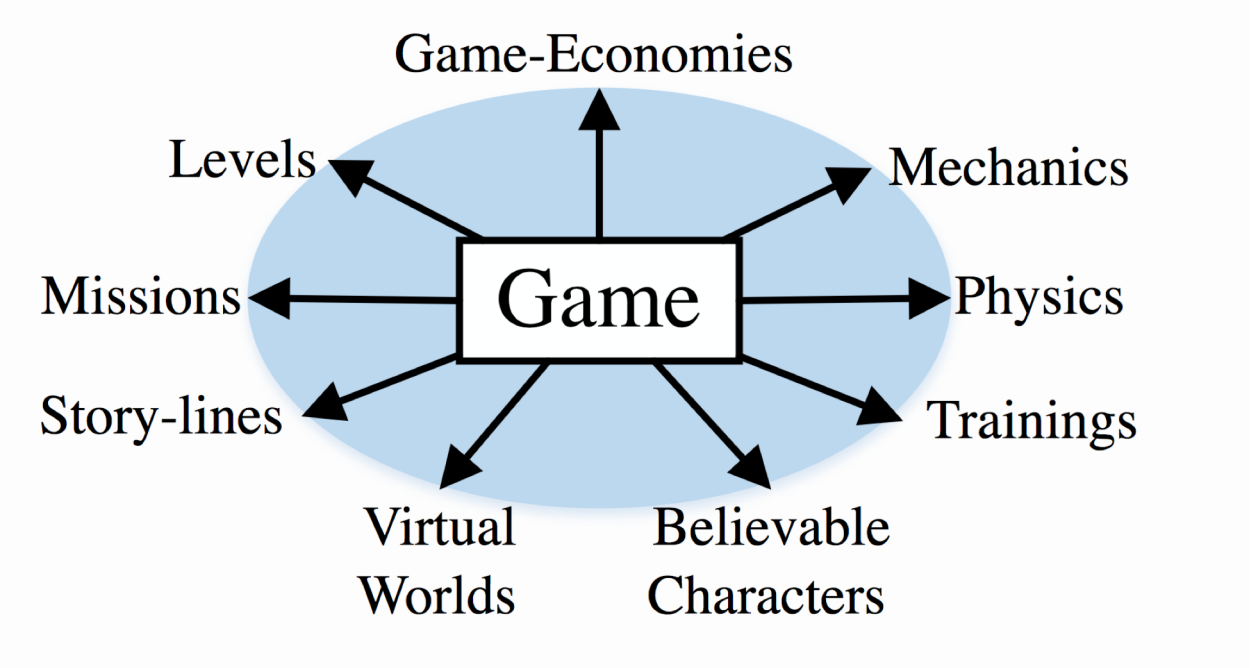
Workshop – State Machine Language

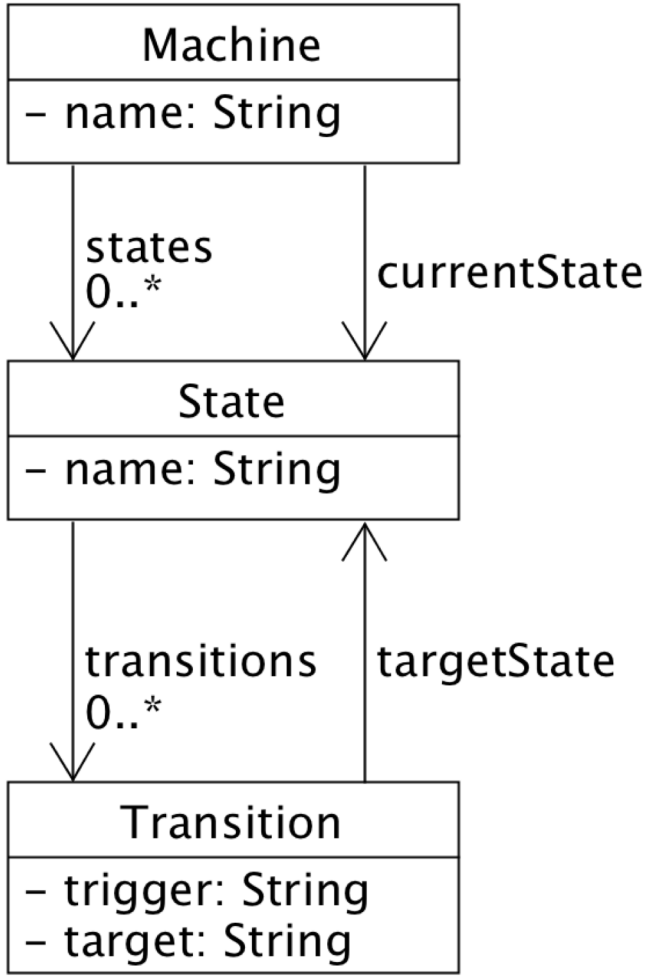
- **Question**: How to build a script language?



