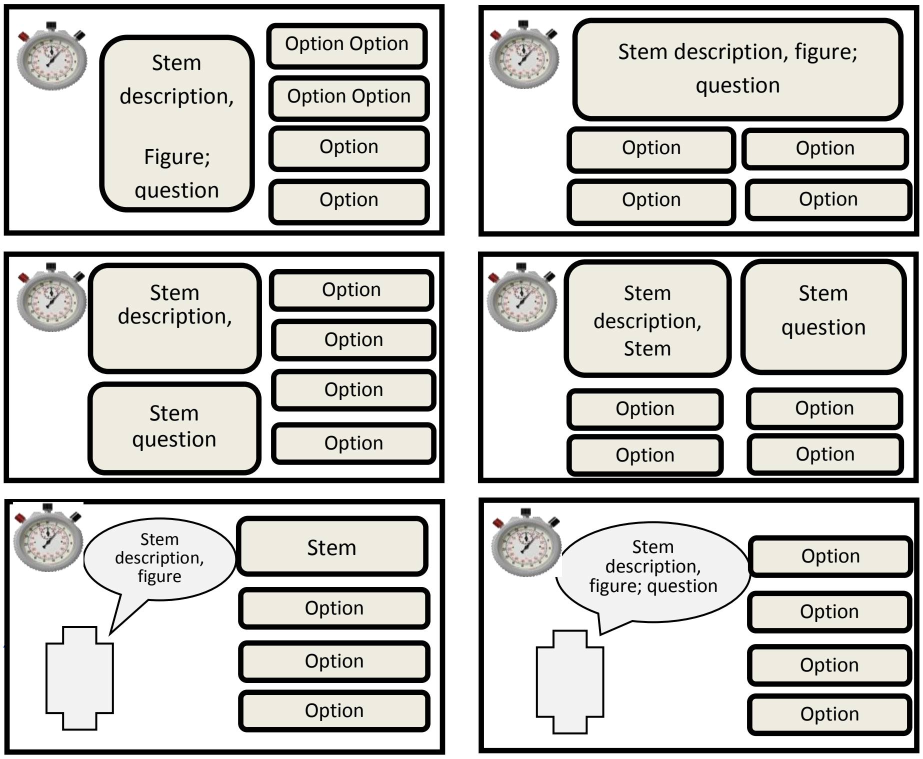
A multiple choice quiz has zero or more characters.

A multiple choice quiz is presented using a layout template. The layout templates are:
// non-competitive quizzes

