Graphical editing support for QuickCheck models

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Testing with QuickCheck

- QuickCheck permits one to write generators for test data and pre/postconditions.

- The expectation is that user provides a model, based on which test data is randomly generated.

- Illustration of testing a *write* operation:

```
write_args(_) -> [key(), int()].

write(Key, Value) -> lock:write(Key, Value).

write_post(_,[Key,Value],Res) -> eq(Res,ok).
```

Global state

operation name

this is a precondition

type of the global state

element of the global state

```
write_pre(S)  -> S#state.started

write_args(S) -> [  key(), int()  ].
```

precondition

generator for arguments

list of arguments to pass to operation *write* of the system under test

returns a generator for integers

returns a generator for keys

Global state is a record-type of type *state* with element *started*, passed as an argument to all operations.

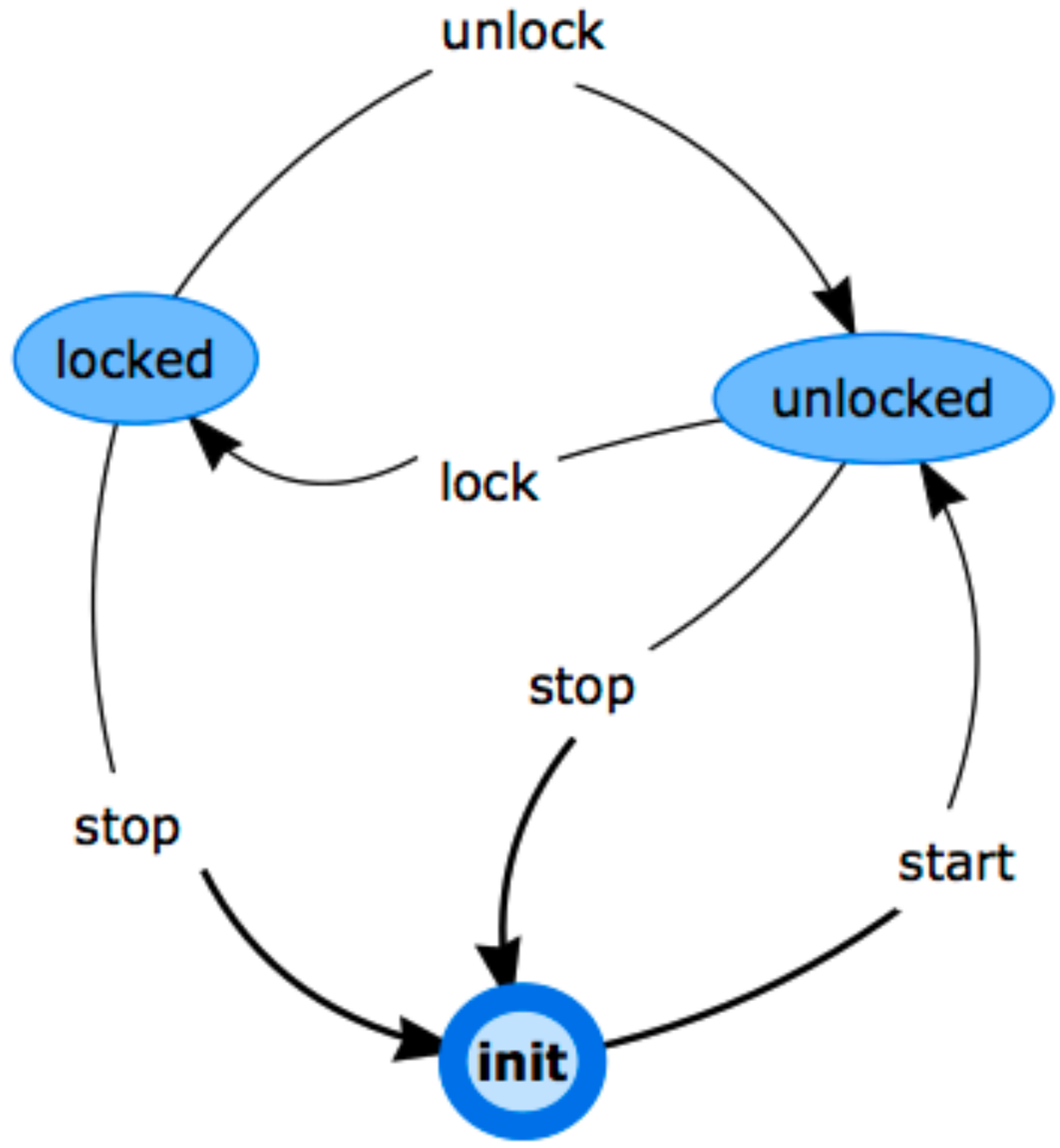
Testing *write* using global state

Assuming *started* is a boolean component of the global state reflecting if the system was started,

```
write_args(S) -> [key(), int()].

write(Key, Value) -> lock:write(Key, Value).

write_pre(S)  -> S#state.started

write_post(S,[Key,Value],Res) -> eq(Res,ok).

write_next(S, Res, [Key, Value]) ->
    S#state{kvs = [{Key,Value} |
        proplists:delete(Key,S#state.kvs)]}.
```

Locker example

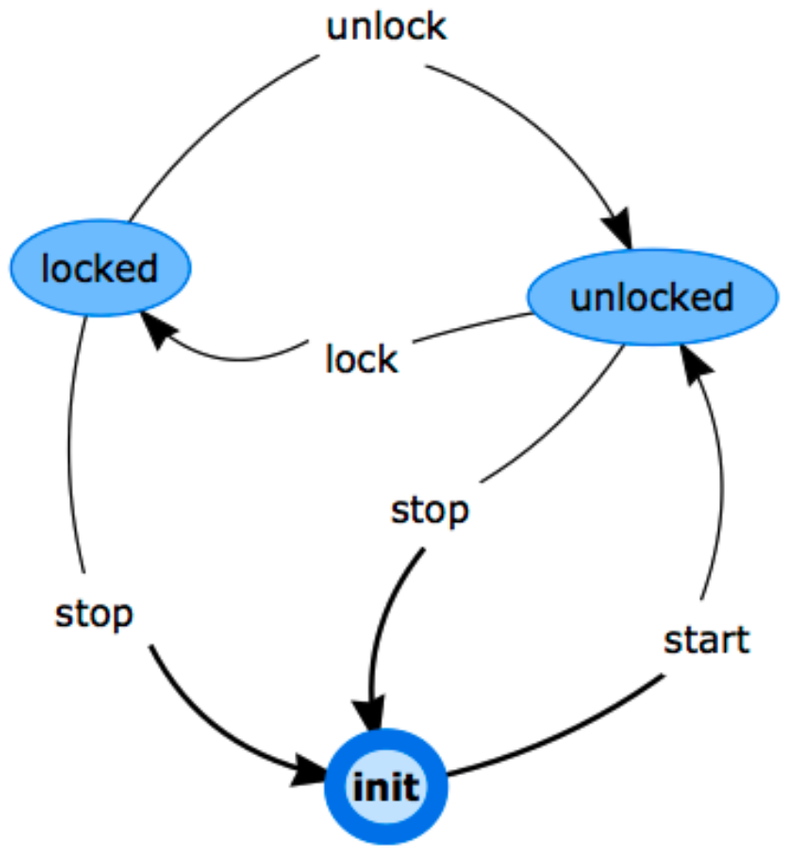
- Can be started/stopped
- Can be locked/unlocked
- Does not include read/write