- **Answer:** Here's a workshop that shows an approach for a simple state machine language.

State Machine Language

- **Machine**
  - Has a name
  - Consists a list of states
  - Has a current state
- **State**
  - Has a name
  - Consists of a list of transitions
- **Transition**
  - Has a trigger and target state
  - When triggered, results in a state machine transition to targetState



Meta-Model of the State Machine Language (SML)

State Machine Language in ANTLR

- ANTLR (ANother Tool for Language Recognition)
  - Parser generator for reading, processing, executing, or translating structured text
  - Widely used to build languages, tools, and frameworks
  - From a grammar, ANTLR generates a parser that can build and walk parse trees
  - http://www.antlr.org

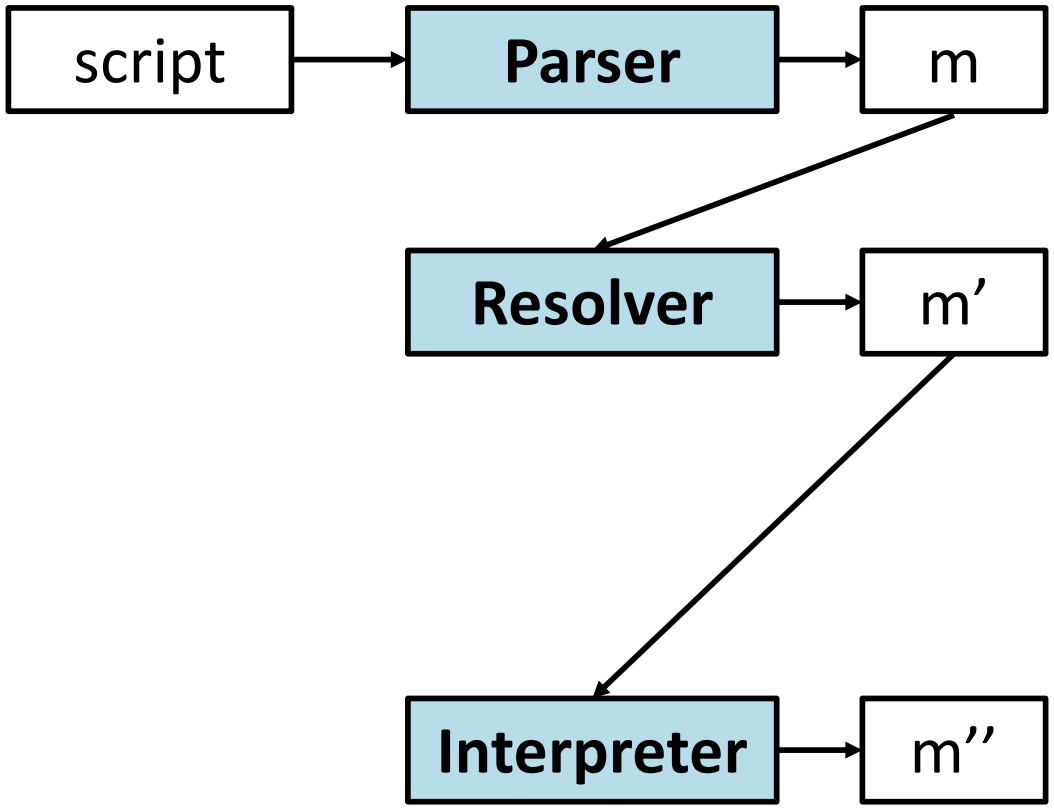
StateMachine.4g | MM.4g

```
1  grammar StateMachine;
2
3  machine: 'machine' name=ID state*;
4
5  state: 'state' name=ID transition*;
6
7  transition: trigger=ID '=>' target=ID;
8
9  ID : LETTER (LETTER | DIGIT)*;
10
11 LETTER : ('a' .. 'z') | ('A' .. 'Z');
12
13 DIGIT: ('0' .. '9');
14
15 WS: [ \r\n\t] + -> channel (HIDDEN);
```

ANTLR specification of State Machine Language (SML)

State Machine Language

- **Parser**
  - ANTLR-based parser
  - Parses script into a model
- **Resolver**
  - Resolves transition targets
  - Looks-up named states and sets the targetState attribute of transtions
  - Generates errors if a name does not exist
- **Interpreter**
  - Runs the state machine
  - Sets the initial state
  - Makes transitions by interpreting user input and updating the currentState

