Changing State in the

Language

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OOPSLA 2011 Demonstration

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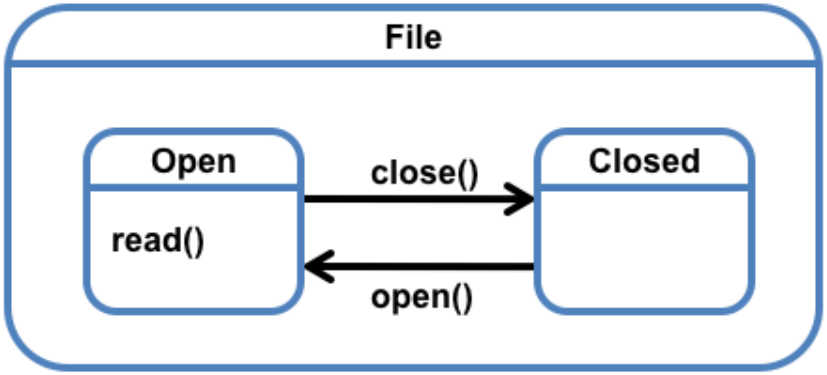
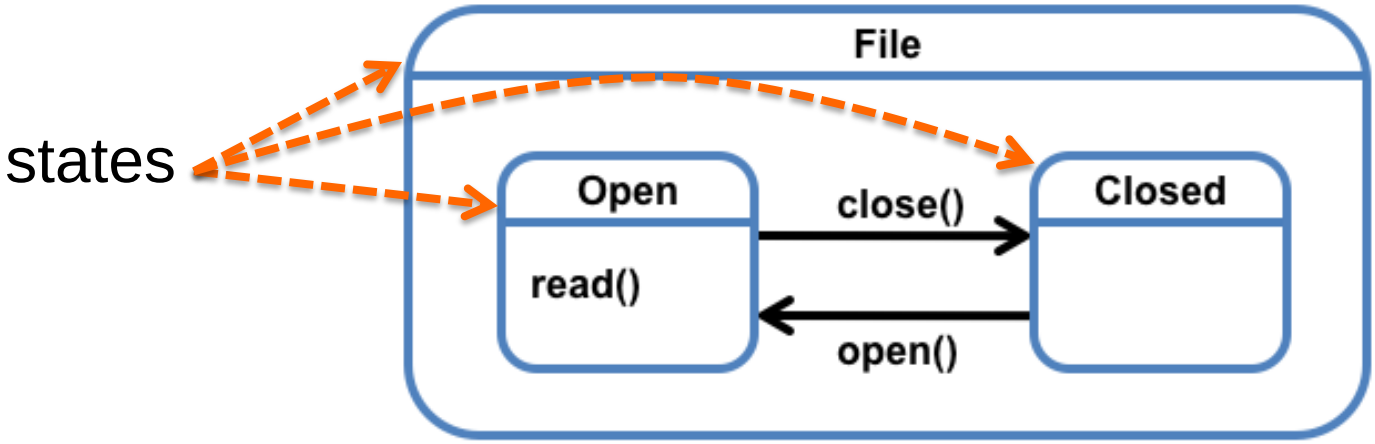
Object Protocols

- An **Object Protocol** dictates an **order** on **method calls**:
  - Has a **finite number** of **abstract states** in which different method calls are valid;
  - Specifies **transitions** between abstract states that occur as a part of some method calls.

- File state chart [harel 87]



File States



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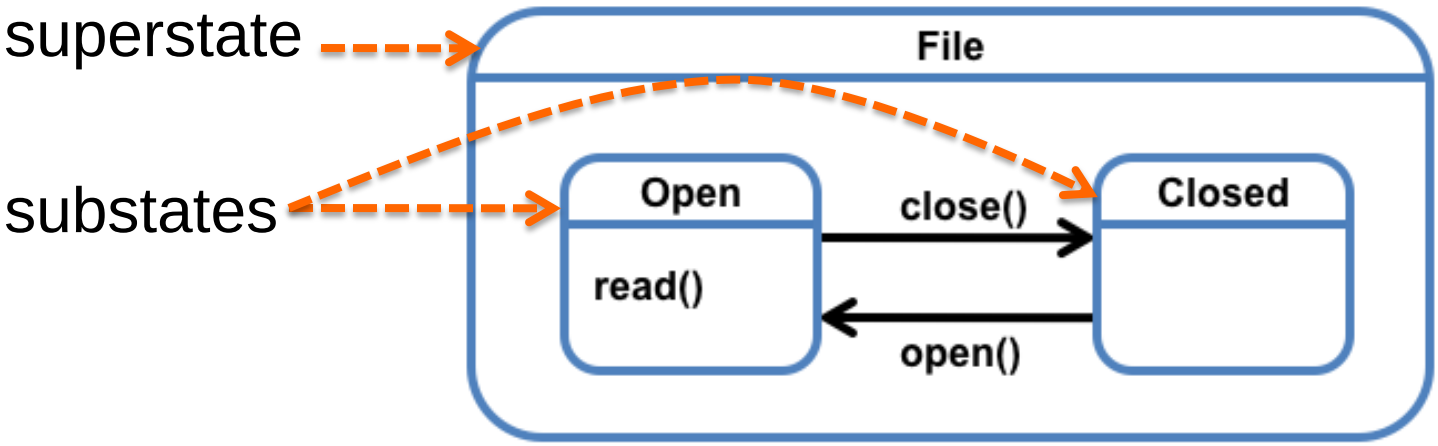
File States



