

STATE IN THE STATELESS WORLD



HELLO



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Working in a remote team of three software engineers, able to offer outsourcing and consulting services, leadership of development teams and code reviews. Managing everything from application architecture to infrastructure. Delivering projects that are documented, covered with tests, with automated provisioning of local development virtual machines and production servers.

WHY WE NEED STATE?



THE PROBLEM

STATUS OF ENTITIES

Our entities can have life of their own, they start out one way and then after series of events they end up different. We want to store that information.



EASY PEASY

JUST ADD A PROPERTY

```
/**
 * @var string
 */
private $status;

/**
 * @return string
 */
public function getStatus()
{
    return $this->status;
}

/**
 * @param string $status
 */
public function setStatus($status)
{
    $this->status = $status;
}
```



EASY PEASY

JUST CHANGE A PROPERTY AND SAVE IT

```
$em = $this->getDoctrine()->getManager();  
$rep = $em->getRepository(Entity::class);  
  
$entity = $rep->find(1);  
  
$entity->setStatus('paid');  
  
$entityManager->flush();
```



BUT THERE ARE ALSO SOME BUSINESS RULES

“I should be able to publish an article only after lector says it is OK”



“Warehouse should not ship customer orders until they have been fully paid”

“Support can promote users if they have verified their email address”



HOW TO ADD BUSINESS RULES?

There must be a clever way to include
business rules in our system.



STATE PATTERN

INTENT

Allow an object to alter its behaviour when its internal state changes. The object will appear to change its class.

<http://wiki.c2.com/?StatePattern>



STATE PATTERN

USAGE

The State pattern can be used, for instance, to implement a Finite State Machine efficiently and elegantly. This approach can be useful when implementing business processes or workflows.

<https://github.com/sebastianbergmann/state>



STATE PATTERN

```
interface DoorState
{
    public function open();

    public function close();

    public function lock();

    public function unlock();
}
```

Start off with a simple interface listing all possible transitions

STATE PATTERN

```
abstract class AbstractDoorState implements DoorState
{
    public function open()
    {
        throw new IllegalStateException;
    }

    public function close()
    {
        throw new IllegalStateException;
    }

    public function lock()
    {
        throw new IllegalStateException;
    }

    public function unlock()
    {
        throw new IllegalStateException;
    }
}
```

Make all transitions throw
exceptions by default

STATE PATTERN

```
class LockedDoorState extends AbstractDoorState
{
    public function unlock()
    {
        return new ClosedDoorState;
    }
}
```

```
class ClosedDoorState extends AbstractDoorState
{
    public function open()
    {
        return new OpenDoorState;
    }

    public function lock()
    {
        return new LockedDoorState;
    }
}
```

Define states as factories to
other states

STATE PATTERN

```
class Door
{
    private $state;

    public function __construct(DoorState $state)
    {
        $this->setState($state);
    }

    public function open()
    {
        $this->setState($this->state->open());
    }

    public function isOpen()
    {
        return $this->state instanceof OpenDoorState;
    }

    ...

    private function setState(DoorState $state)
    {
        $this->state = $state;
    }
}
```