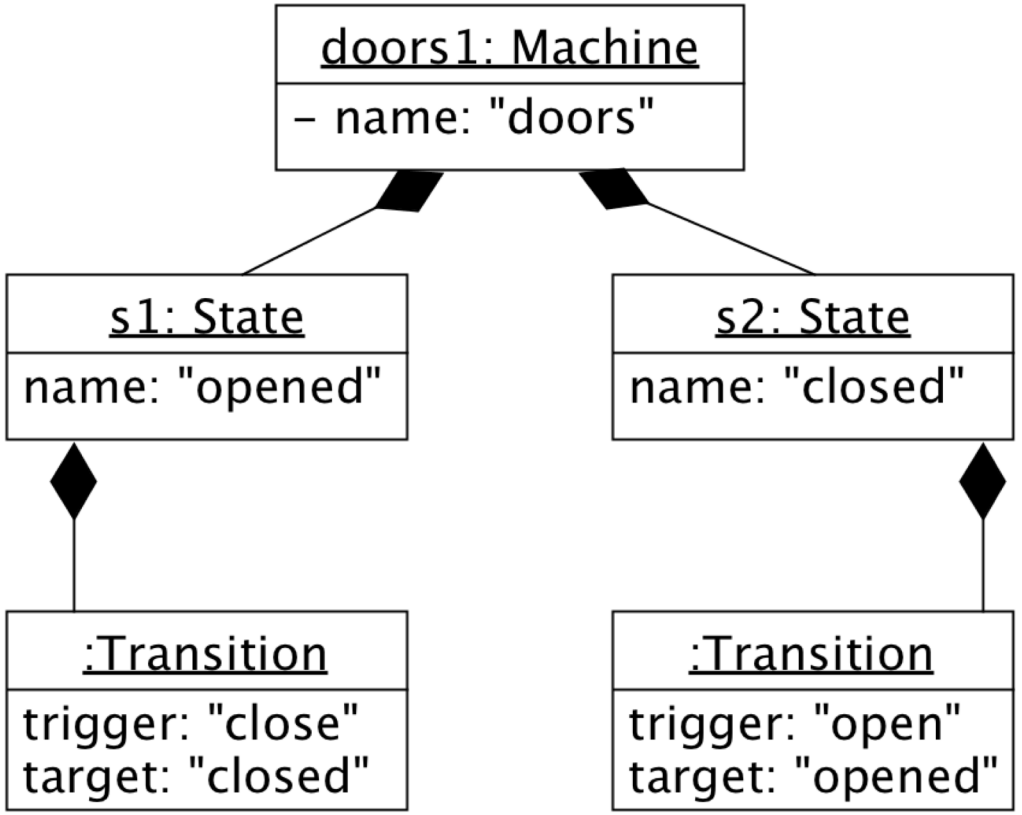


Transformation pipeline
(components in teal, data in white)

