Tutorial

Story Driven Modeling – A Practical Guide to Model Driven Software Development

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Overview

Story Driven Modeling:

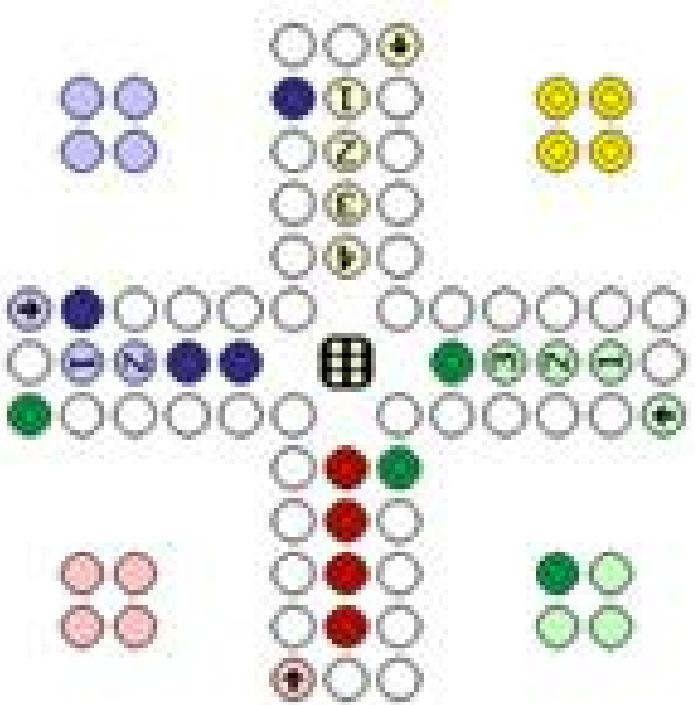
Steps:

- Textual use case description
- Story Boarding (OOA)
  (Test specification)
- Class diagram derivation (OOD)
- Behavior derivation (Coding)
- Code generation
- Validation (Testing)

Features:

- Use Case Driven
- Model Driven
- Iterative
- Test Driven Development

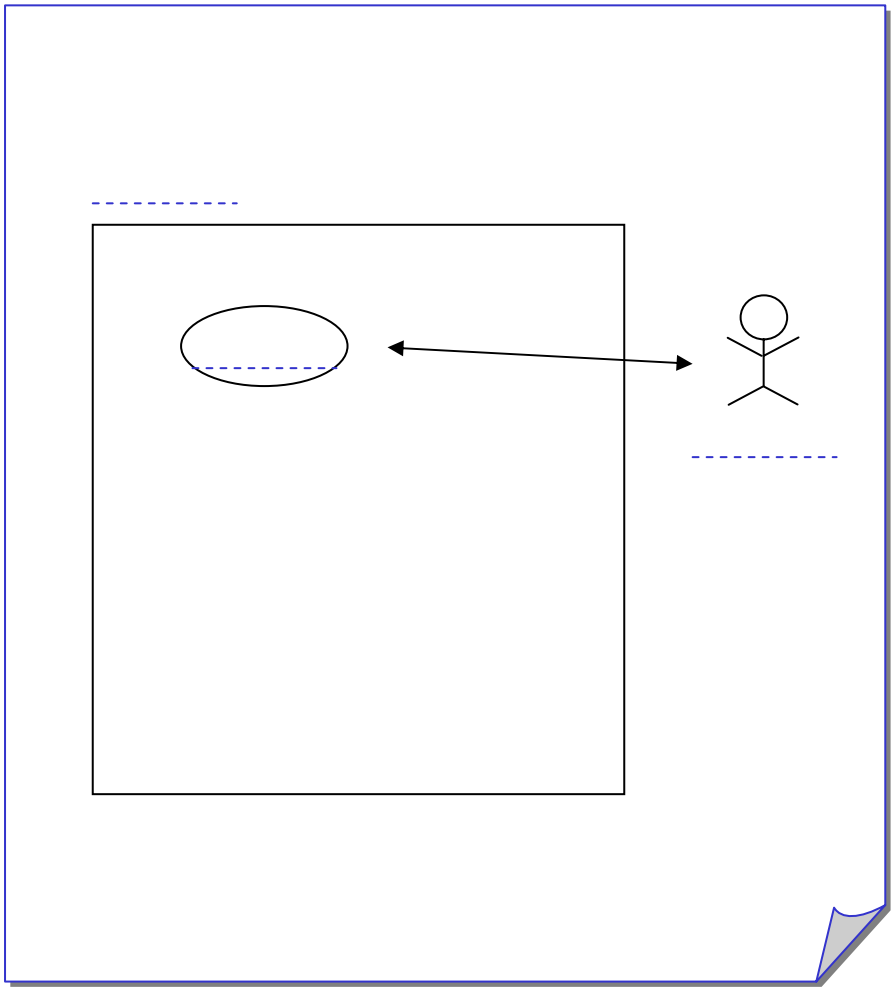
2. The running example: Ludo



3. Use case description

Requirements elicitation as usual:

- Use case diagrams for overview



3. Use case description (cont.)

Textual scenario descriptions:

- focus on scenarios
- several scenarios per use case
- focus on one example situation at a time
- use concrete names

Use case _ _ _ _ _ _ _, _ _ _ _ _ _ _ _ :

Start situation: _ _ _ _ _ _ _ _ _ _ _ _ _
_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Invocation: _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Step 1: _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Step 2: _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Result situation: _ _ _ _ _ _ _ _ _ _
_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

4. Object oriented analysis with story boards

Usual text book approach:

- analyse the text scenarios
- nouns become classes
- verbs become methods or associations
- ...

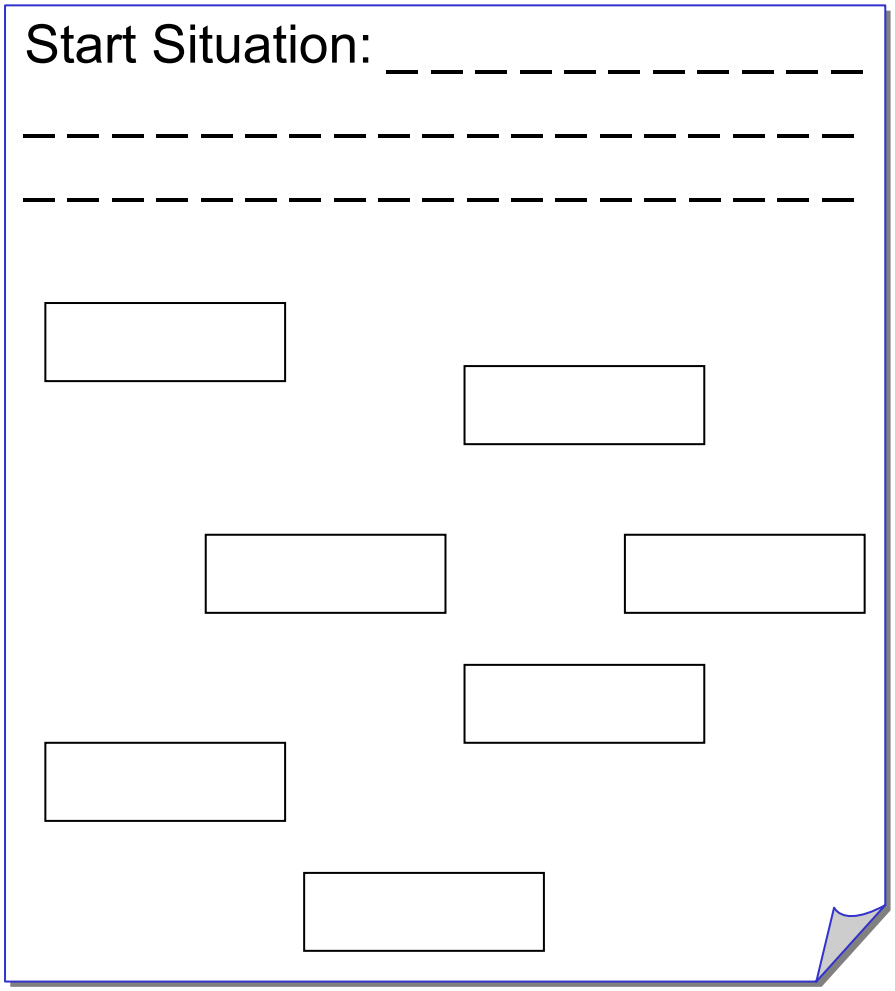
Our experience:

- this does not work !
- very high skills required
- fruitless discussion on details
- *class diagrams are not appropriate for the analysis and discussion of behavior*