Add state to your entity



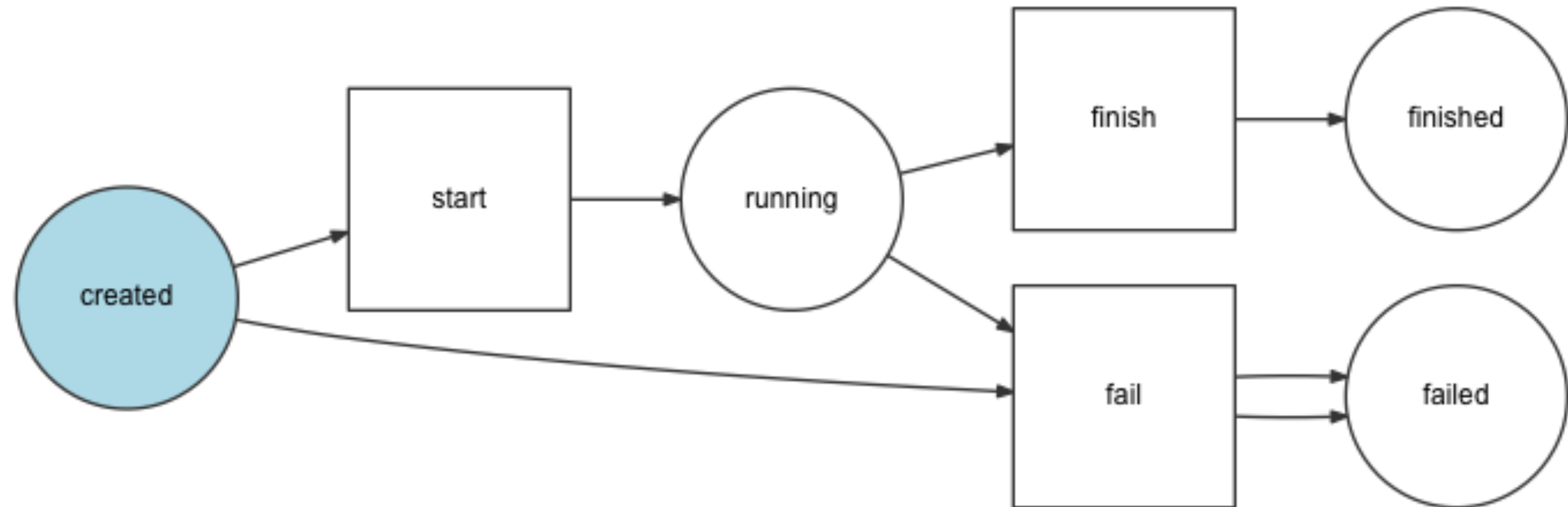
BUT MY ENTITIES ARE ALREADY BIG!

Shoving all that inside your entity makes them fat.

**IS THERE A
BETTER
WAY?**



STATE MACHINES



Defining states and allowed transitions between them

STATE MACHINES PACKAGES

`composer require symfony/workflow`

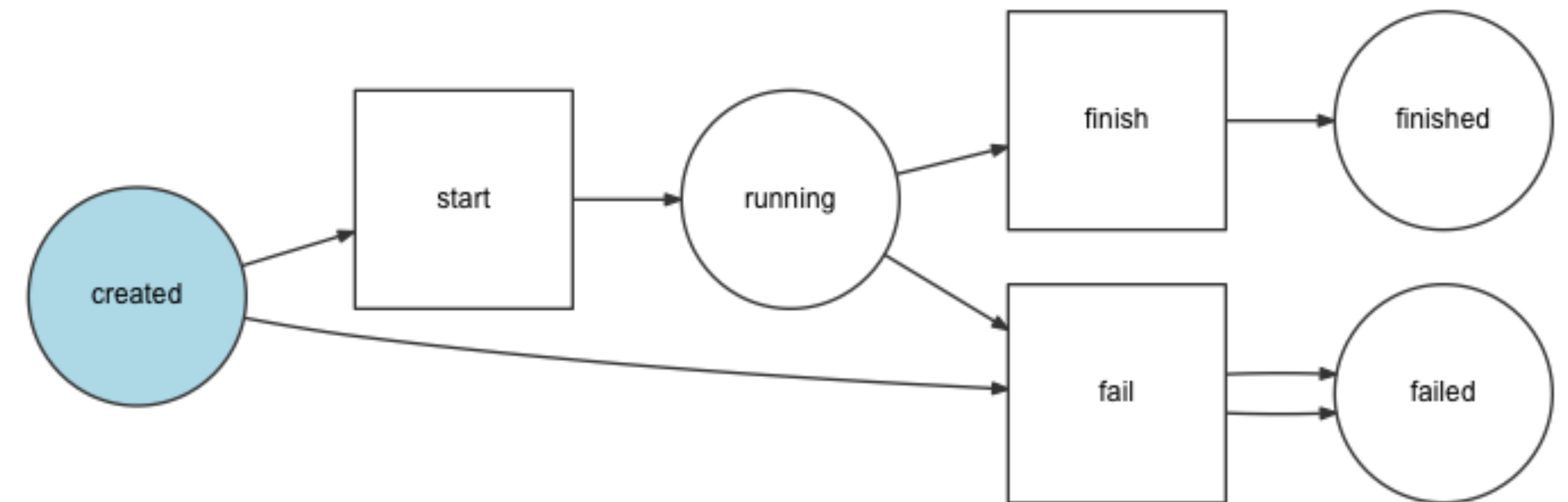
`composer require winzou/state-machine`

`composer require yohang/finite`

Pick one

SYMFONY WORKFLOW CONFIG

```
framework:
  workflows:
    workload:
      type: 'state_machine'
      marking_store:
        type: 'single_state'
        arguments:
          - status
      supports:
        - AppBundle\Entity\Workload
      places:
        - created
        - running
        - finished
        - failed
      transitions:
        start:
          from: created
          to: running
        finish:
          from: running
          to: finished
        fail:
          from: [created, running]
          to: failed
```



SYMFONY WORKFLOW USAGE

```
$workload = new AppBundle\Entity\Workload();  
  
$stateMachine = $this->container->get('state_machine.workload');  
  
if ($stateMachine->can($workload, 'start')) {  
    $stateMachine->apply($workload, 'start');  
}
```

Focus on what needs to be done, not if it can be done!