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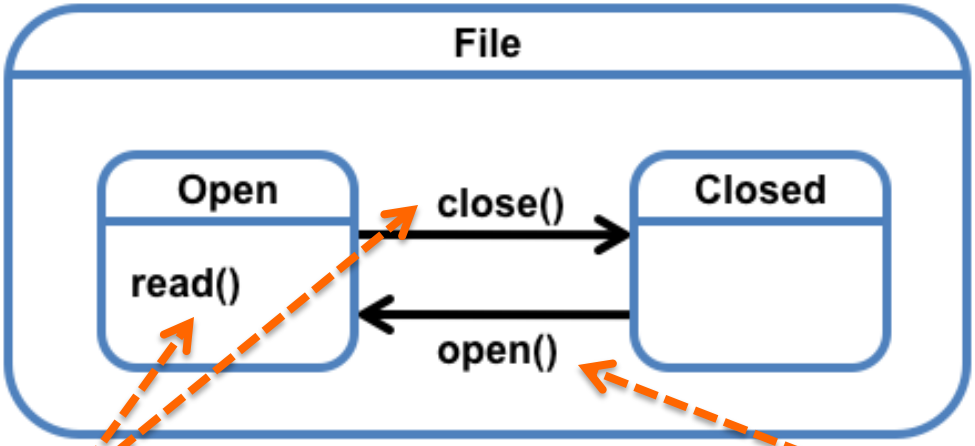
File States



Methods available
in the Open state

Method available
in the Closed state

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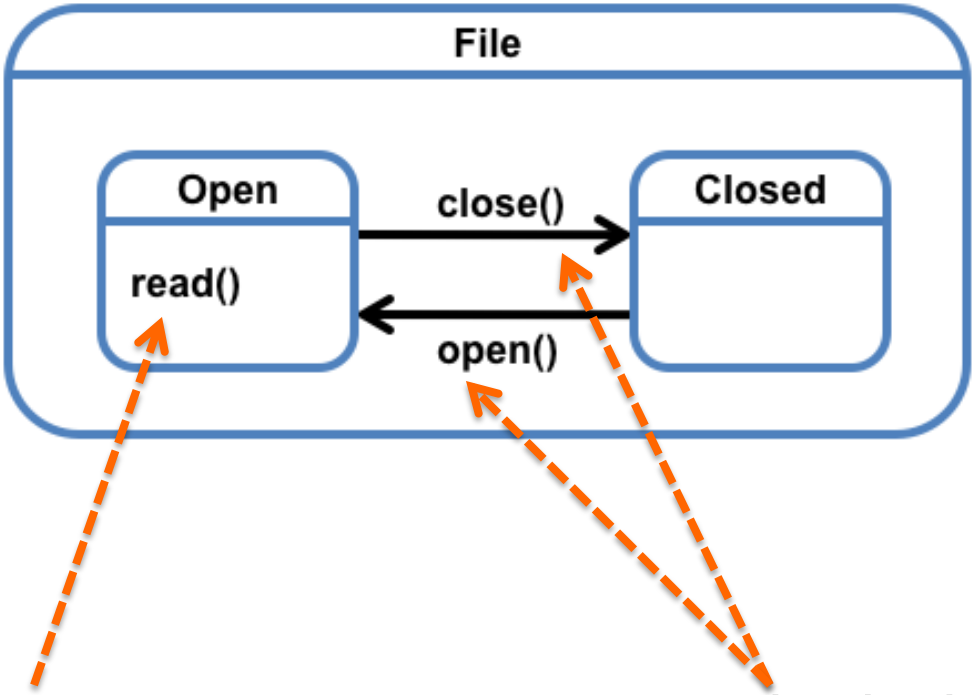
File States



Method that keeps the object in the same state

Methods that transition the state of the object

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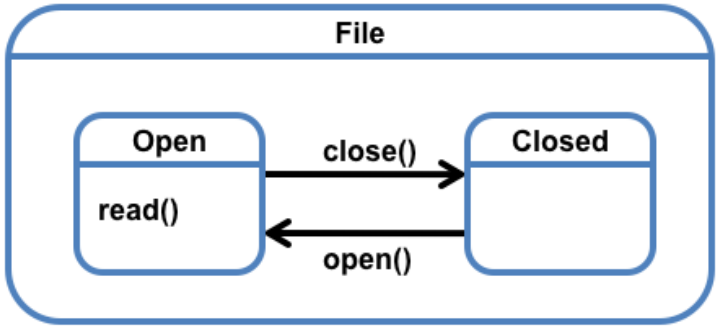
Plaid Syntax



- Need to encode:

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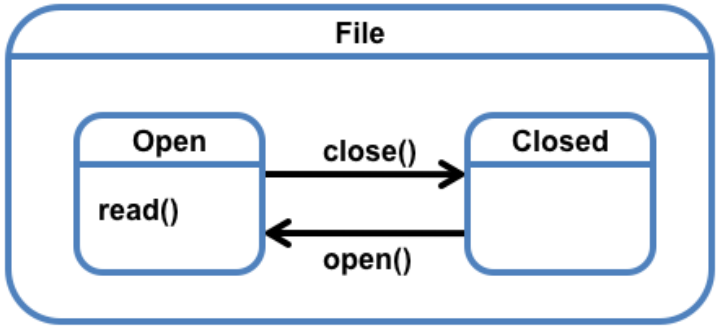
Code from File.plaid