4. Object oriented analysis with story boards (cont.)

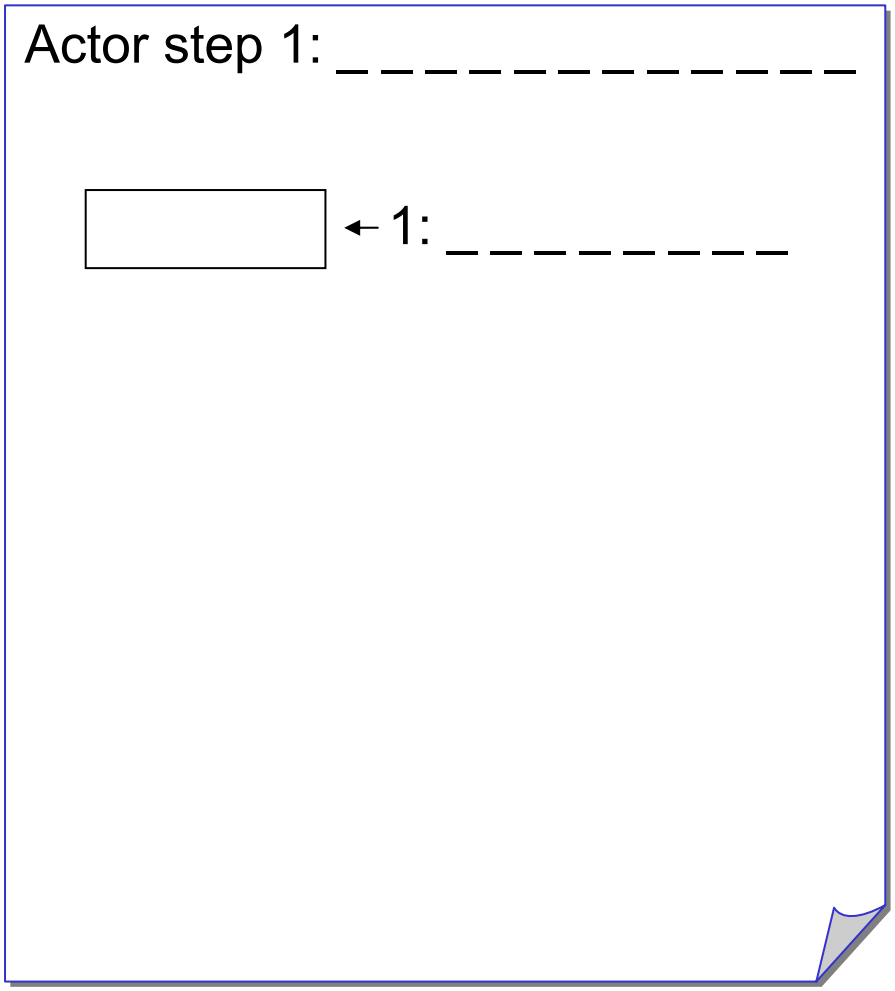
SDM approach:

- analyse the text scenarios
- nouns become *objects*
- verbs become *method invocations* or *links*
- ...



4. Object oriented analysis with story boards (cont.2)

- use case execution is modeled by one method invocation
- drawn as collaboration message
- multiple scenarios for one use case call the same method (but in different situations)
- this method implements the use case
- use case ←→ method mapping enables tracebility
- step descriptions may become implementation comments



4. Object oriented analysis with story boards (cont.3)

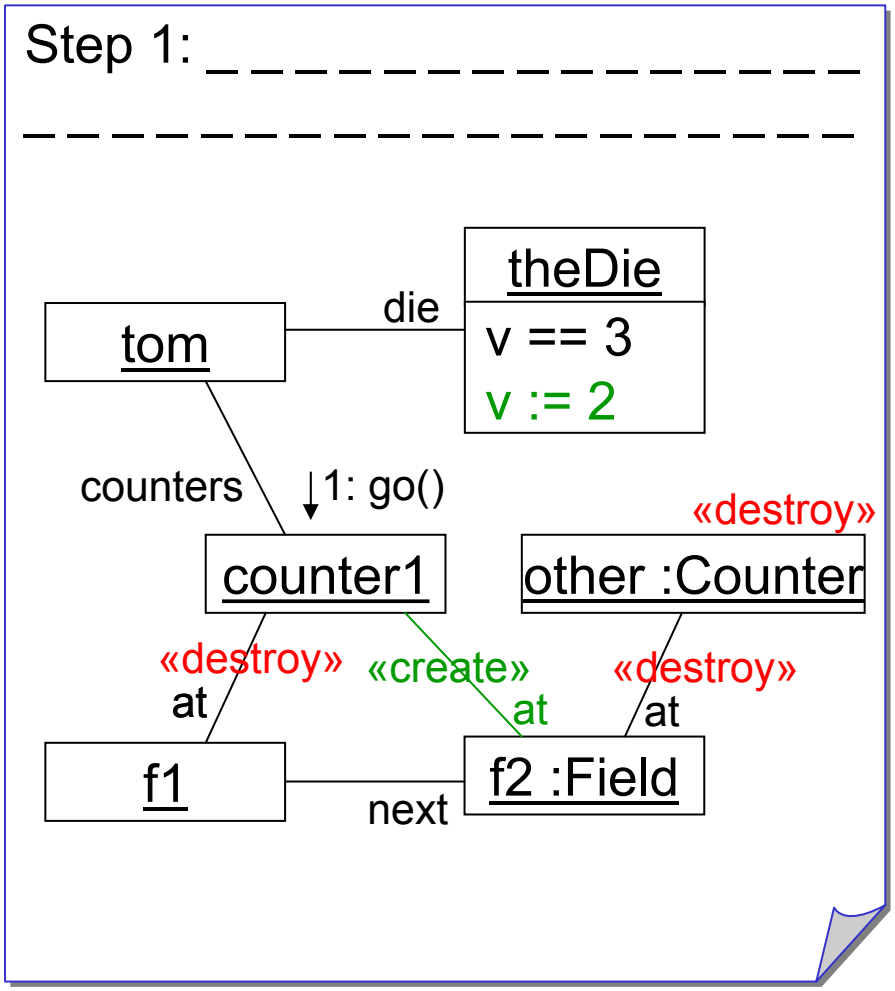
use case ←→ method mapping

- uc1 <<uses>> uc2 → method uc1() may call method uc2()
- uc1 <<includes>> uc2 → uc1() always calls uc2()
- uc2 <<extends>> uc1 → uc1() provides extension points / call backs. uc2() may subscribe for such a call back

4. Object oriented analysis with story boards (cont.4)

Outlining method behavior in concrete example situations:

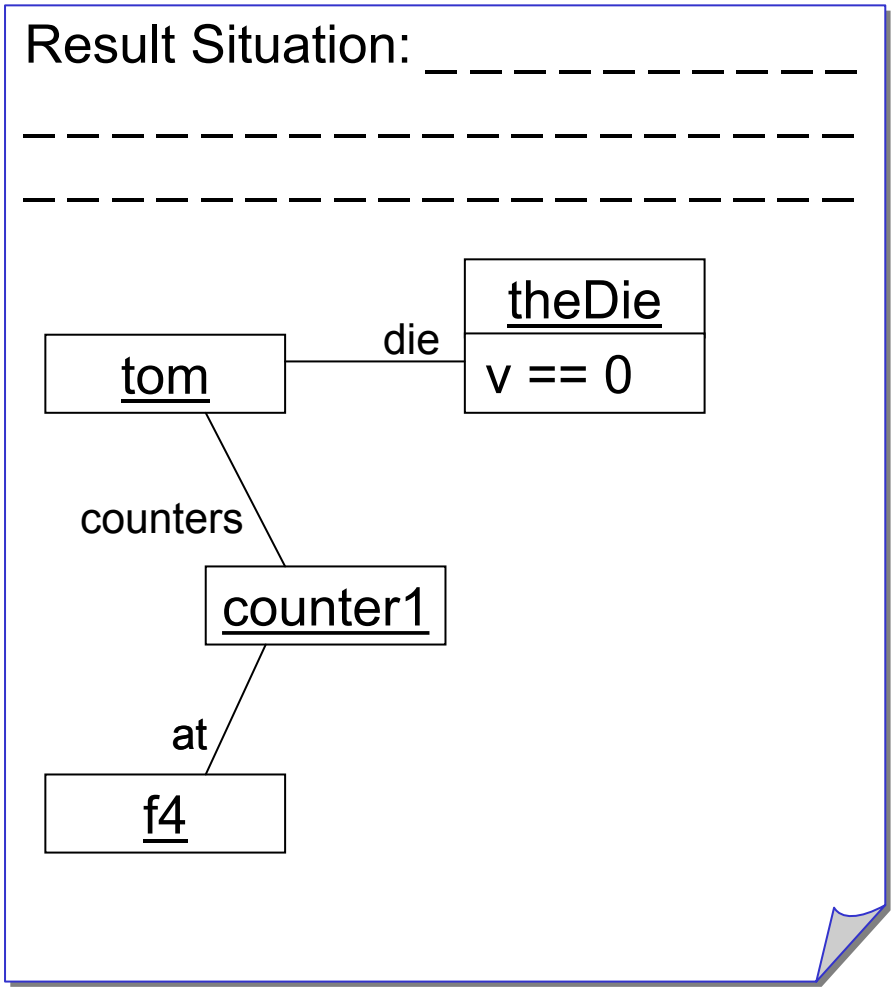
- <<create>> and <<destroy>> markers
- := attribute assignments
- recurring objects without class name
  first time on stage with class name
  (change of perspective)
- collaboration messages
- alternatively sequence diagrams