SYMFONY WORKFLOW EVENTS

```
class Workflow
{
    public function __construct(
        Definition $definition,
        MarkingStoreInterface $markingStore = null,
        EventDispatcherInterface $dispatcher = null,
        $name = 'unnamed'
    )
    ...
}
```

Cool, EventDispatcher is there!

SYMFONY WORKFLOW EVENTS

```
$stateMachine->can($workload, 'start');
```

GUARD

`workflow.guard`

`workflow.[workflow name].guard`

`workflow.[workflow name].guard.[transition name]`

SYMPHONY WORKFLOW EVENTS

```
class WorkloadSubscriber implements EventSubscriberInterface
{
    public function guardStart(GuardEvent $guardEvent)
    {
        ...

        $guardEvent->setBlocked(true);
    }

    public static function getSubscribedEvents()
    {
        return [
            'workflow.workload.guard.start' => ['guardStart']
        ];
    }
}
```

Block it if necessary!

SYMPHONY WORKFLOW EVENTS

```
$stateMachine->apply($workload, 'start');
```

LEAVE

```
workflow.leave  
workflow.[workflow name].leave  
workflow.[workflow name].leave.[transition name]
```

TRANSITION

```
workflow.transition  
workflow.[workflow name].transition  
workflow.[workflow name].transition.[transition name]
```

ENTER

```
workflow.enter  
workflow.[workflow name].enter  
workflow.[workflow name].enter.[transition name]
```

ENTERED

```
workflow.entered  
workflow.[workflow name].entered  
workflow.[workflow name].entered.[transition name]
```

COMPLETED

```
workflow.completed  
workflow.[workflow name].completed  
workflow.[workflow name].completed.[transition name]
```

ANNOUNCE

```
workflow.announce  
workflow.[workflow name].announce  
workflow.[workflow name].announce.[transition name]
```

SYMPHONY WORKFLOW IN TEMPLATES

lmuzinic/web-luka.muzinic.net	2d44505310	1	lmuzinic	2017-04-03 20:13:12	2017-04-03 20:13:14	details
lmuzinic/web-luka.muzinic.net	66823fe034	1	lmuzinic	2017-04-03 20:21:33	2017-04-03 20:21:35	details
lmuzinic/web-luka.muzinic.net	95c2d9eb3e	2	lmuzinic	2017-04-25 11:43:14		details stop

```
{% if workflow_can(workload, 'fail') %}  
  <a class="btn btn-small btn-danger" href="#">stop</a>  
{% endif %}
```

SYMFONY WORKFLOW TEST COVERAGE

```
public function testWorkloadCanNotStart()
{
    $result = $this->stateMachine->can($this->workload, 'start');
    $this->assertFalse($result);
}

public function testWorkloadCanFinish()
{
    $result = $this->stateMachine->can($this->workload, 'fail');
    $this->assertTrue($result);
}

public function testWorkloadCanFail()
{
    $result = $this->stateMachine->can($this->workload, 'finish');
    $this->assertTrue($result);
}
```

```
bash-4.3# vendor/bin/phpunit --testdox
```

```
s\AppBundle\Workload\Running
[x] Workload can not start
[x] Workload can finish
[x] Workload can fail
```

POSSIBLE USAGES

BINARY

enable/disable
open/closed

PUBLISHING

articles (draft, approved, published, archived)

PAYMENTS

subscriptions (active, pending renewal, expired)
order (ordered, shipped, canceled, returned, refunded)

GAMES

character levels (peasant, beginner, warrior, lord)
action state (running, jumping)

USAGES IN THE WILD

`sylius/sylius` using `winzou/state-machine`

So far the list is short

TIPS AND TRICKS

“Discuss it with
your team/client”

“Treat them same
as serialising”

“Leave a paper
trail”