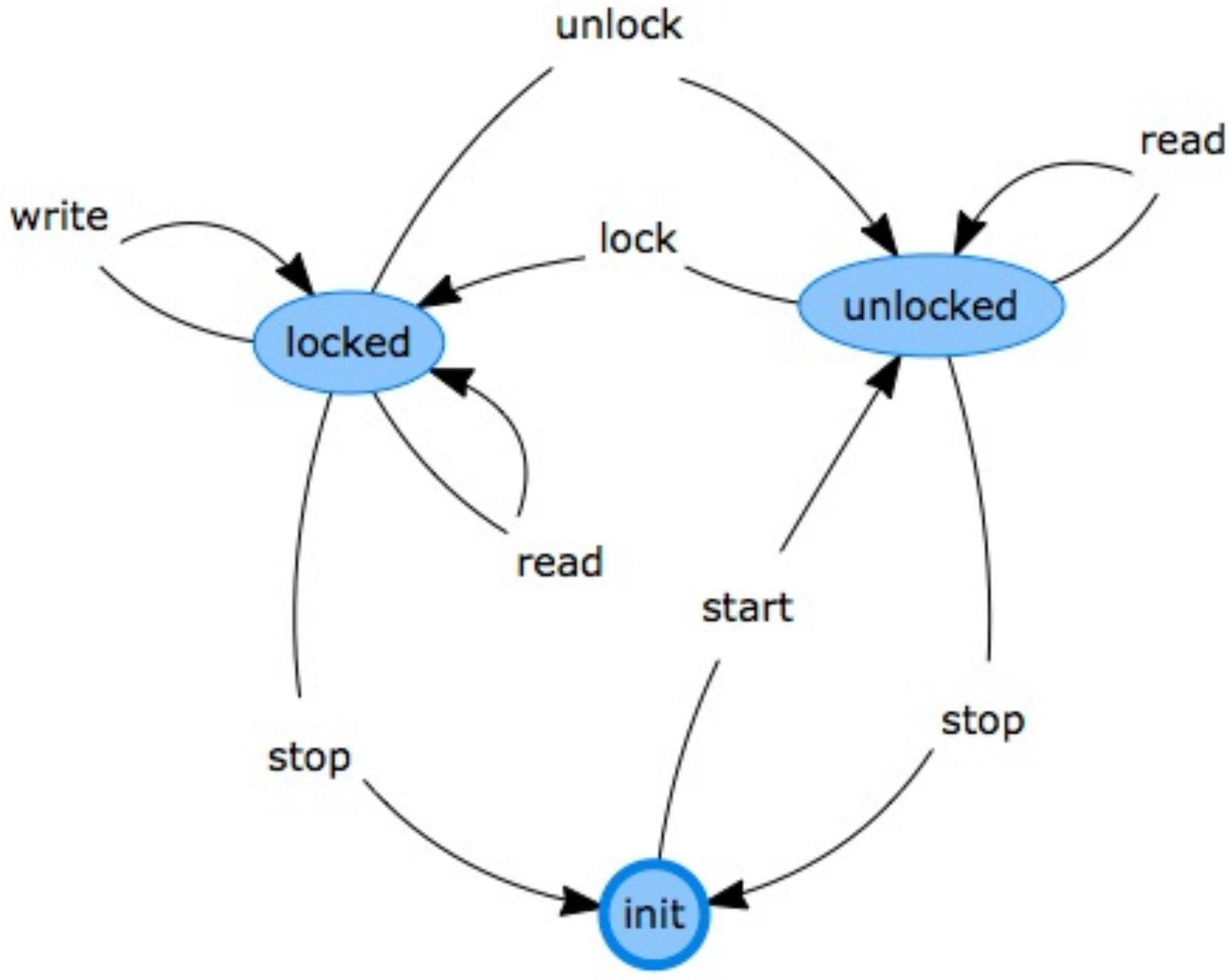
Part of this diagram in pure QuickCheck

```
lock_pre(S) -> S#state.started andalso not S#state.locked.
lock_args(S) -> [].
lock_next(S,Res,[])-> S#state{locked=true}.

unlock_pre(S) -> S#state.started andalso S#state.locked.
unlock_args(S) -> [].
unlock_next(S,Res,[])-> S#state{locked=false}.
```