Plaid Syntax



- Need to encode:
  - States and dimensions

```
state File {

}
```

```
state Open case of File {


}
```

```
state Closed case of File {


}
```

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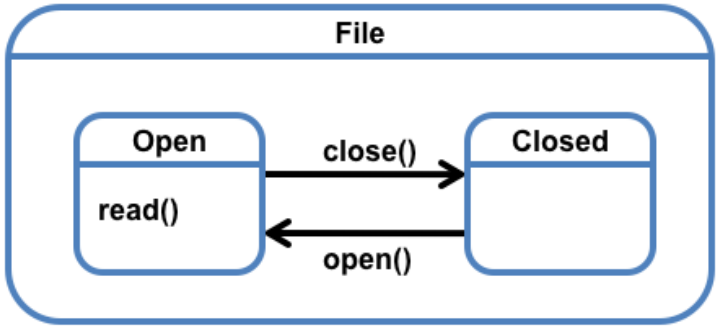
Code from File.plaid

Plaid Syntax



- Need to encode:
  - States and dimensions
  - Actions and supporting representation

```
state File {
   val filename;
}
```

```
state Open case of File {
   val filePtr;
   method read() {…}
   method close() {…}
}
```

```
state Closed case of File {
   method open() {
      …
   }
}
```

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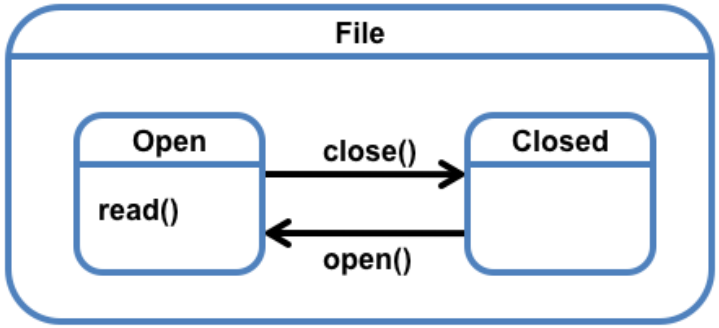
Code from File.plaid

Plaid Syntax



- Need to encode:
  - States and dimensions
  - Actions and supporting representation
  - Transitions

```
state File {
   val filename;
}
```

```
state Open case of File {
   val filePtr;
   method read() {…}
   method close() { this ← Closed; }
}
```

```
state Closed case of File {
   method open() {
      this ← Open { val filePtr = … };
   }
}
```

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Code from File.plaid

Using Files

- Instantiation:

```
val fs = new Closed { val filename = “path.to.file”; };
```

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Code from File.plaid

Using Files

- Matching:

```
method readAndCloseFile(theFile) {

}
```

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Code from File.plaid

Using Files

- Matching:

```
method readAndCloseFile(theFile) {
  match (theFile) { /* make sure the file is Open */
    case Closed { theFile.open() }
    case Open { /* no op – already Open */ }
  };

}
```

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Code from File.plaid

Using Files

- Matching:

```
method readAndCloseFile(theFile) {
  match (theFile) { /* make sure the file is Open */
    case Closed { theFile.open() }
    case Open { /* no op – already Open */ }
  };
  val ret = theFile.read();


}
```

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Code from File.plaid

Using Files

- Matching:

```
method readAndCloseFile(theFile) {
  match (theFile) { /* make sure the file is Open */
    case Closed { theFile.open() }
    case Open { /* no op – already Open */ }
  };
  val ret = theFile.read();
  theFile.close();

}
```

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Code from File.plaid

Using Files

- Matching:

```
method readAndCloseFile(theFile) {
  match (theFile) { /* make sure the file is Open */
    case Closed { theFile.open() }
    case Open { /* no op – already Open */ }
  };
  val ret = theFile.read();
  theFile.close();
  ret
}
```

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Conditionals

- If functions: (

```
method readTwiceAndAdd(openFile) {
  var result = openFile.read();
  val second = openFile.read();
  if (second != -1) { //only add if not EOF symbol
    result = result + second;
  };
  result
}
```