4. Object oriented analysis with story boards (cont.5)

Result situation:

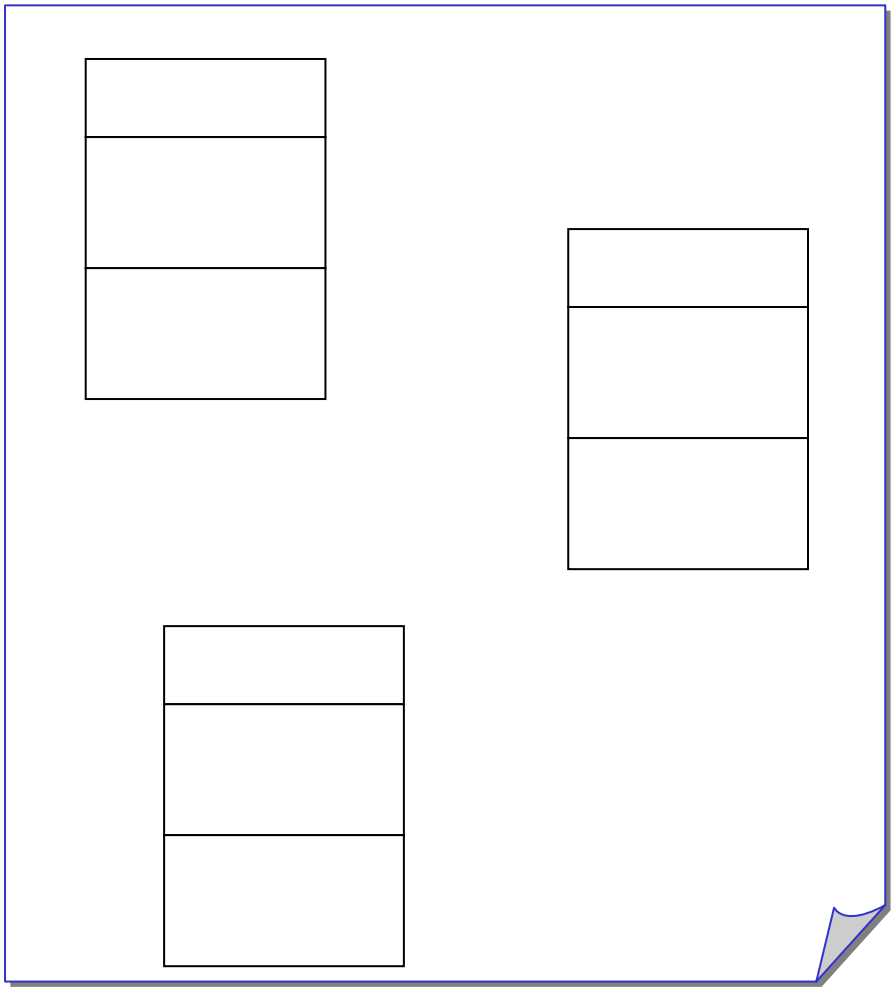
- models resulting object structure
- used for testing



6a Derivation of Class Diagrams

Collect the types from the story boards:

- Classes
- Associations
- Attribute declarations
- Method declarations



6a Derivation of Class Diagrams (cont.)

- Class diagram derivation is straight forward
- Semi-automatic tool support by Fujaba
- Intermediate story board step results in much better domain level class diagrams
- code generation for class diagrams
- *story boards are appropriate for the analysis and discussion of behavior*
- story boards also useful during refinement and coding
- story boards may serve as test specifications
- story boards may drive the implementation

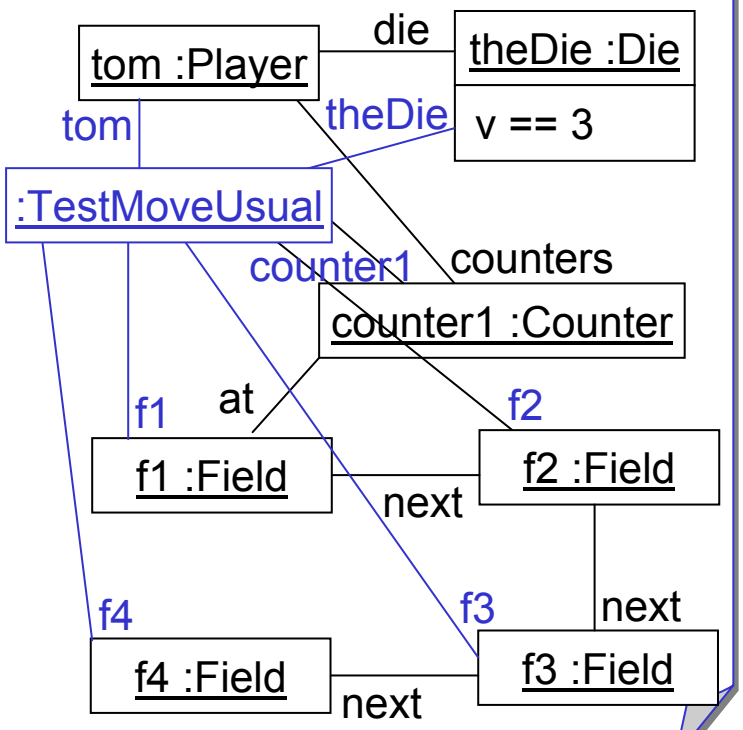
5. Test Derivation

- Scenarios → JUnit Tests
- start situation → setup code
- invocation → invocation
- result situation → code that checks object structure equivalence

5. Test Derivation (cont.)

- Scenarios → JUnit Tests, start situation → setup code

Start Situation: Tom rolled a 3 and selects counter 1 for moving

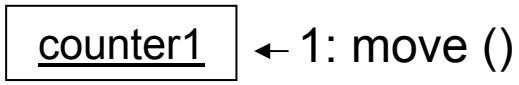



```
class TestMoveUsual implements TestCase {
    private Player tom;
    private Die theDie;
    private Counter counter1;
    ...
    void setUp () {
        tom = new Player ();
        theDie = new Die ();

        theDie.setV (3)

        tom.setDie (theDie);

        counter1 = new Counter ();
        tom.addToCounters (counter1);
        . . .
```

5. Test Derivation (cont.2)

- Scenarios → JUnit Tests, start situation → setup code

Invocation: counter 1 is moved

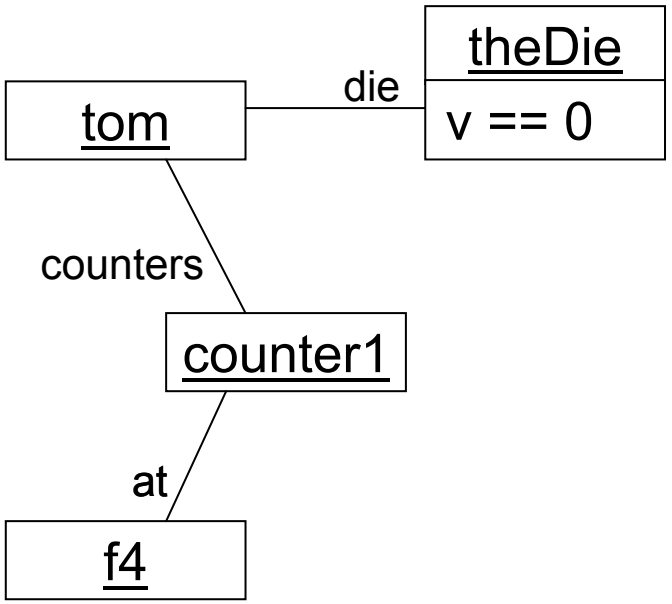



```
class TestMoveUsual implements TestCase
{
    . . .
    void testMoveUsual ()
    {
        this.counter1.move();
        . . .
```

5. Test Derivation (cont.3)

- Scenarios → JUnit Tests, start situation → setup code

Result Situation: the die is counted down to zero and counter 1 reached field 4




```
class TestMoveUsual implements TestCase {
void testMoveUsual ()
{
    this.counter1.move();
    assertTrue (tom.getDie() == theDie);
    assertTrue (theDie.getV() == 0);
    assertTrue (counter1.getPlayer () == tom);
    assertTrue (counter.getAt () == f4);
}
```

5. Test Derivation (cont.4)

- more complex result situations work, too (see later)
- start situation, invocation, result situation → JUnit tests
- steps may be exploited, too, cf. [SCESM05]
- analysis scenarios ←→ tests
- test driven software development