Very easy to make a mistake in one of the above expressions

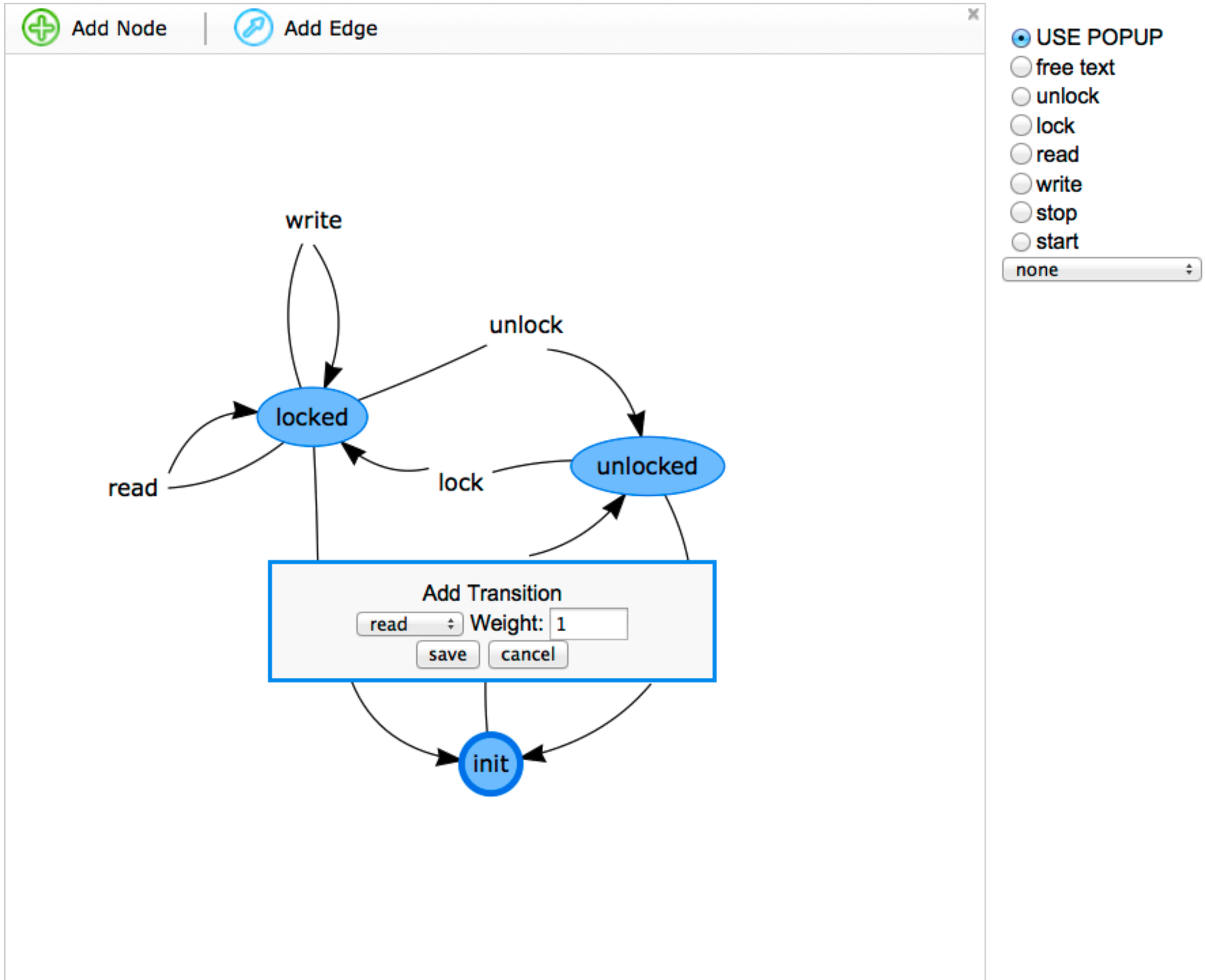


Now if we are doing something more complex



A lot of effort will go into ‘state maintenance’

Addition of a *read* transition around *unlocked*.