FINITE STATE MACHINES

JS

```
npm install javascript-state-machine
```

Python

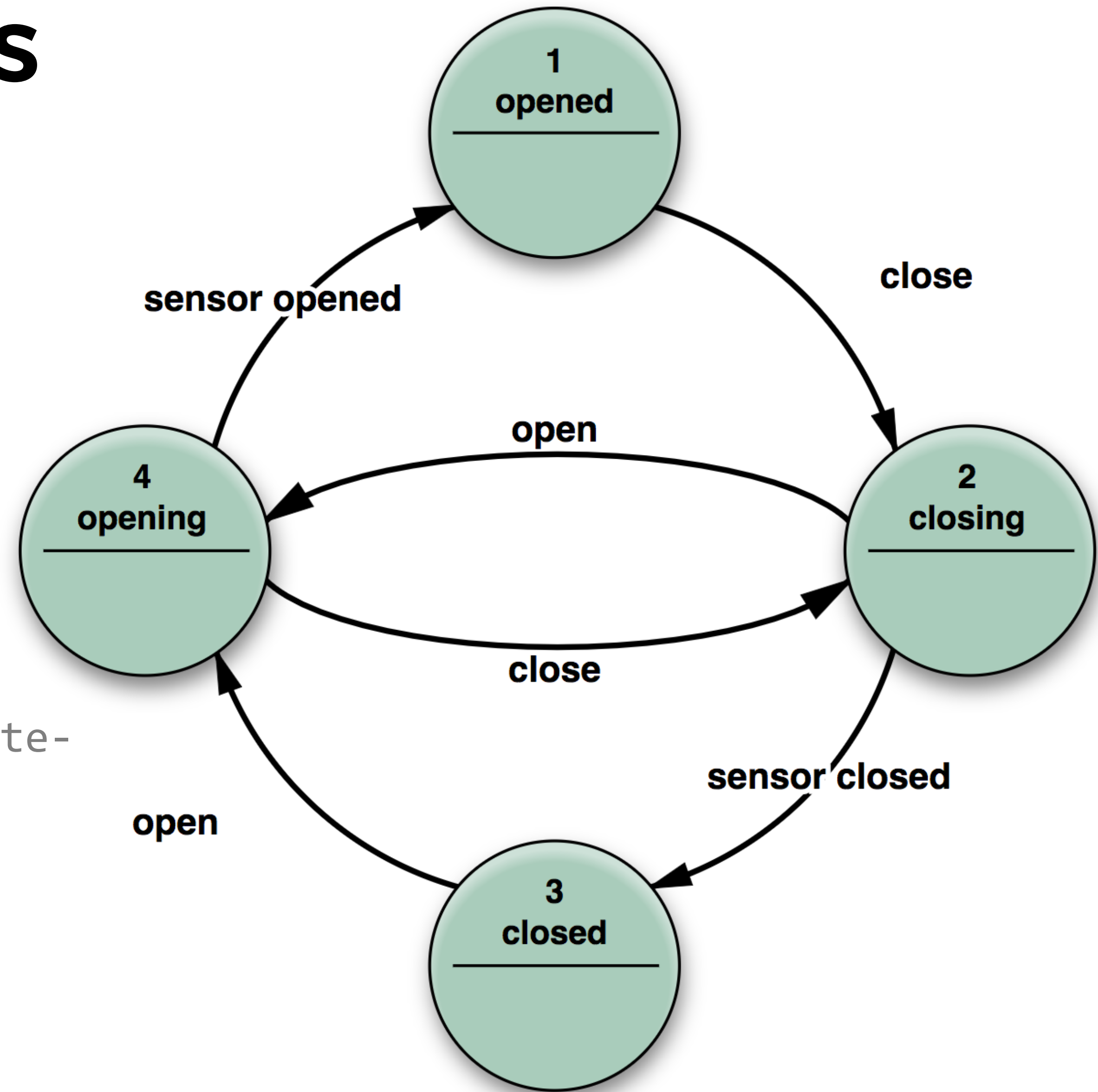
```
pip install transitions
```

Ruby

```
gem install state_machine
```

PostgreSQL

<http://felixge.de/2017/07/27/implementing-state-machines-in-postgresql.html>



WHAT DID WE LEARN?



RECAP

State machines are cool



STORE STATE SOMEWHERE

Models are good for storing state and bad for business logic how to transition between states.

Group that logic in one place, if possible. Preferably through state machines.



STATE PATTERN

The object will appear to change its class.

Look at sebastianbergmann/state as an excellent example of state pattern.



STATE MACHINES

Do not reinvent the wheel, use available packages if possible.

Test them as every other piece of code.

Enforce their usage throughout project.

QUESTIONS?



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