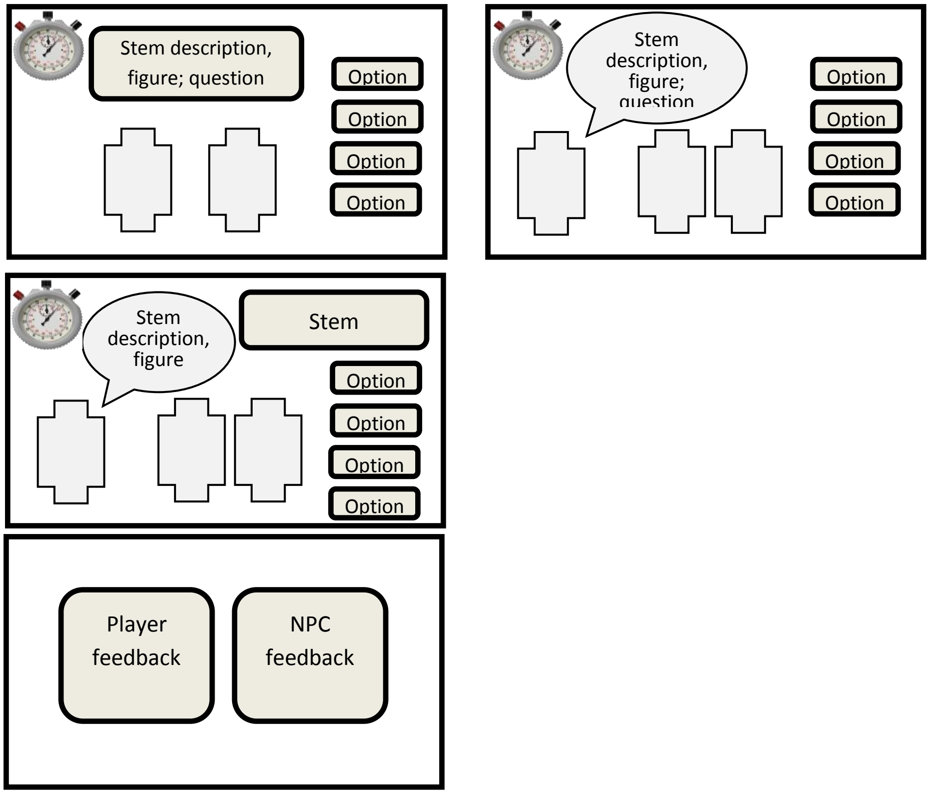



Stem description, figure
Stem question
Option
Option
Option
Stem description, figure; question
Option
Option
Option
Option
feedback
Stem description, figure; question
Option
Option
Option
Option
Stem description, figure; question
Option
Option
Option
Option
Stem description, figure
Stem question
Option
Option
Option
Option
Player feedback
NPC feedback

// timed, multiple choice quizzes



// Timed, competitive, multiple choice quizzes



A game element (character, prop) can be animated.

Animations are SLOW, MEDIUM, and FAST.

Animation movements:
- walk
- glide
- sit down
- stand up
- talk
- hand wave
- hand shake
- dance

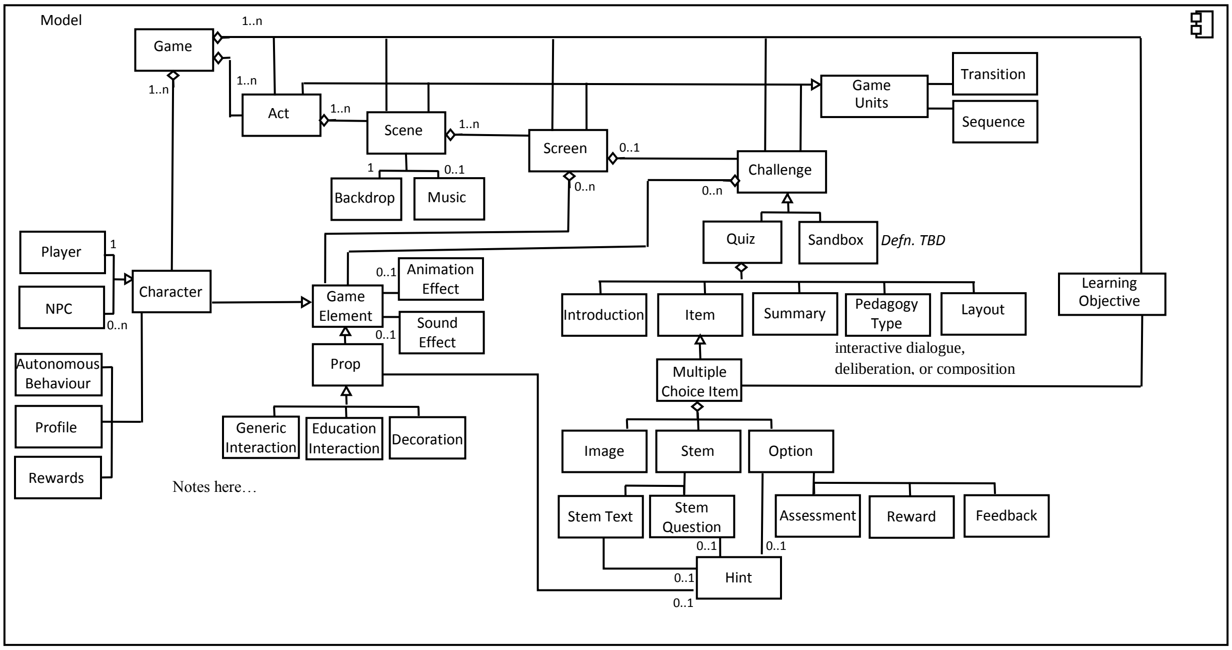
animation effects:
- fade in
- fade out
- twinkle
- shimmer

A game element has zero or one sound effects.

