



I'm a PHP developer

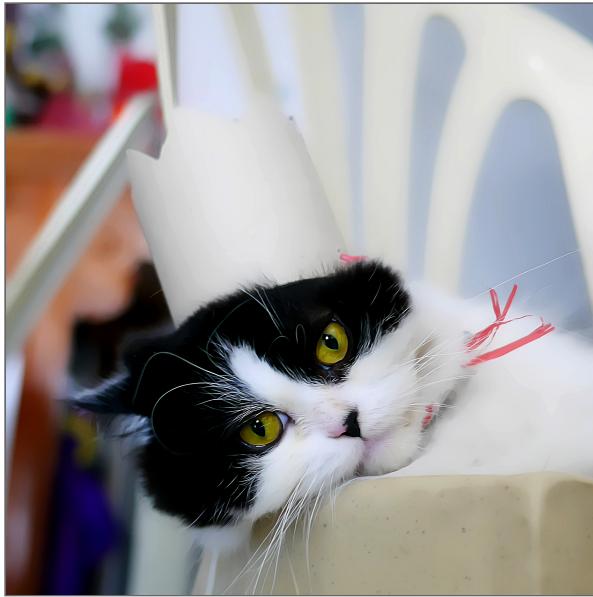
Organizer of Triangle PHP and  
Director of WWCode  
Raleigh/Durham

I work at a company that builds  
tools for network security threat  
assessment



## WHAT WE'LL COVER:

- Processes from paper to web forms
- What is Event Sourcing?
- Introducing what this code looks like (LIGHT)
- Advantages and Disadvantages



© PHOTO BY TRAVEL  
ORIENTED

## SIGN THE WAIVER

I, \_\_(state your name)\_\_, will not blame Emily if Event Sourcing makes my head explode. I promise I will not leave a bad review. And I promise to be kind to myself as I learn new things.

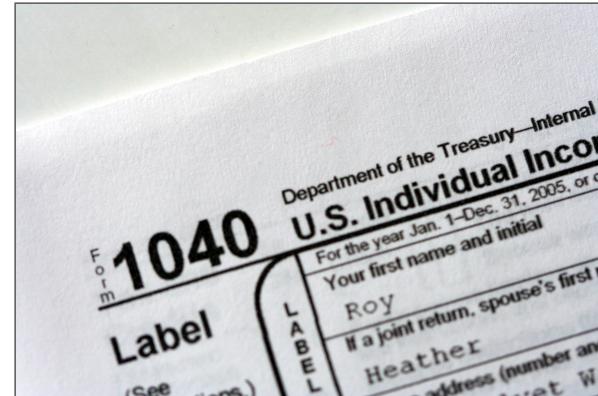


*Emily will not be held responsible if your head explodes*

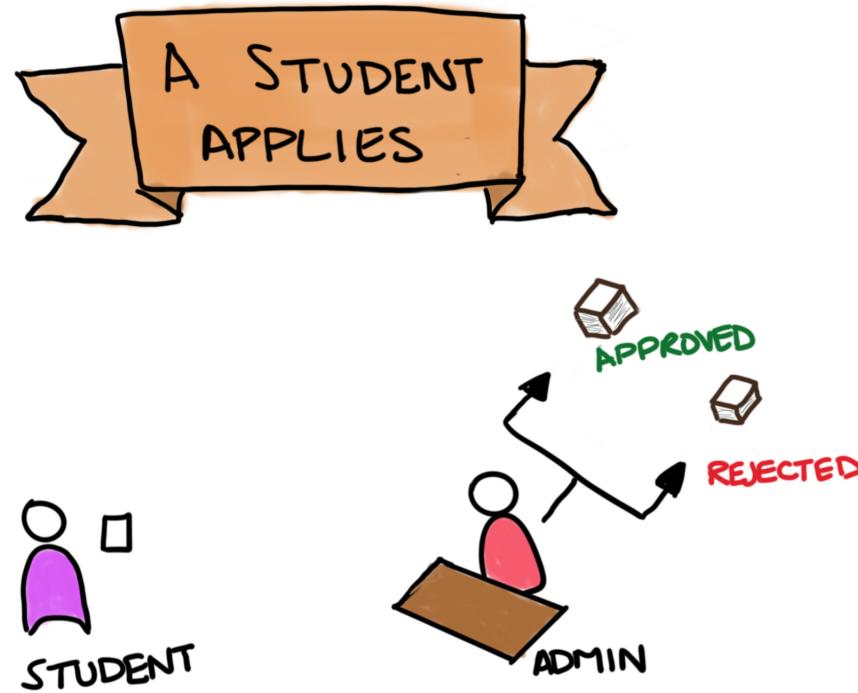
# FORMS

A lot of our systems were built to replace paper processes

They often closely map to this physical form.