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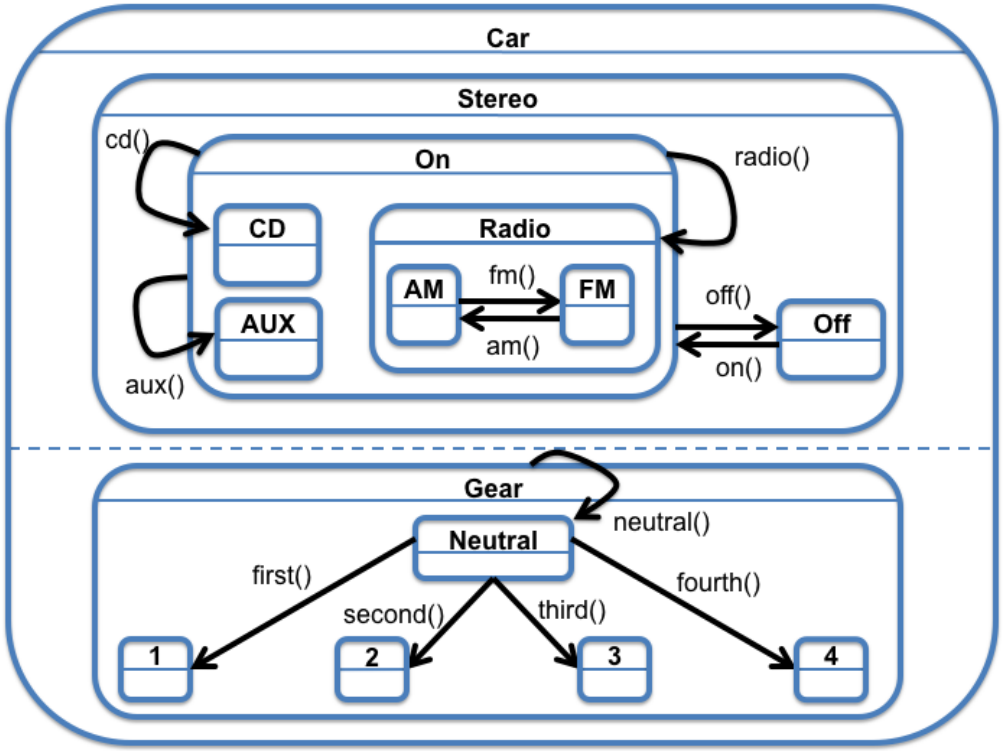
Code from File.plaid

And-states and Composition

- A Car has a more complicated state chart



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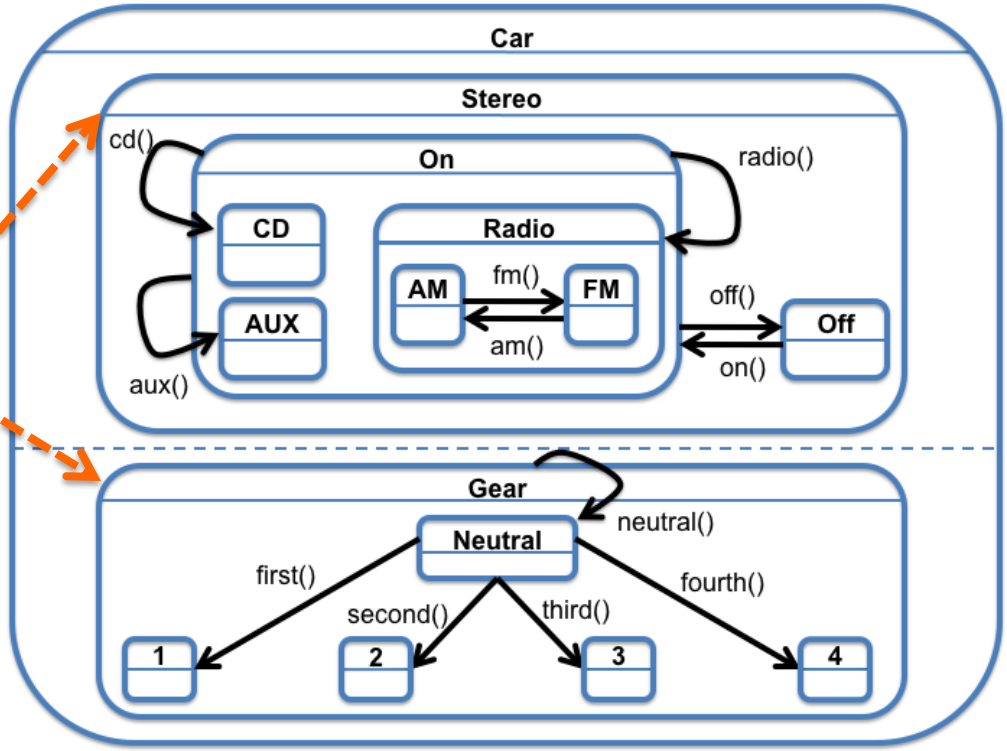
And-states and Composition

- A Car has a more complicated state chart

Two independent dimensions within Car

Changing a Gear does not impact the stereo state



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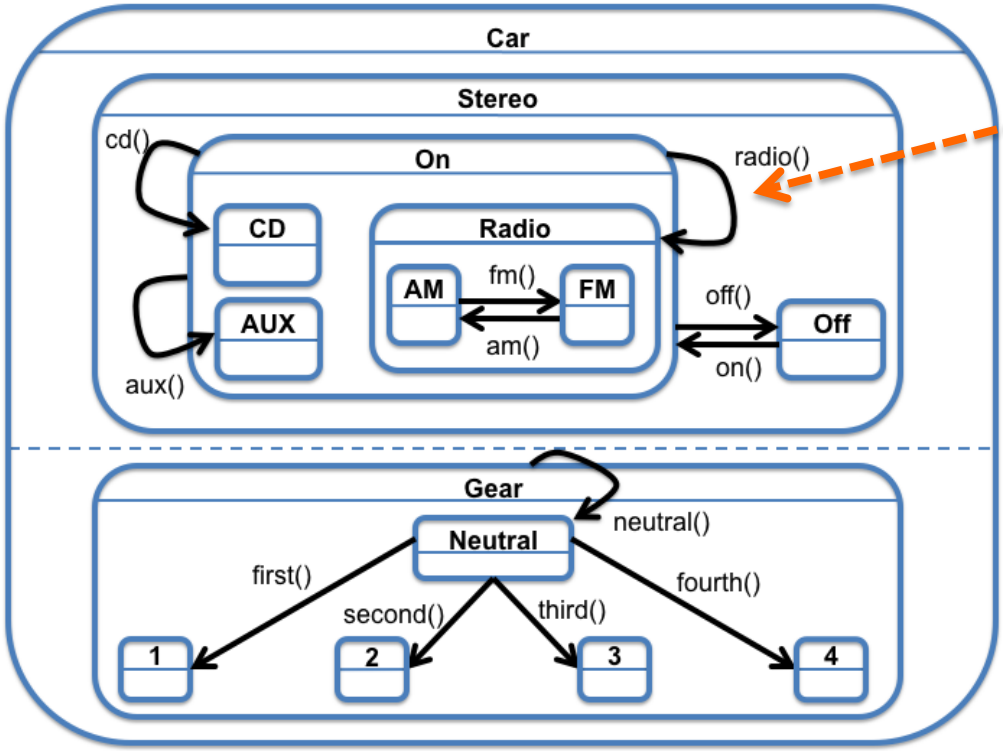
And-states and Composition