3. Semi-Formal SimSYS Game Specification

Xxxx

UML [reference]



4. Formal SimSYS Game Specification

xxx

Represented in XSD [reference]

Tool used: Eclipse [reference]

Table 1. SimSYS Formal Game Specification (XSD)

```
<?xml version="1.0" encoding="UTF-8"?>
<schema xmlns="http://www.w3.org/2001/XMLSchema" xmlns:tns="http://www.example.org/GameSchema/"
targetNamespace="http://www.example.org/GameSchema/">
   <element name="GameElement" type="tns:GameElementType" abstract="true"></element>


   <complexType name="GameElementType">
            <sequence>
                        <element name="AnimationEffect" type="string" maxOccurs="1"
                                    minOccurs="0">
                        </element>
                        <element name="SoundEffect" type="string" maxOccurs="1"
```

```
              minOccurs="0">
          </element>


      </sequence>
  </complexType>

  <complexType name="Prop">
      <complexContent>
          <extension base="tns:GameElementType">
              <sequence>
                  <element name="Hint" type="tns:HintType"></element>
              </sequence>
          </extension>
      </complexContent>
  </complexType>

  <complexType name="GenericInteraction">
      <complexContent>
          <extension base="tns:Prop"></extension>
      </complexContent>
  </complexType>

  <complexType name="EducationInteraction">
      <complexContent>
          <extension base="tns:Prop"></extension>
      </complexContent>
  </complexType>


  <element name="Game" type="tns:GameType"></element>

  <complexType name="GameType">
      <sequence>
          <element name="Act" type="tns:ActType" maxOccurs="unbounded"
              minOccurs="1">
          </element>
          <element name="LearningObjective"
              type="tns:LearningObjectiveType" maxOccurs="unbounded"
              minOccurs="1">
          </element>


          <element name="Character" type="tns:Character" maxOccurs="unbounded" minOccurs="1"></element>
      </sequence>
  </complexType>

  <complexType name="ActType">
      <complexContent>
          <extension base="tns:GameUnitType">
              <sequence>
                  <element name="LearningObjective"
                      type="tns:LearningObjectiveType">
                  </element>
                  <element name="Scene" type="tns:SceneType" maxOccurs="unbounded"
minOccurs="1"></element>
              </sequence>
          </extension>
      </complexContent>
  </complexType>

  <complexType name="SceneType">
```

```
          <complexContent>
                  <extension base="tns:GameUnitType">
                          <sequence>
                                  <element name="LearningObjective"
                                          type="tns:LearningObjectiveType">
                                  </element>
                                  <element name="Screen" type="tns:ScreenType"
                                          maxOccurs="unbounded" minOccurs="1">
                                  </element>
                                  <element name="Backgroud" type="tns:BackgroundType" maxOccurs="1"
minOccurs="1"></element>
                                  <element name="Music" type="tns:MusicType" maxOccurs="1"
minOccurs="0"></element>
                          </sequence>
                  </extension>
          </complexContent>
  </complexType>

  <complexType name="ScreenType">
          <complexContent>
                  <extension base="tns:GameUnitType">
                          <sequence>
                                  <element name="LearningObjective"
                                          type="tns:LearningObjectiveType">
                                  </element>

                                  <element name="Challenge" type="tns:ChallengeType"
                                          maxOccurs="unbounded" minOccurs="0">
                                  </element>
                                  <element name="GameElement" type="tns:GameElementType"
maxOccurs="unbounded" minOccurs="0"></element>
                          </sequence>
                  </extension>
          </complexContent>
  </complexType>

  <complexType name="ChallengeType">
          <complexContent>
                  <extension base="tns:GameUnitType">
                          <sequence>
                                  <element name="LearningObjective"
                                          type="tns:LearningObjectiveType">
                                  </element>
                                  <element name="GameElement" type="tns:GameElementType"
maxOccurs="unbounded" minOccurs="0"></element>
                          </sequence>