6b Derivation of the Implementation

- Dobs + BeanShell + Coding

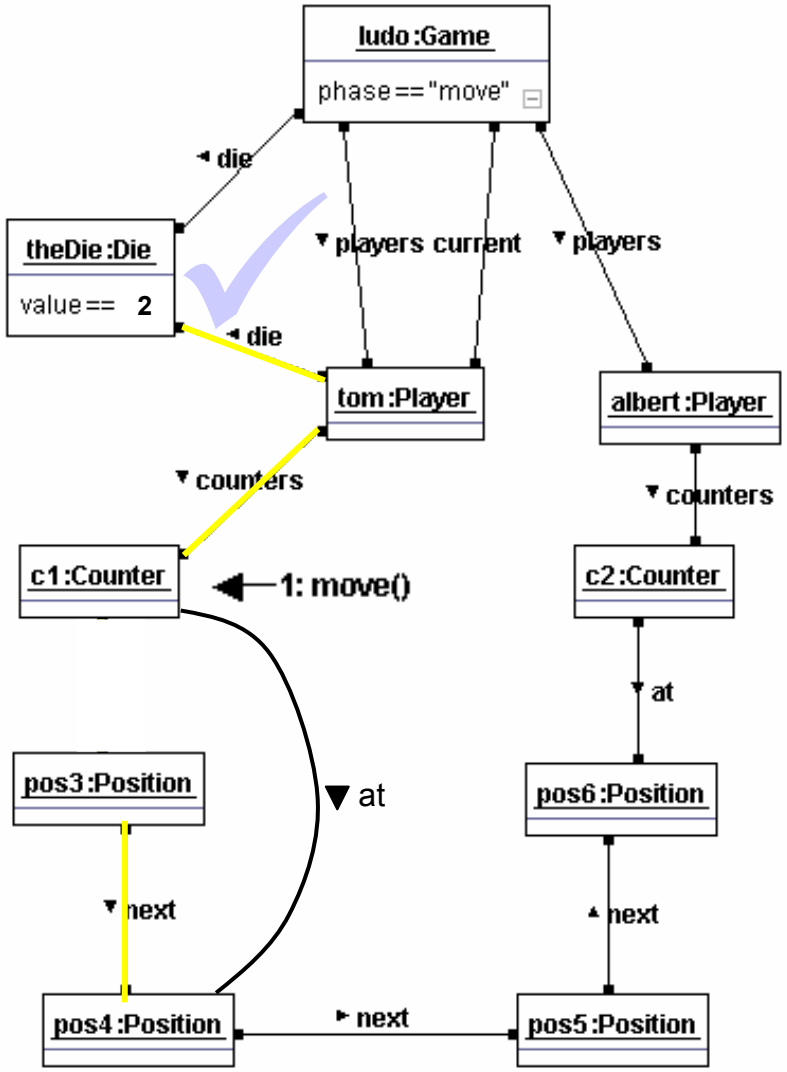
Tool Demo

or

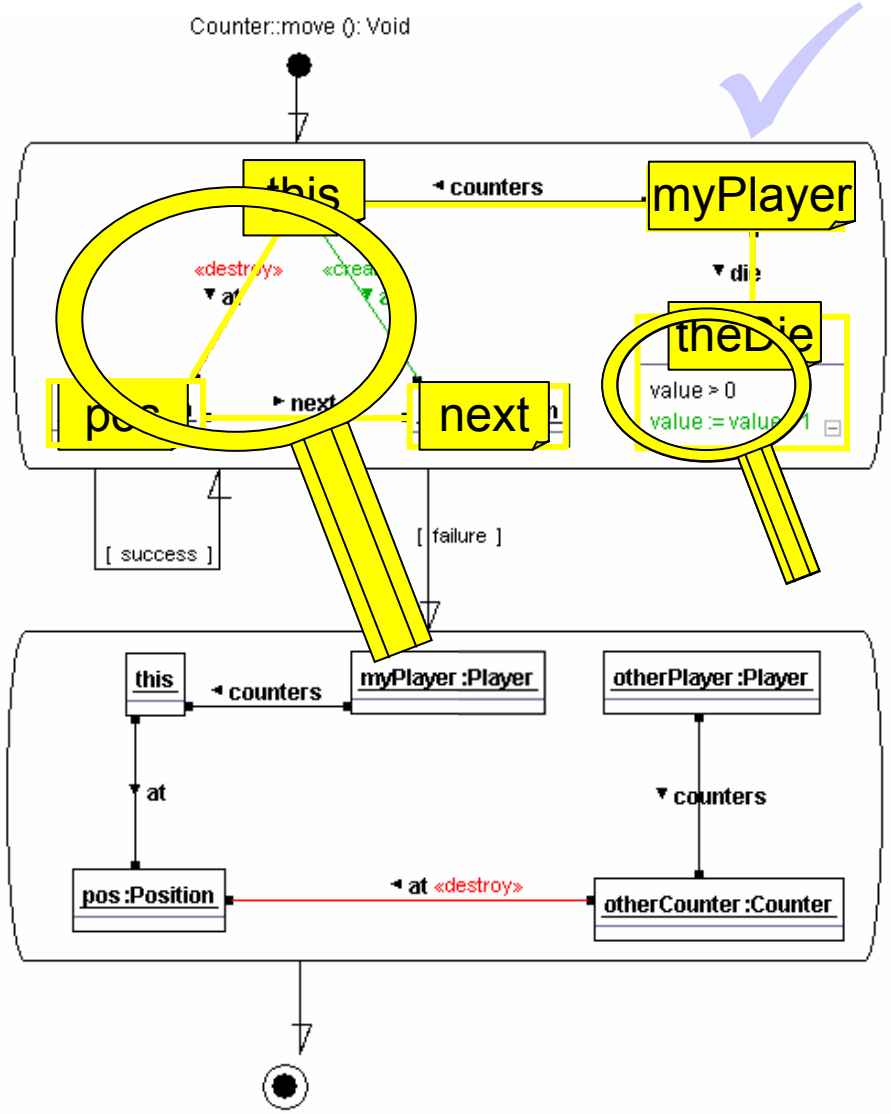
- combine story boards to rule diagrams [SCESM04]
- assign execution semantics
- code generation

6b Derivation of the Implementation (cont.)