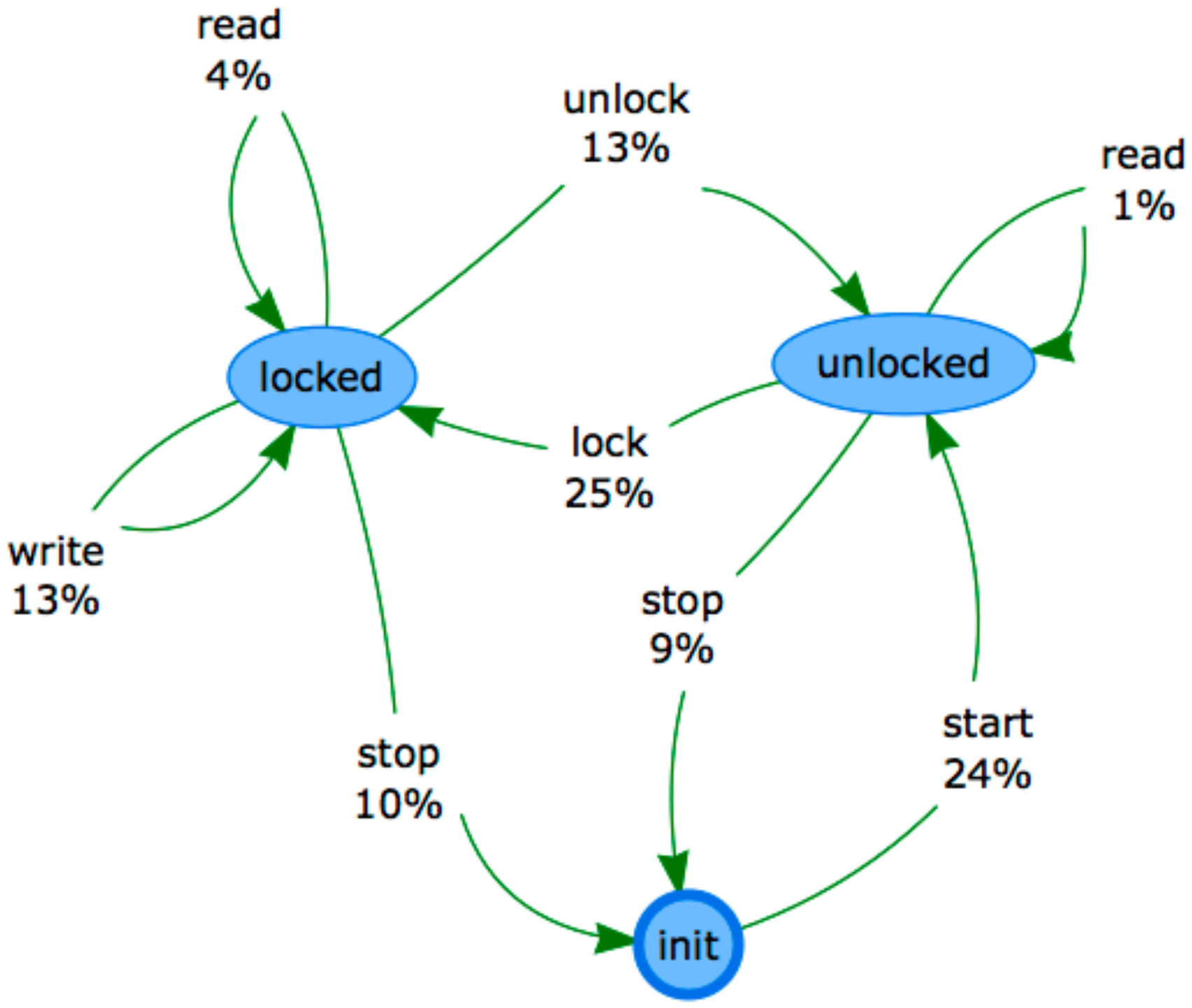


What we did

- Developed a tool to edit graphical models.
- Names of operations are extracted from Erlang code.
- For the above example, the resulting model is half the size of the traditional model …