- A Car has a more complicated state chart



radio() method available in all substates of On. Always ends in the Radio state.

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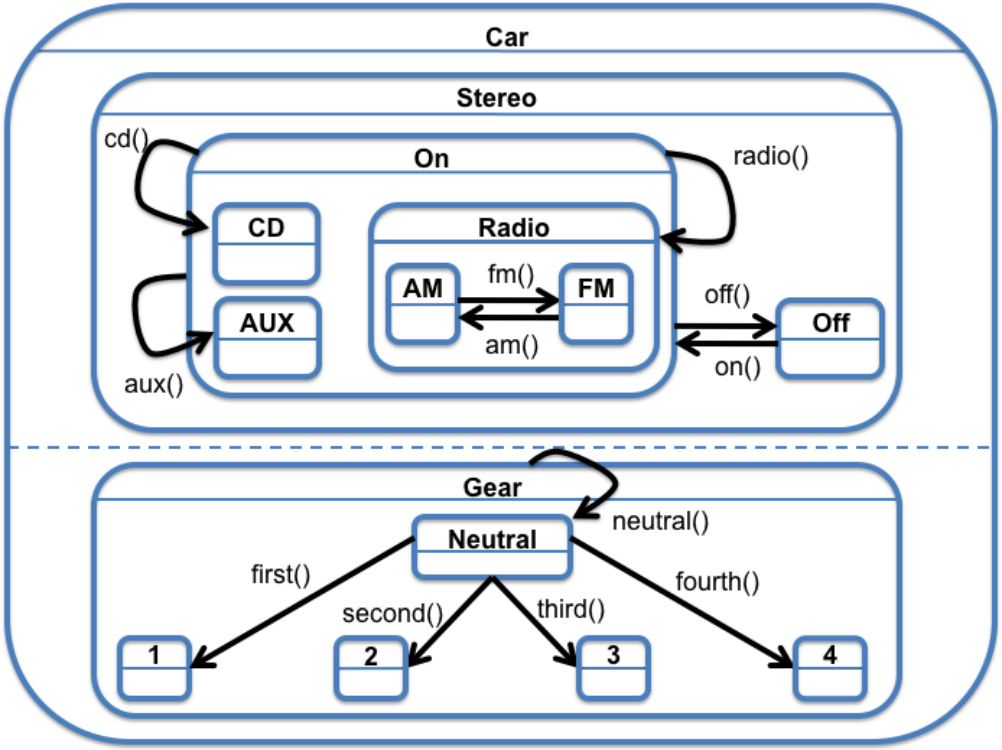
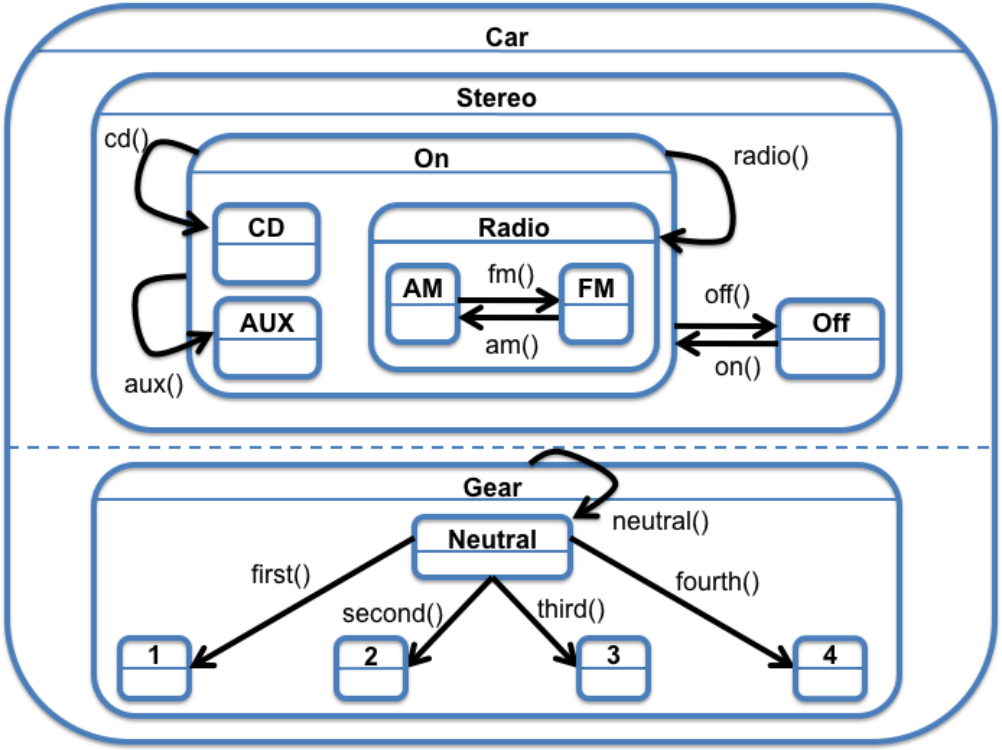
Plaid Car