                  </extension>
          </complexContent>
  </complexType>

  <complexType name="Quiz">
          <complexContent>
                  <extension base="tns:ChallengeType"></extension>
          </complexContent>
  </complexType>

  <complexType name="SandBox">
          <complexContent>
                  <extension base="tns:ChallengeType"></extension>
          </complexContent>
  </complexType>
```

```
<complexType name="Introduction">
    <complexContent>
        <extension base="tns:Quiz"></extension>
    </complexContent>
</complexType>

<complexType name="Item">
    <complexContent>
        <extension base="tns:Quiz"></extension>
    </complexContent>
</complexType>

<complexType name="Summary">
    <complexContent>
        <extension base="tns:Quiz"></extension>
    </complexContent>
</complexType>

<complexType name="PedagogyType">
    <complexContent>
        <extension base="tns:Quiz"></extension>
    </complexContent>
</complexType>

<complexType name="Layout">
    <complexContent>
        <extension base="tns:Quiz"></extension>
    </complexContent>
</complexType>

<complexType name="MultipleChoiceItem">
    <complexContent>
        <extension base="tns:Item">
            <sequence>
                <element name="Image" type="tns:ImageType"></element>
                <element name="Stem" type="tns:StemType"></element>
                <element name="Option" type="tns:OptionType"></element>
                <element name="LearningObjective" type="tns:LearningObjectiveType"></element>
            </sequence>
        </extension>
    </complexContent>
</complexType>

<complexType name="ImageType"></complexType>

<complexType name="StemType">
    <sequence>
        <element name="StemText" type="tns:StemTextType"></element>
        <element name="StemQuestion" type="tns:StemQuestionType"></element>
    </sequence>
</complexType>

<complexType name="OptionType">
    <sequence>
        <element name="Assessment" type="string"></element>
        <element name="Reward" type="string"></element>
        <element name="Feedback" type="string"></element>
        <element name="Hint" type="tns:HintType" maxOccurs="1" minOccurs="0"></element>
    </sequence>
</complexType>

<complexType name="StemTextType">
```

```
          <sequence>
                    <element name="Hint" type="tns:HintType" maxOccurs="1" minOccurs="0"></element>
          </sequence>
   </complexType>

   <complexType name="StemQuestionType">
          <sequence>
                    <element name="Hint" type="tns:HintType" maxOccurs="1" minOccurs="0"></element>
          </sequence>
   </complexType>

   <complexType name="HintType"></complexType>

   <complexType name="LearningObjectiveType"></complexType>


   <complexType name="Player">
          <complexContent>
                    <extension base="tns:Character">
                              <sequence>

                                        <element name="PlayerID" type="ID" maxOccurs="1" minOccurs="1"></element>
                              </sequence>
                    </extension>
          </complexContent>
   </complexType>

   <complexType name="NonPlayer">
          <complexContent>
                    <extension base="tns:Character">
                              <sequence>
                                        <element name="NonPlayerID" type="ID" maxOccurs="unbounded"
minOccurs="0"></element>
                              </sequence>
                    </extension>
          </complexContent>
   </complexType>

   <element name="GameUnits" type="tns:GameUnitType"></element>

   <complexType name="GameUnitType">
          <sequence>
                    <element name="Transition" type="string"></element>
                    <element name="Sequence" type="string"></element>
          </sequence>
   </complexType>

   <complexType name="Character">
          <complexContent>
                    <extension base="tns:GameElementType">
                              <sequence>
                                        <element name="AutonomousBehaviour" type="string"></element>
                                        <element name="Profile" type="string"></element>
                                        <element name="Rewards" type="string"></element>
                              </sequence>
                    </extension>
          </complexContent>
   </complexType>



   <attribute name="NewAttribute" type="string"></attribute>

   <complexType name="BackgroundType"></complexType>

   <complexType name="MusicType"></complexType>
</schema>
```

5. Mapping the Informal, Semi-formal, and Formal Specifications

Xxx

Ensure the xsd is complete and correct with respect to the informal and semi-formal representations.