“doors” State Machine – Parsing

- Parsing the below textual program results in object model on the left

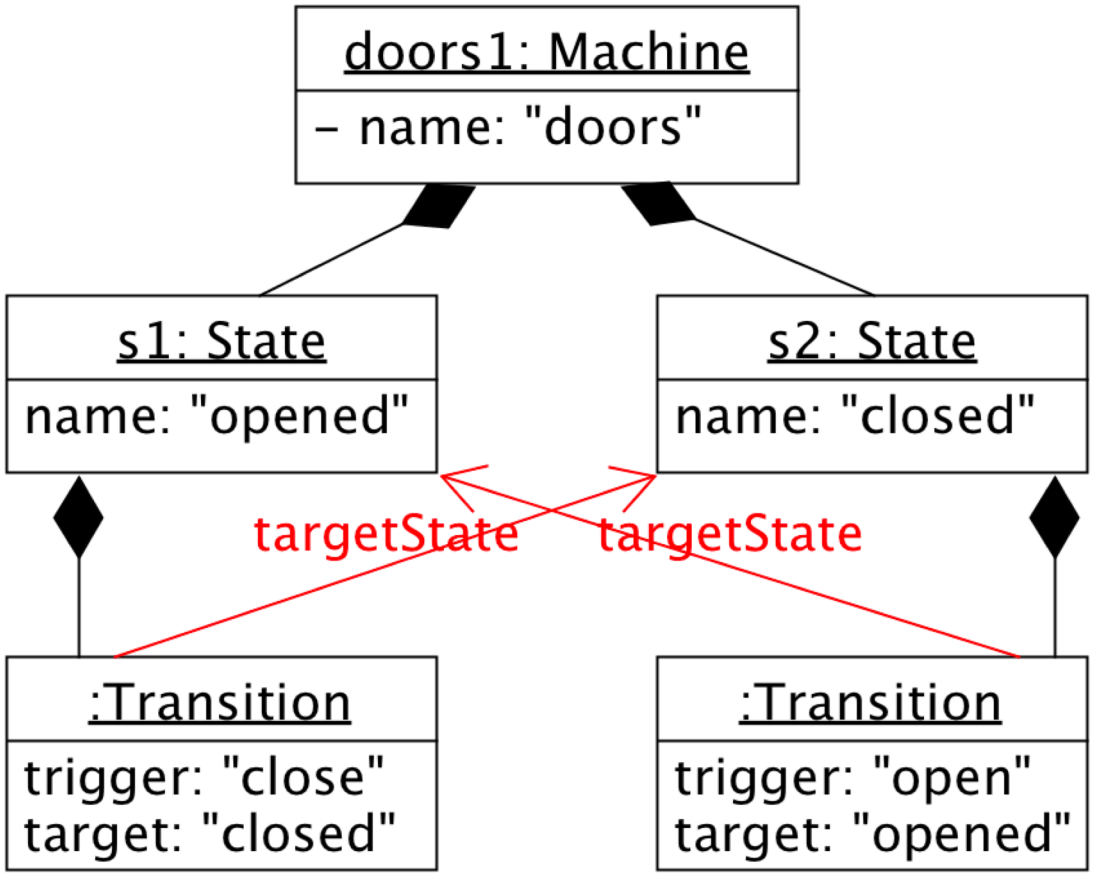
```
machine doors
  state opened
    close => closed
  state closed
    open => opened
```



Resulting state machine model

“doors” State Machine – Resolving

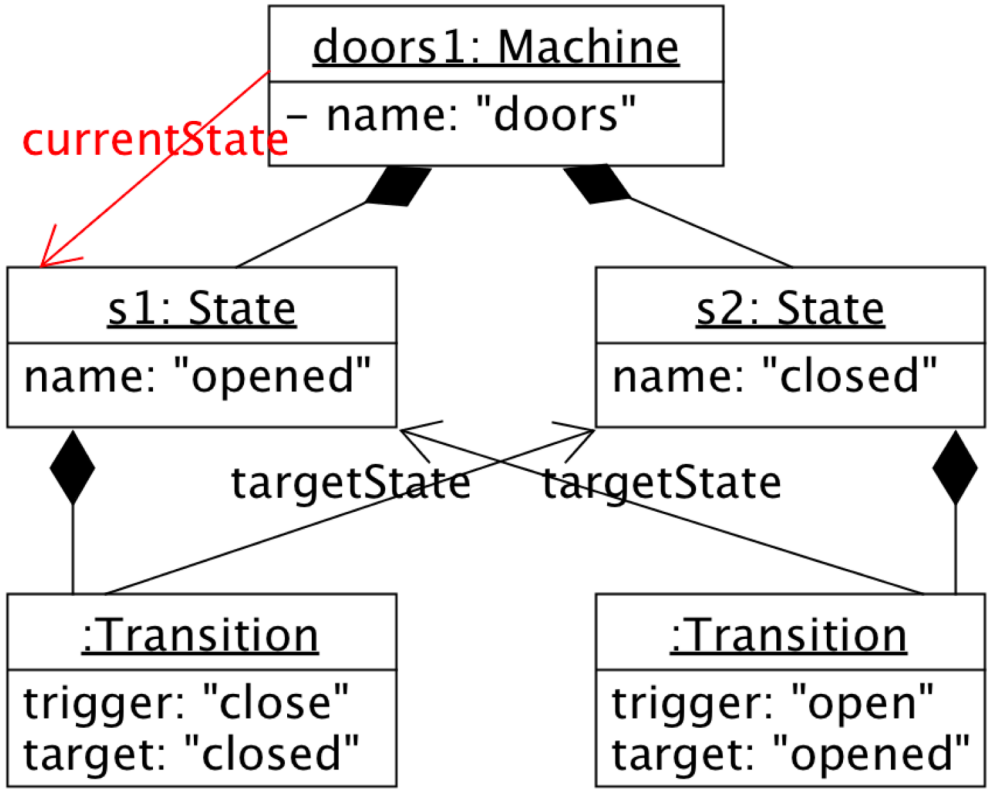
- **Resolver**
  - Resolves transition targets
  - Looks-up named states and sets the targetState attribute of transtions
  - Generates errors if a name does not exist