Code from Car.plaid

Plaid Car




```
state Gear {
  method neutral() { this ← Neutral }
}
```

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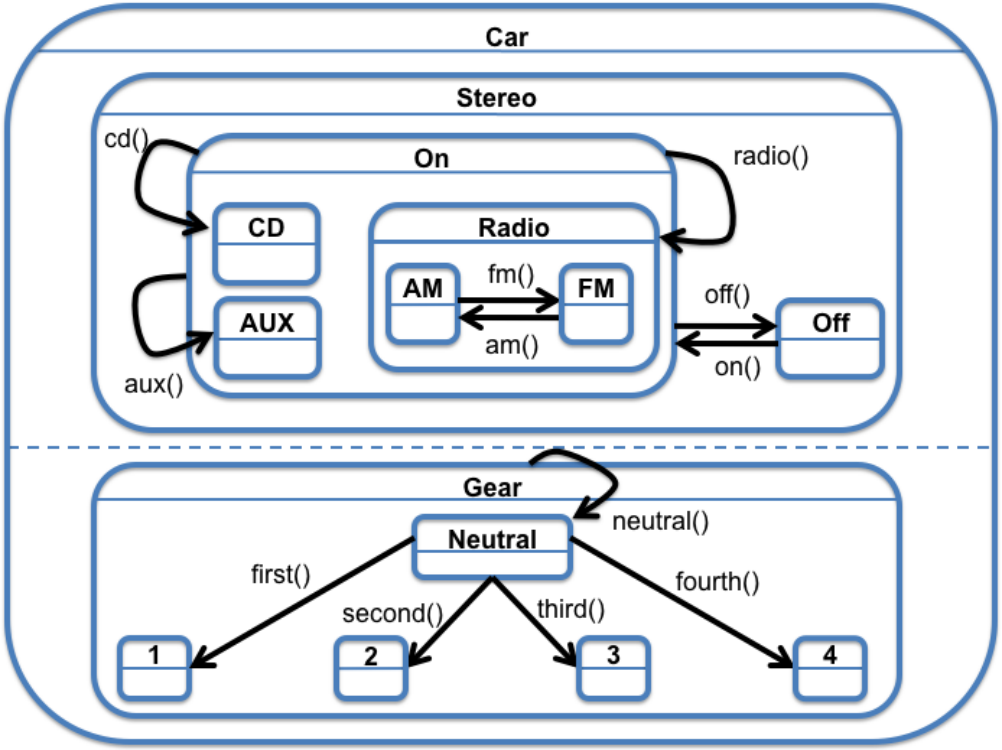
Code from Car.plaid

Plaid Car




```
state Gear {
  method neutral() { this ← Neutral }
}
```

```
state 1 case of Gear { }
state 2 case of Gear { }
...
```

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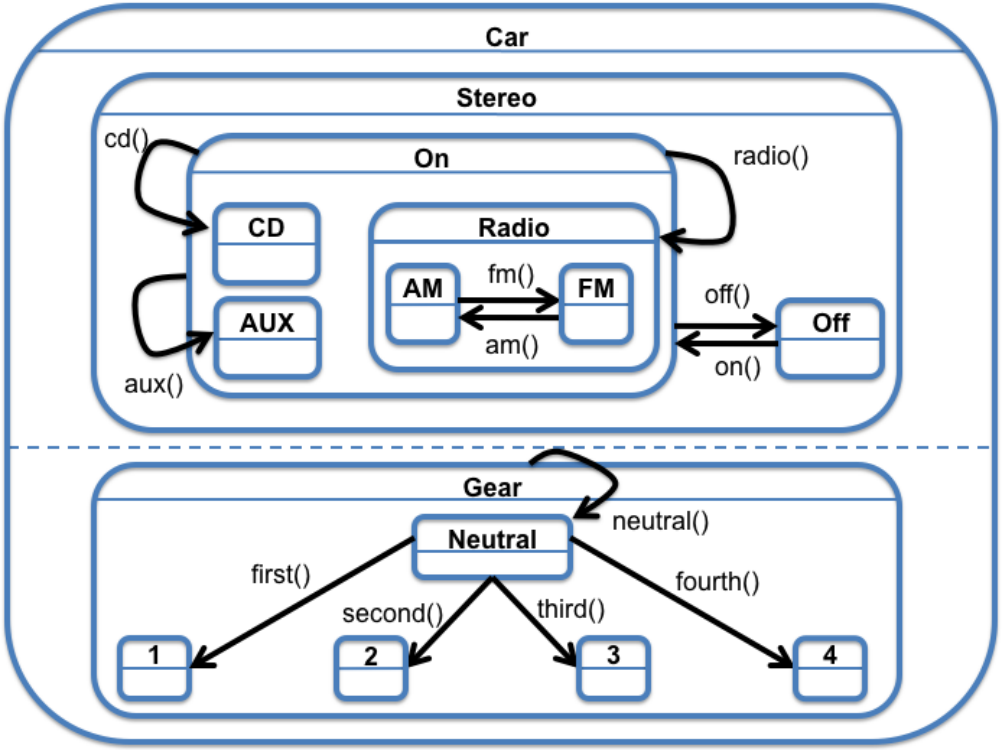
Code from Car.plaid