6. SimSYS Game Example (XML)

xxx

Tools used : Liqquid XML Studio 2014 [reference] and Eclipse [reference]

Describe what is generated below (fake game)

Ensure a complete game is included in the table

Table 2 SimSYS Game XML Example

```
<?xml version="1.0" encoding="UTF-8"?>
<tns:Game xmlns:tns="http://www.example.org/GameSchema/" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.example.org/GameSchema/ GameSchema.xsd ">
  <Act>
    <Transition>Transition</Transition>
    <Sequence>Sequence</Sequence>
    <LearningObjective/>
    <Scene>
      <Transition>Transition</Transition>
      <Sequence>Sequence</Sequence>
      <LearningObjective/>
      <Screen>
        <Transition>Transition</Transition>
        <Sequence>Sequence</Sequence>
        <LearningObjective/>
      </Screen>
      <Backgroud/>
    </Scene>
  </Act>
  <LearningObjective/>
  <Character>
    <AutonomousBehaviour>AutonomousBehaviour</AutonomousBehaviour>
    <Profile>Profile</Profile>
    <Rewards>Rewards</Rewards>
  </Character>
</tns:Game>
```

Tool Used: http://devutilsonline.com/xsd-xml/generate-xml-from-xsd
Root Element: Game

```
<?xml version="1.0"?>
<gam:Game xmlns:gam="http://www.example.org/GameSchema/">
  <!--1 or more repetitions:-->
  <Act>
    <Transition>string</Transition>
    <Sequence>string</Sequence>
    <LearningObjective/>
    <!--1 or more repetitions:-->
    <Scene>
      <Transition>string</Transition>
      <Sequence>string</Sequence>
      <LearningObjective/>
      <!--1 or more repetitions:-->
      <Screen>
        <Transition>string</Transition>
        <Sequence>string</Sequence>
        <LearningObjective/>
        <!--Zero or more repetitions:-->
        <Challenge>
```

```
          <Transition>string</Transition>
          <Sequence>string</Sequence>
          <LearningObjective/>
          <!--Zero or more repetitions:-->
          <GameElement>
            <!--Optional:-->
            <AnimationEffect>string</AnimationEffect>
            <!--Optional:-->
            <SoundEffect>string</SoundEffect>
          </GameElement>
        </Challenge>
        <!--Zero or more repetitions:-->
        <GameElement>
          <!--Optional:-->
          <AnimationEffect>string</AnimationEffect>
          <!--Optional:-->
          <SoundEffect>string</SoundEffect>
        </GameElement>
      </Screen>
      <Backgroud/>
      <!--Optional:-->
      <Music/>
    </Scene>
  </Act>
  <!--1 or more repetitions:-->
  <LearningObjective/>
  <!--1 or more repetitions:-->
  <Character>
    <!--Optional:-->
    <AnimationEffect>string</AnimationEffect>
    <!--Optional:-->
    <SoundEffect>string</SoundEffect>
    <AutonomousBehaviour>string</AutonomousBehaviour>
    <Profile>string</Profile>
    <Rewards>string</Rewards>
  </Character>
</gam:Game>
```

Root Element: GameElement

```
<?xml version="1.0"?>
<gam:GameElement xmlns:gam="http://www.example.org/GameSchema/">
  <!--Optional:-->
  <AnimationEffect>string</AnimationEffect>
  <!--Optional:-->
  <SoundEffect>string</SoundEffect>
</gam:GameElement>
```

Root Element: GameUnits

```
<?xml version="1.0"?>
<gam:GameUnits xmlns:gam="http://www.example.org/GameSchema/">
  <Transition>string</Transition>
  <Sequence>string</Sequence>
</gam:GameUnits>
```

7. Application of the SimSYS Game Specification

Java code, screenshots

8. Conclusions and Future Work

References

Eclipse

Liqquid XML Studio 2014

XSD

XML

OMG UML

Jaxb Library

IEEE CGAMES 2012 Cooper…

IEEE CGAMES 2012 Longstreet…