State Machine Model with resolved target states in red

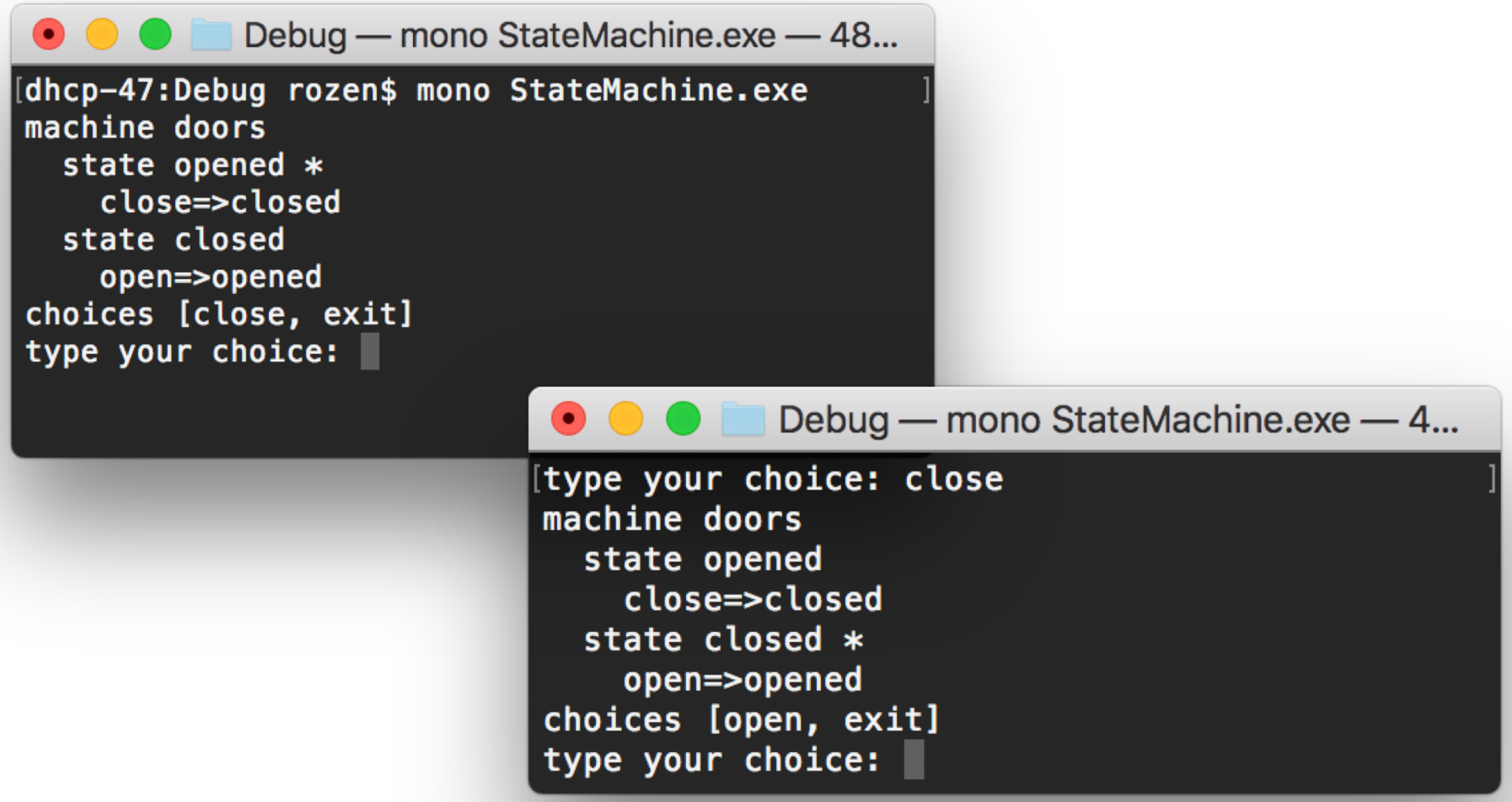
“doors” State Machine – Running

- **Interpreter**
  - Runs the state machine
  - Sets the initial state
  - Makes transitions by interpreting user input and updating the currentState



State Machine Model initialized current state in red

State Machine Language – Demo



Workshop – Practical

1. Download the C# sources and compile them using Xamarin Studio (or another IDE)
2. Run the tool from the command-line using Mono
3. Create a state machine program of a door that can also be locked and run it.
4. Investigate how the Visitor pattern works. Which visitors does the code contain?
5. Extend the API with a mechanism for registering methods that are called when transitions happen and test it.

Resources

https://vrozen.github.io/agd2018/StateMachine.zip

https://www.xamarin.com