Plaid Car




```
state Gear {
  method neutral() { this ← Neutral }
}
```

```
state 1 case of Gear { }
state 2 case of Gear { }
...
```

```
state Neutral case of Gear {
  method first() { this ← 1 } ...
}
```

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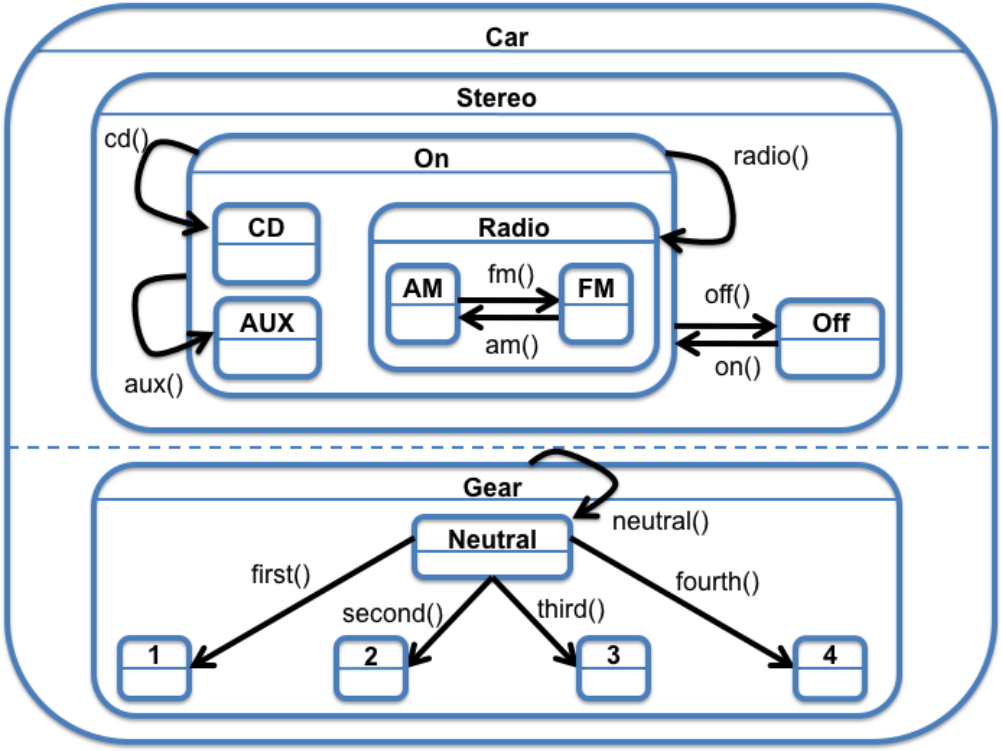
Code from Car.plaid

Plaid Car




```
state Gear {
  method neutral() { this ← Neutral }
}
```

```
state 1 case of Gear { }
state 2 case of Gear { }
...
```

```
state Neutral case of Gear {
  method first() { this ← 1 } ...
}
```

```
state Car = Stereo with Gear;
```

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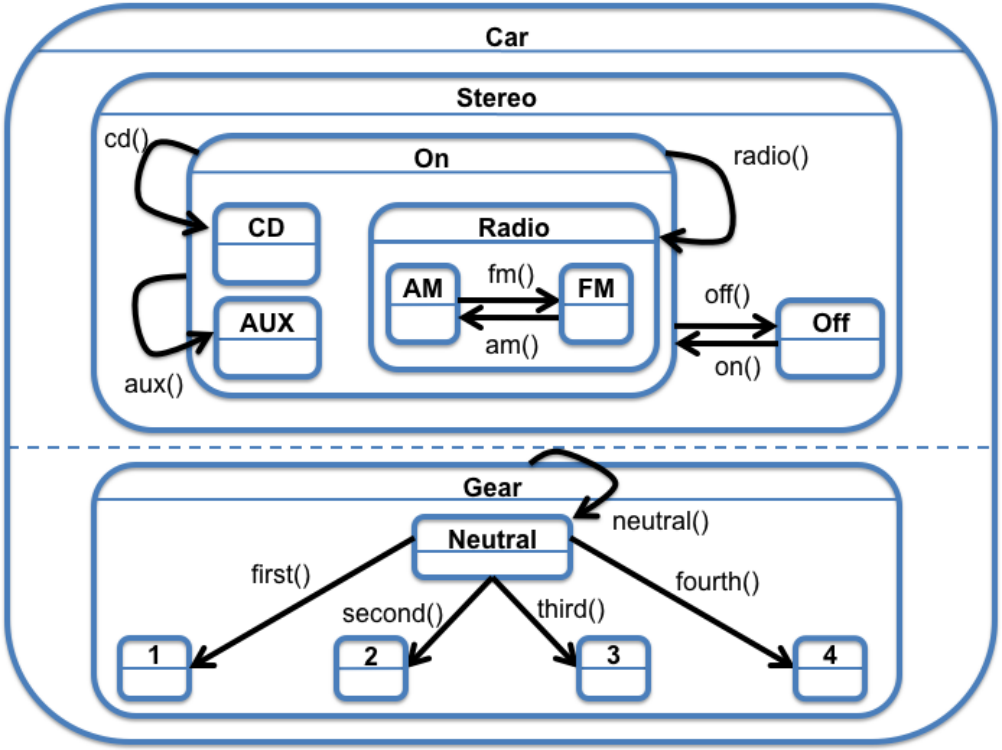
Code from Car.plaid