Main Memory Objects

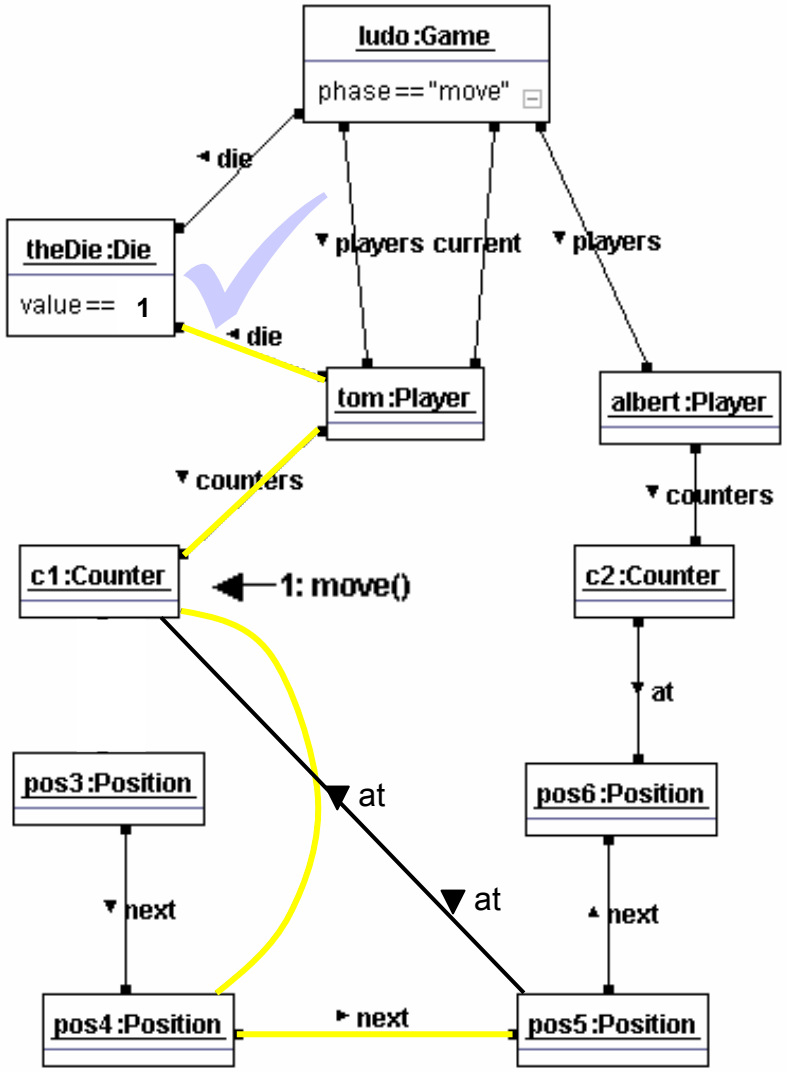


Rule Diagram / Program

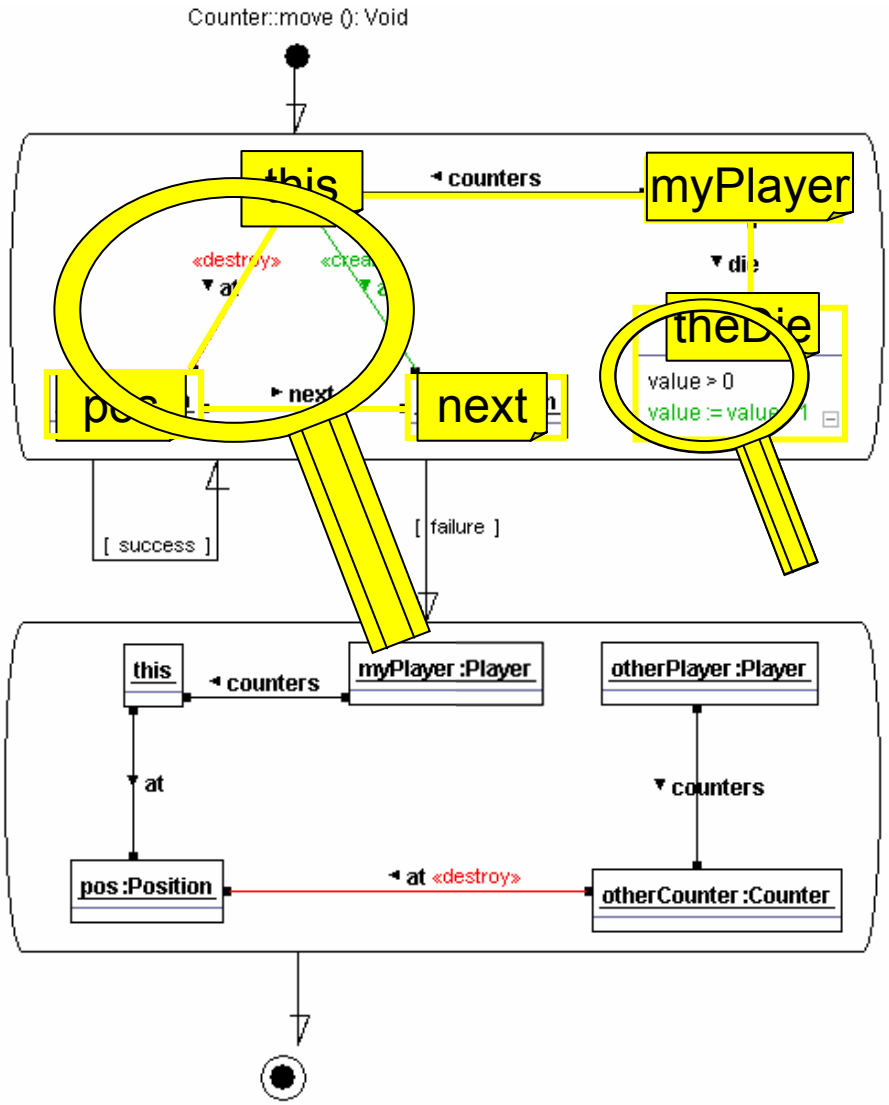


6b Derivation of the Implementation (cont.2)

Main Memory Objects

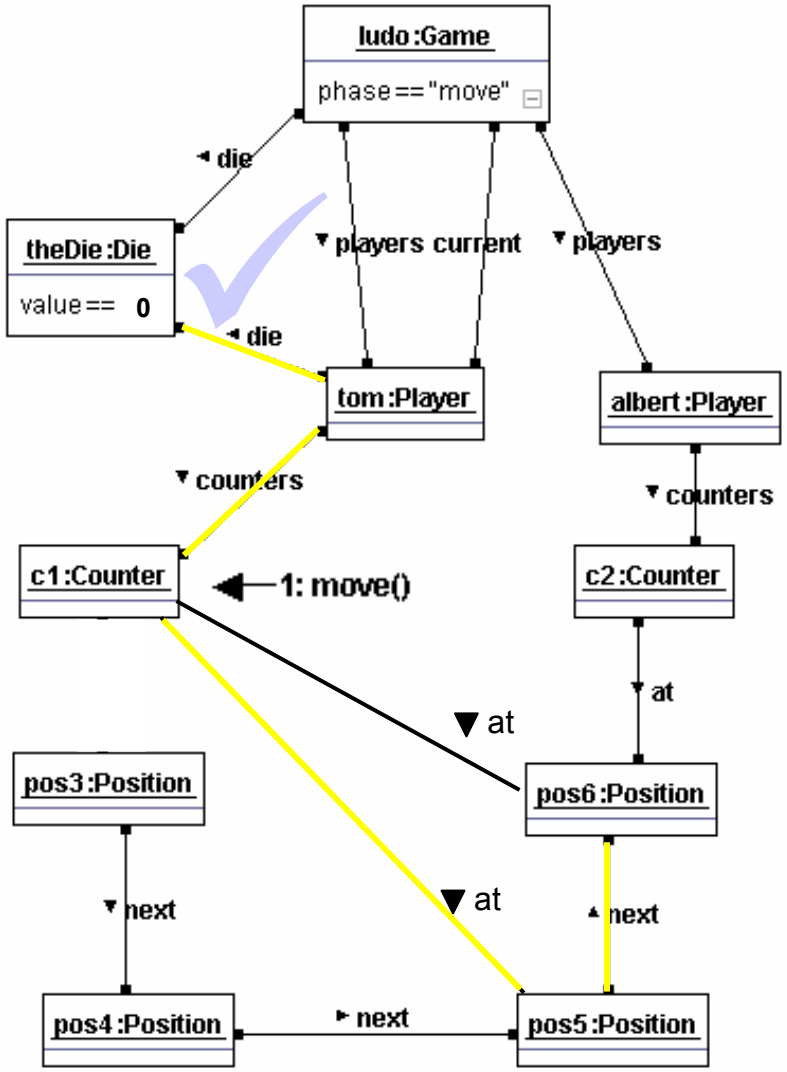


Rule Diagram / Program

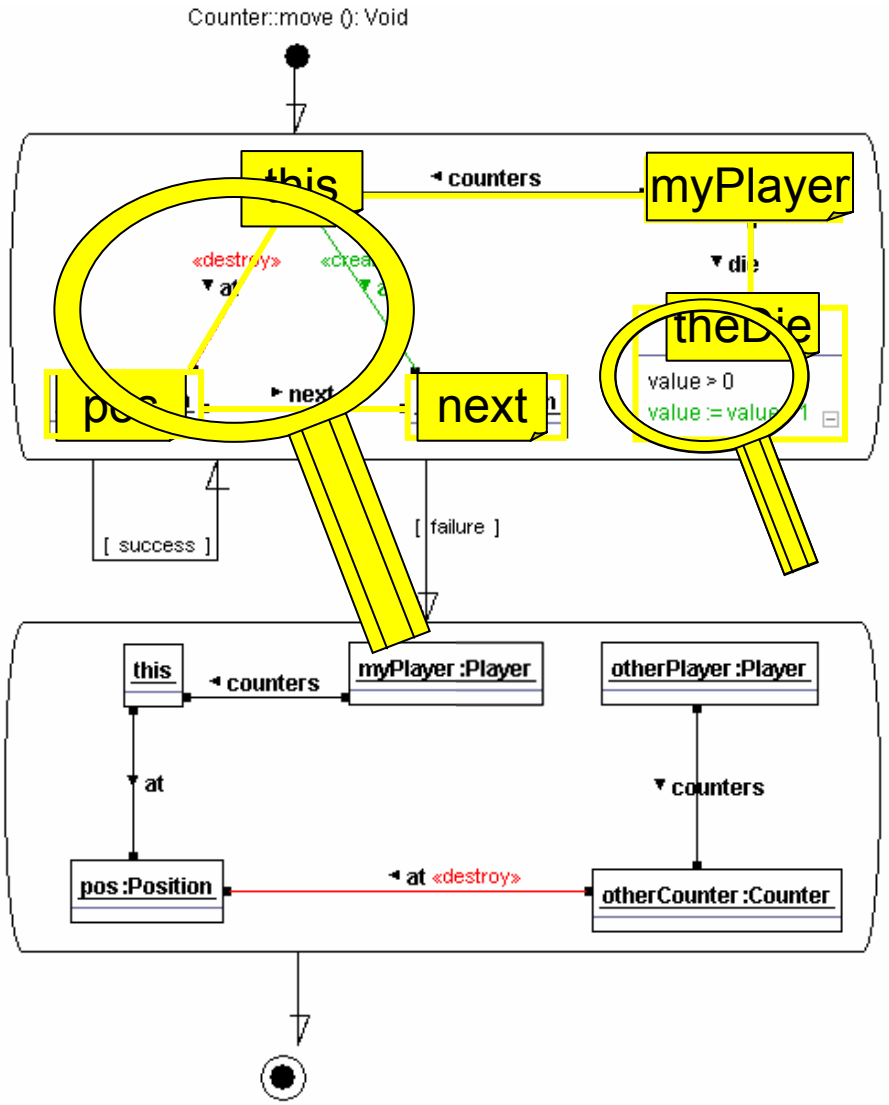


6b Derivation of the Implementation (cont.3)