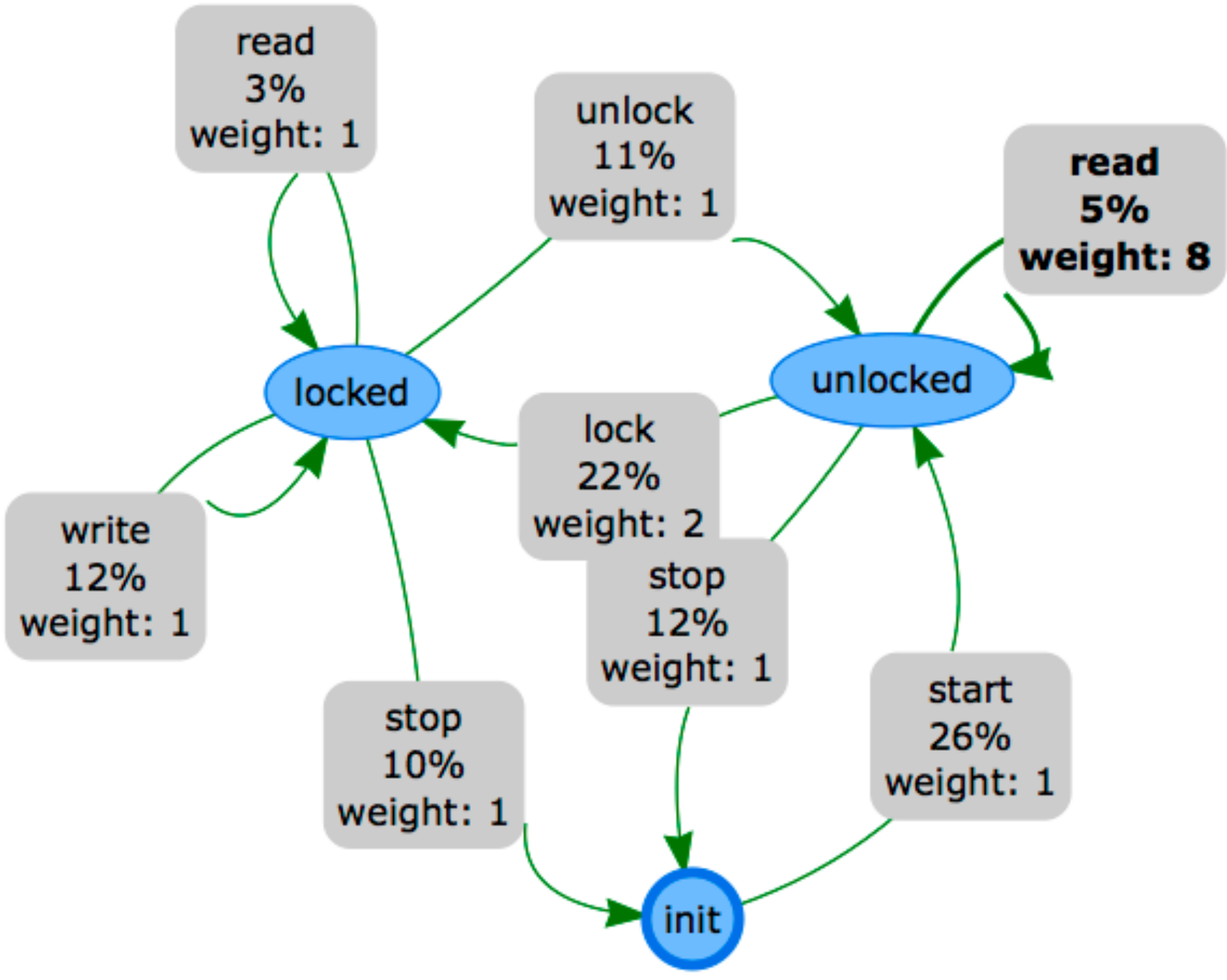
  … and much easier to maintain.
- Test failures and frequencies are automatically extracted from results of test execution.

Frequencies



Running tests produces a distribution of transitions

Weights can be updated



Changing weights makes operations of interest run more frequently.

Conclusions

- Existing QuickCheck models are hard to develop for complex state-transition diagrams.

- Developed interface to edit such diagrams.

- This will be part of the upcoming version of QuickCheck.

- Currently working on the case study with an industrial partner - testing of the interface to video on demand system.