Plaid Car




```
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  method neutral() { this ← Neutral }
}
```

```
state 1 case of Gear { }
state 2 case of Gear { }
...
```

```
state Neutral case of Gear {
  method first() { this ← 1 } ...
}
```

```
state Car = Stereo with Gear;
```

Composition

Code from Car.plaid

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Questions?

Let’s write some code!

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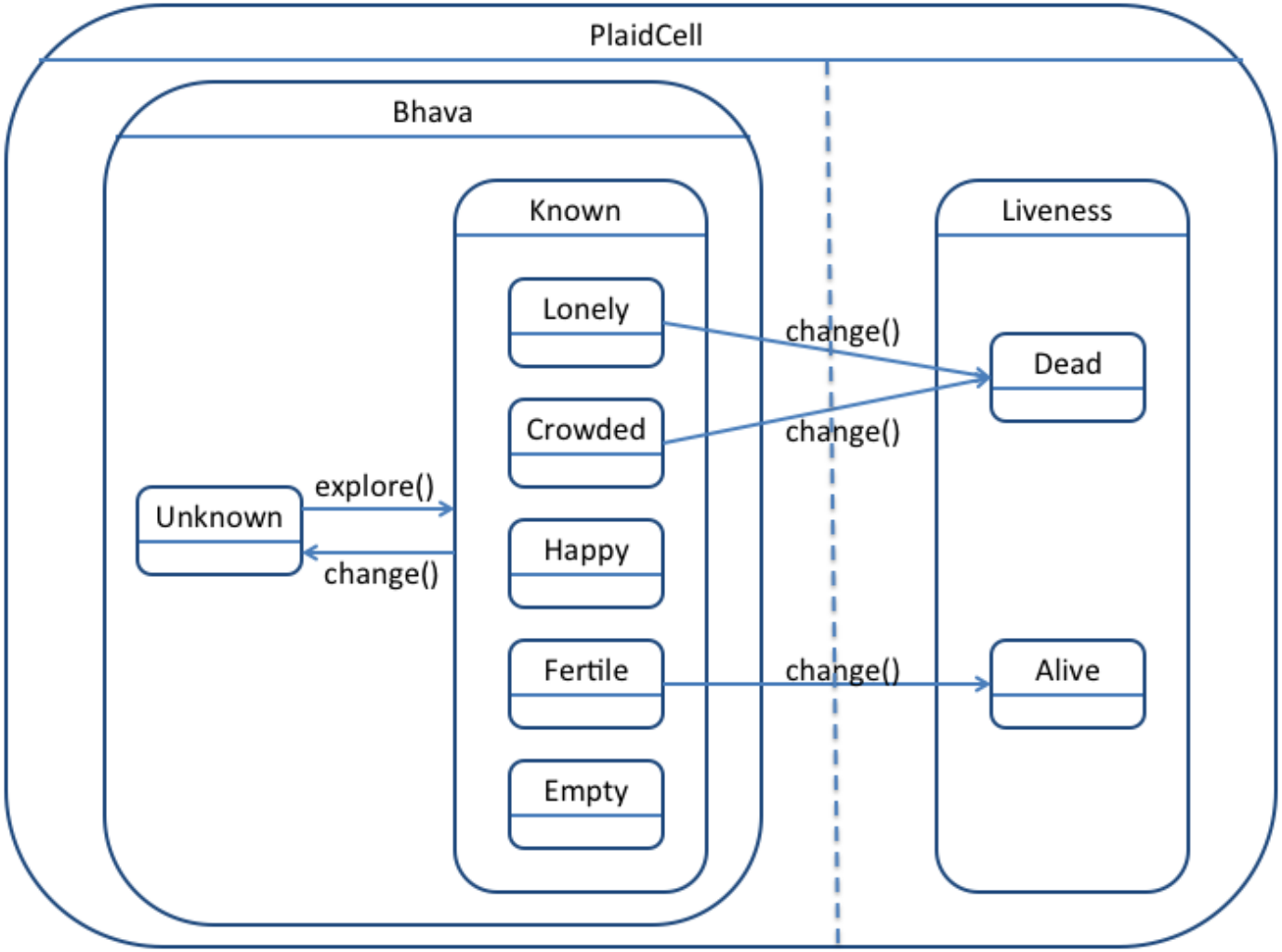
Game Of Life Rules

For each step, iterate over each cell and

- If the cell is alive and
  - Has 0 or 1 Alive neighbors, it dies from Loneliness
  - Has 2 or 3 Alive neighbors, it is Happy and stays alive
  - Has 4 or more Alive neighbors, it dies from Overcrowding
- If the cell is dead and
  - Has 2 or fewer Alive neighbors, it remains Dead
  - Has 3 or more Alive neighbors, it is Fertile and becomes Alive

Game Of Life State Chart



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