Main Memory Objects

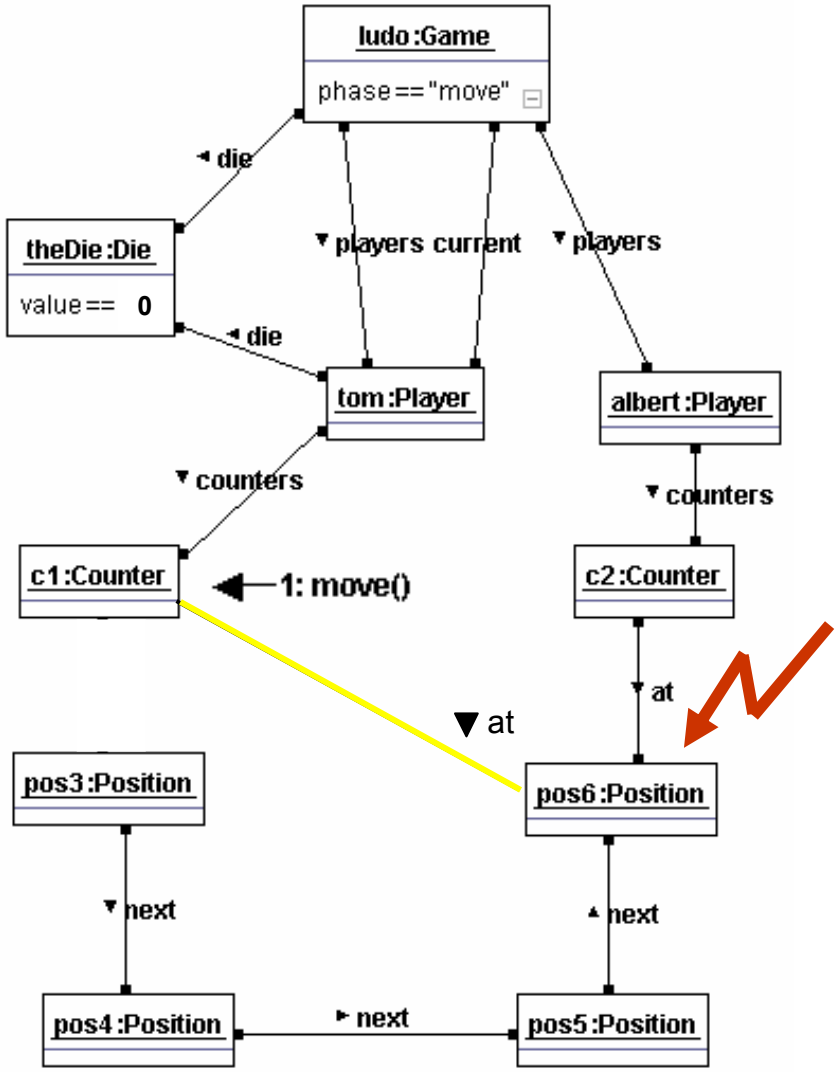


Rule Diagram / Program

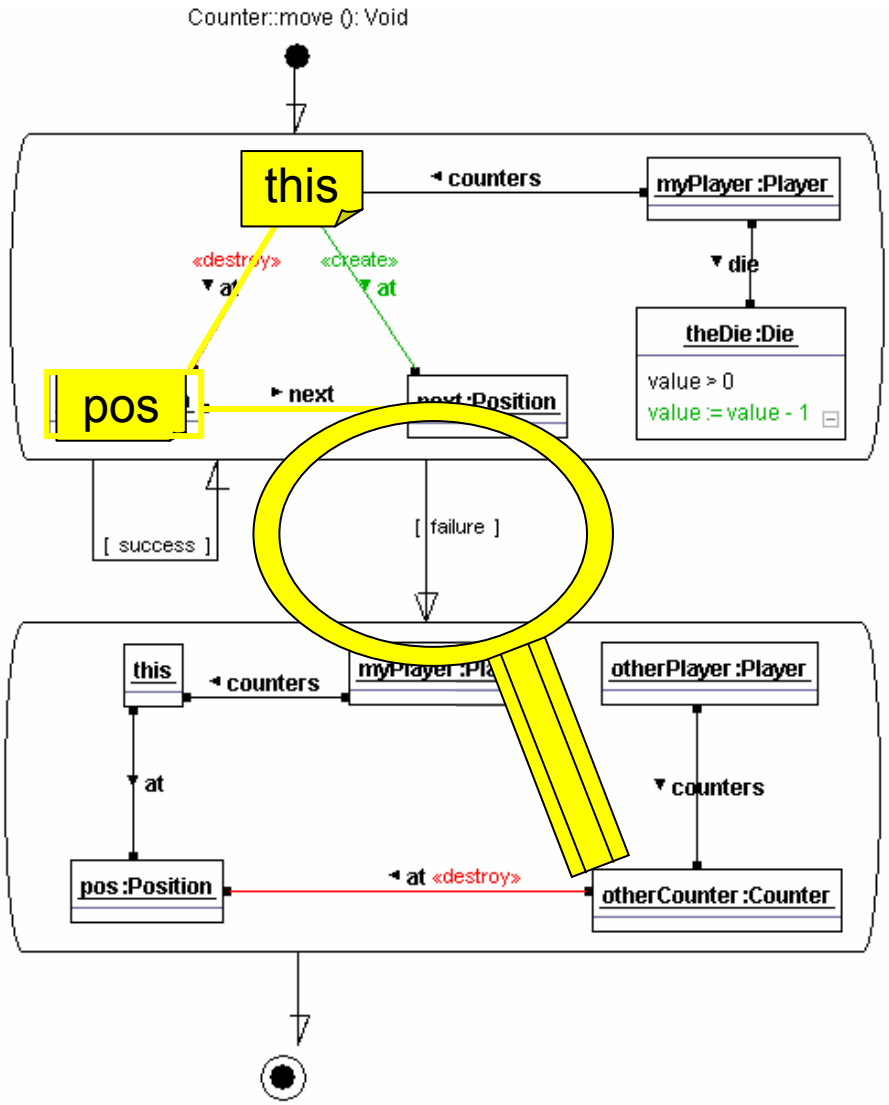


6b Derivation of the Implementation (cont.4)

Main Memory Objects

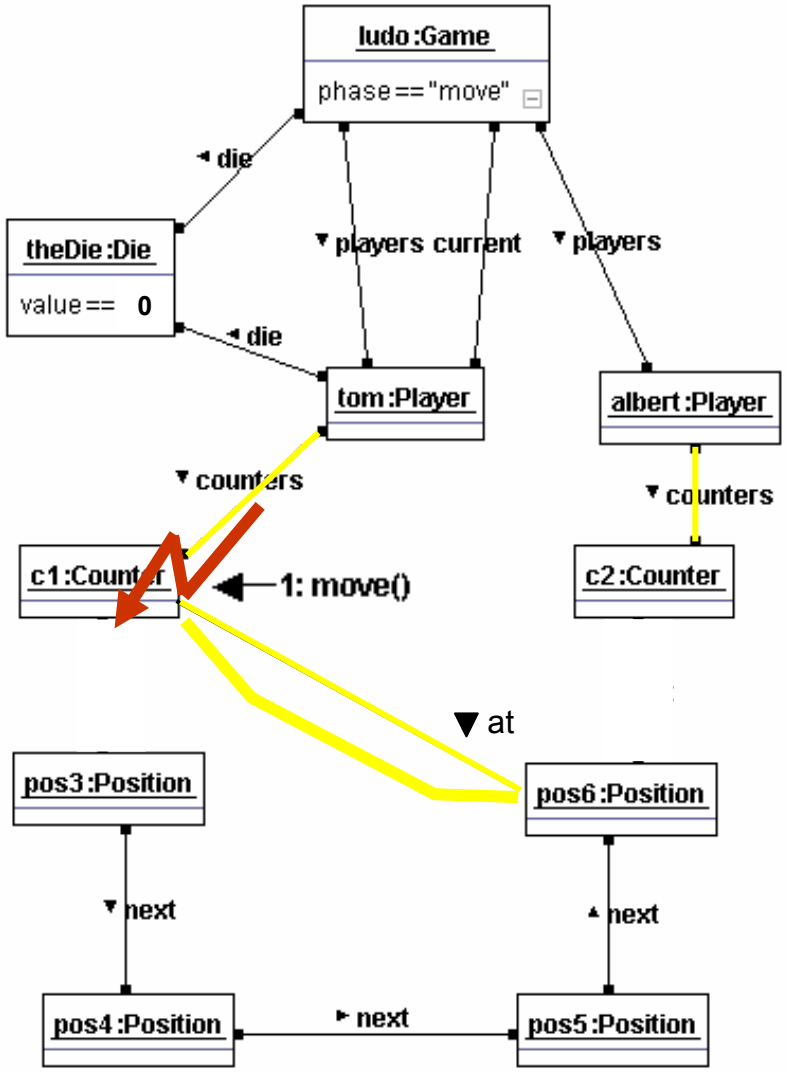


Rule Diagram / Program

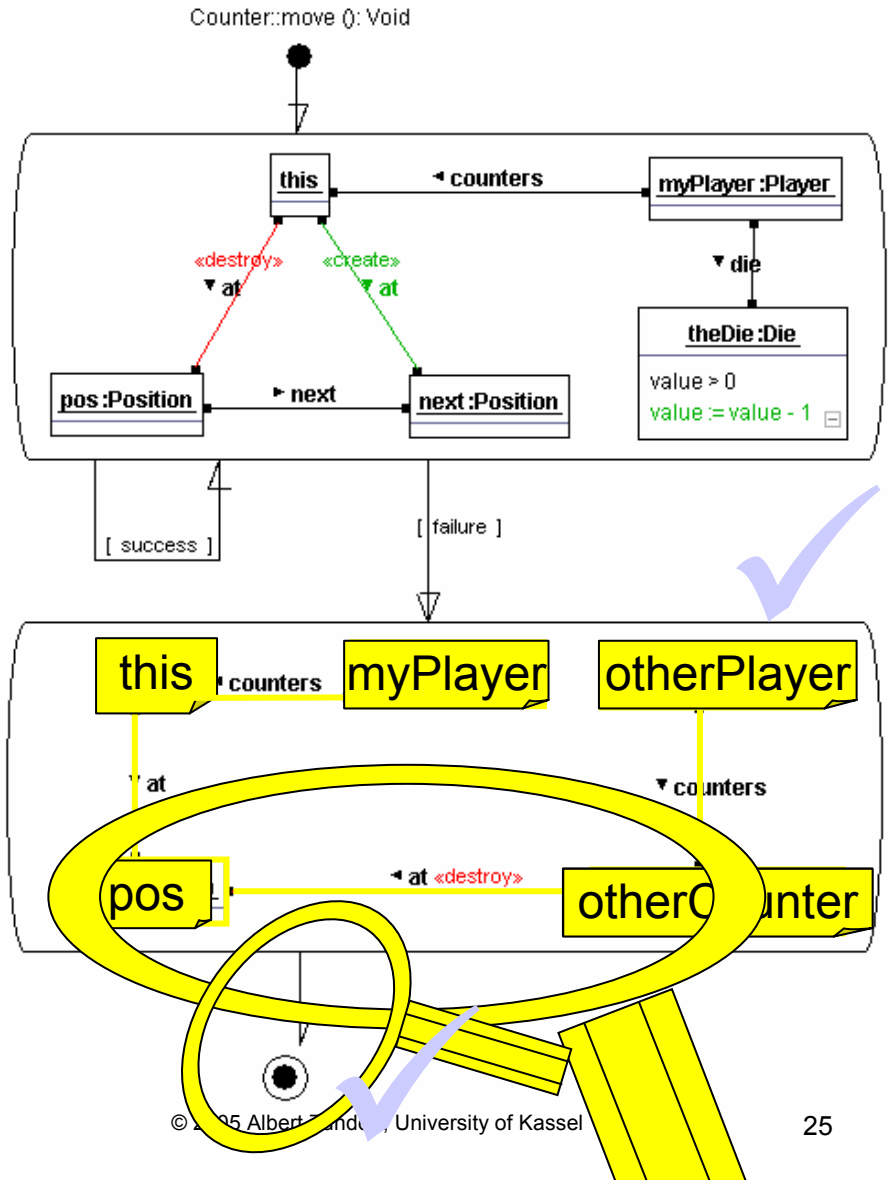


6b Derivation of the Implementation (cont.5)

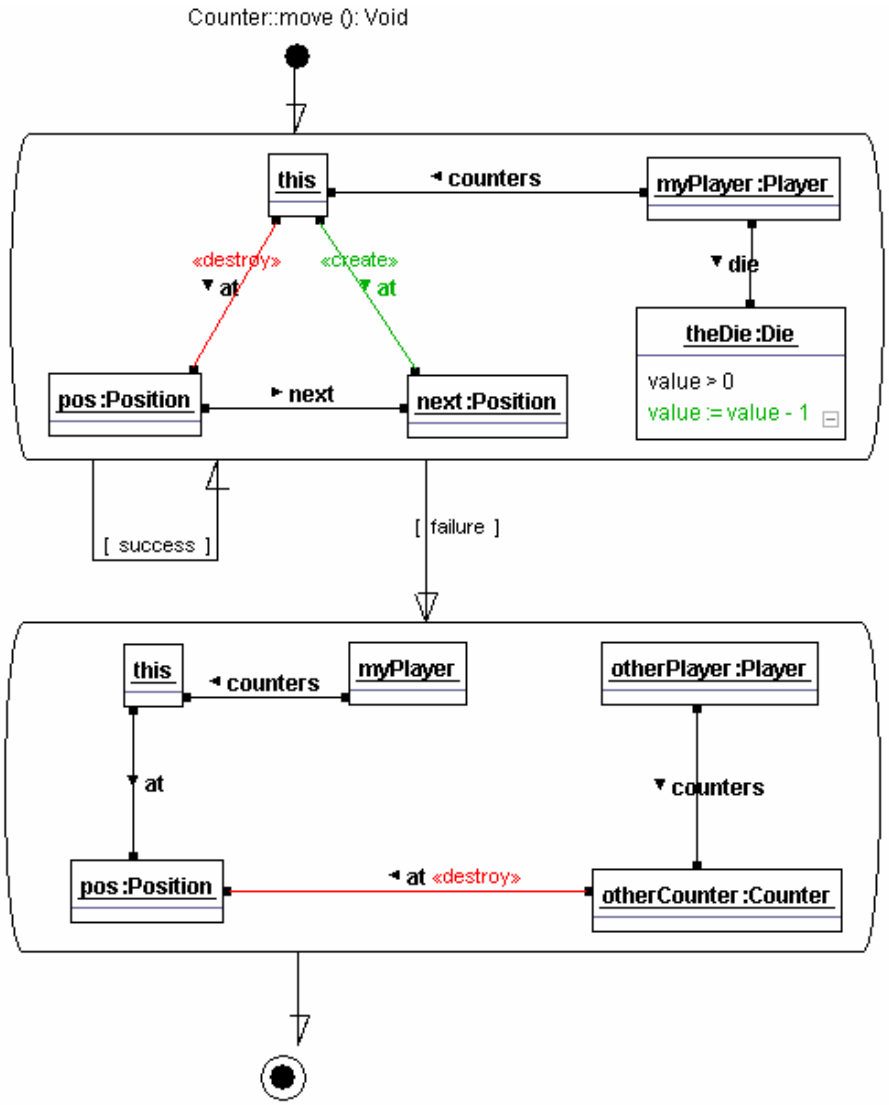
Main Memory Objects



Rule Diagram / Program

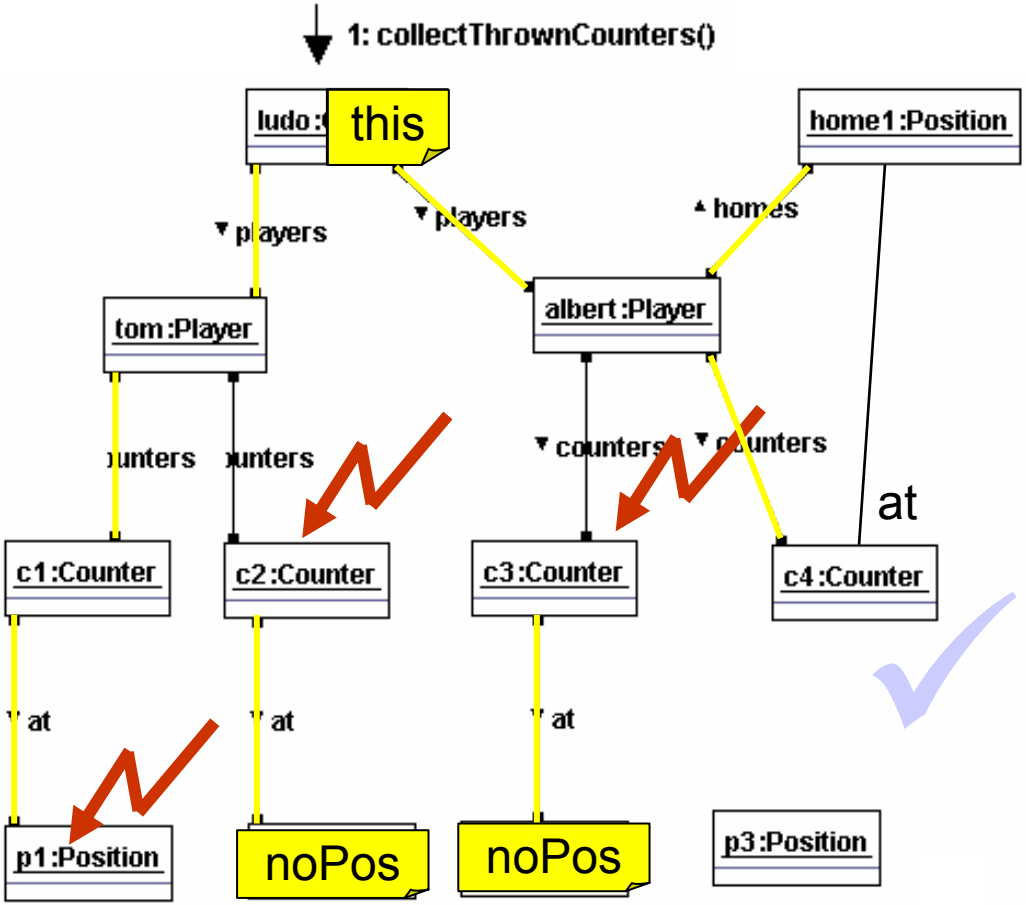


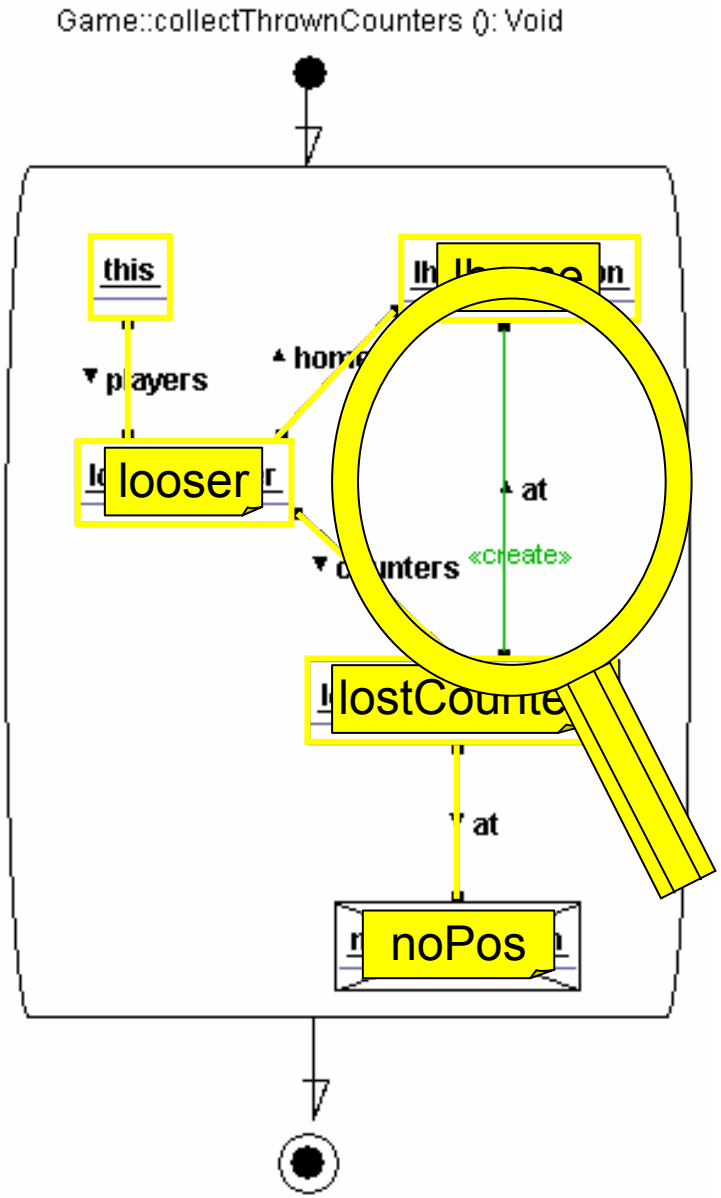
6b Derivation of the Implementation (cont.6)




```
class Counter {
public void move () { Position pos; . . .
while (sdmSuccess) {
   try {
   sdmSuccess = false;
   pos = this.getAt ();
   JavaSDM.ensure (pos != null);
   next = pos.getNext ();
   JavaSDM.ensure (next != null);
   myPlayer = this.getOwner ();
   JavaSDM.ensure (myPlayer != null);
   theDie = myPlayer.getDie ();
   JavaSDM.ensure (theDie != null);
   JavaSDM.ensure (theDie.getV() > 0);
   sdmSuccess = true;
   this.setAt (null);
   this.setAt (next);
   theDie.setV(theDie.getV() - 1); }
   catch (SDMException e) {}
} // while
```

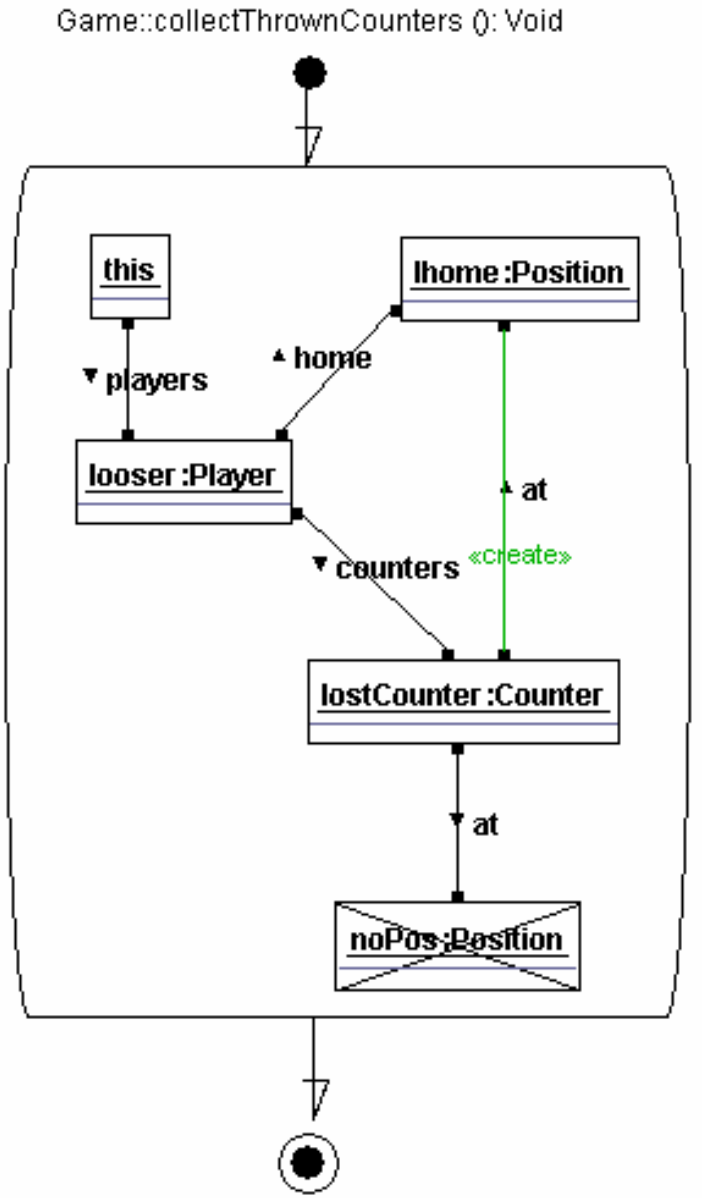
6b Derivation of the Implementation (cont.7)





6b Derivation of the Implementation (cont.8)

```
class Game {
public void collectThrownCounters () { . . .
Iterator looserIter = this.iteratorOfPlayers();
while (!sdmSuccess && looserIter.hasNext()) {
   try {
   sdmSuccess = false;
   looser = looserIter.next ();
   lhome = looser.getHome ();
   JavaSDM.ensure (lhome != null);
   countersIter = looser.iteratorOfCounters ();
   while (!sdmSuccess && countersIter.hasNext()) {
      try {
      lostCounter = countersIter.next ();
      JavaSDM.ensure (lostCounter.getAt() == null);
      sdmSuccess = true;
      lostCounter.setAt (lhome);
      } catch (SDMException e) {}
   } // while
   } catch (SDMException e) {}
} // while
```



6b Derivation of the Implementation (cont.9)

- manual derivation of rule diagrams from stories
- brain required
- systematic guide lines provided e.g. in [SCESM04]
- automatic code generation [GraGra]

7. Validation

- JUnit Tests → Implementation realizes the Scenarios
- Coverage analysis → Implementation does additional things
  - unnecessary code, or
  - missing scenarios
- Debugging aids

Tool Demo

Summary

Story Driven Modeling

- model level analysis with story boards
- model level tests
- model level implementation with rule diagrams
- code generation
- model level testing / debugging

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References

- [SCESM04] I. Diethelm, L. Geiger, A. Zündorf: *Systematic Story Driven Modeling, a case study*; Workshop on Scenarios and state machines: models, algorithms, and tools; ICSE 2004, Edinburgh, Scottland, May 24 – 28 (2004).
- [SCESM05] Leif Geiger, Albert Zündorf: *Story Driven Testing*; in proc. 4th International Workshop on Scenarios and State Machines: Models, Algorithms and Tools (SCESM'05) ICSE 2005 Workshop
- [GraGra] T.Fischer, J.Niere, L.Torunski, A.Zündorf: *Story Diagrams: A new Graph Grammar Language based in the Unified Modeling Language*; in Proc. of TAGT '98 - 6th International Workshop on Theory and Application of Graph Transformation. Technical Report tr-ri-98-201, University of Paderborn; (1999)