© PHOTO BY AIDAN MORGAN

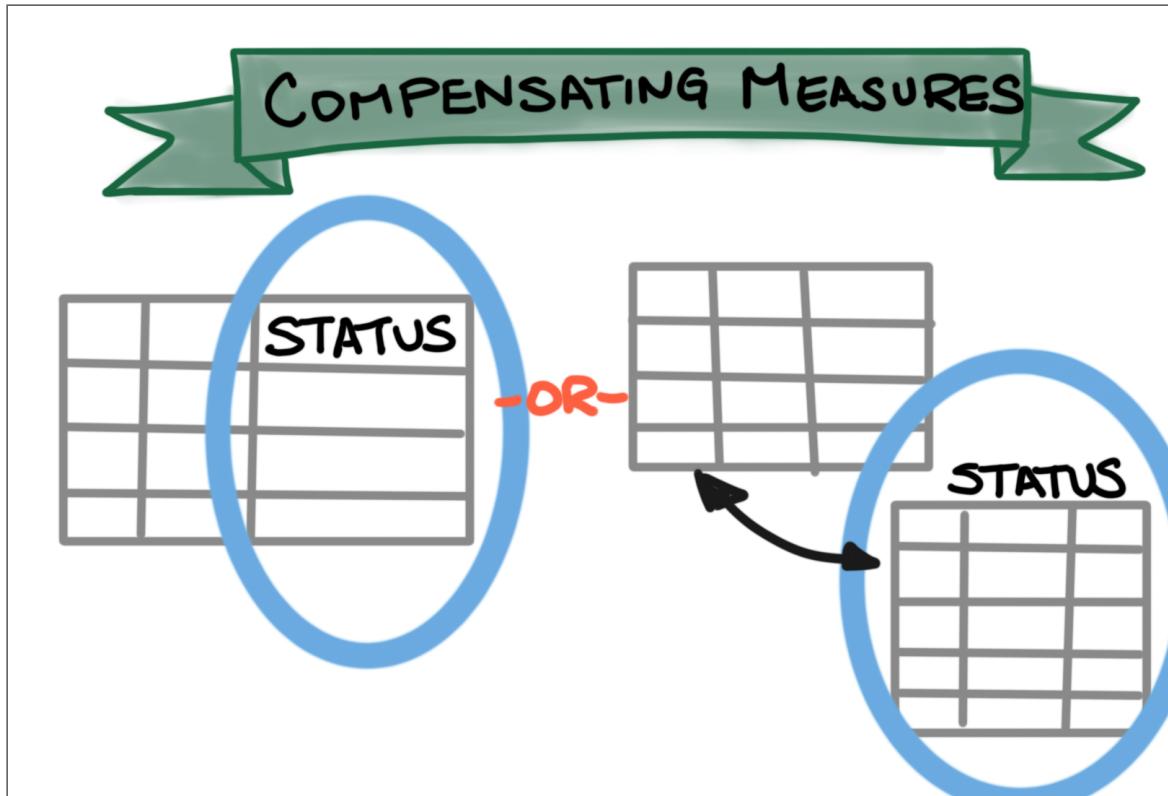


# PAPER FORMS HANDLING STATE

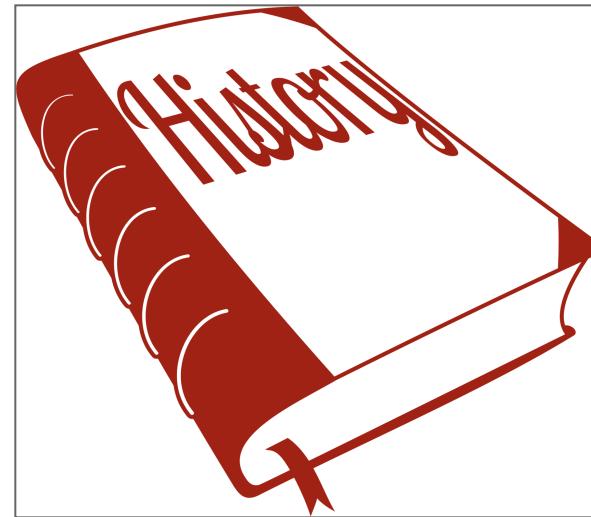


Status labels are like a rubber stamp

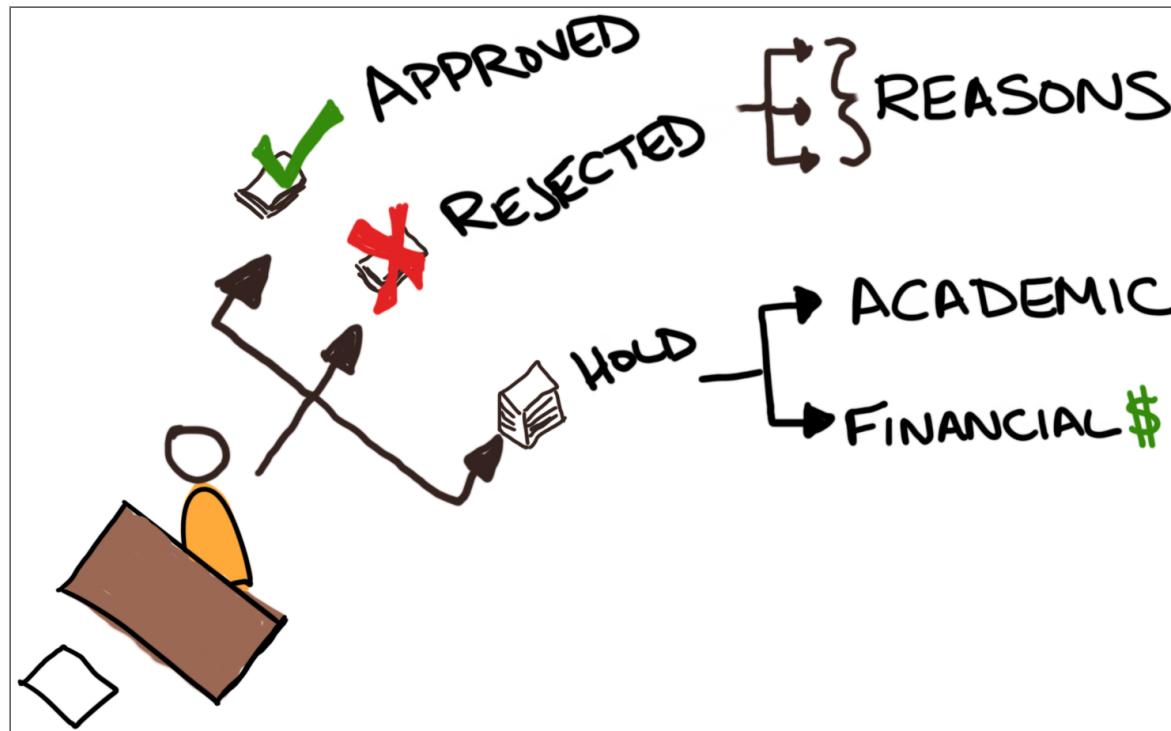
Status doesn't always communicate why or what happened



# WHY ARE THEY IN THE CURRENT STATE?



# HOW WORKFLOWS BECOME COMPLEX



# PAPER FORMS HANDLING STATE



Piles indicate status of the form

# A SIMPLE STATUS DROP-DOWN

▼

# A "SIMPLE" STATUS DROP-DOWN

RECEIVED  
CANCELLED  
COURSE CANCELLED  
COURSE NOT APPROVED  
CPC DENIED  
CPC NOT APPROVED  
CPC PENDING TRANSCRIPT  
CPC PROCESSING  
DENIED  
DROPPED AFTER CENSUS  
DROPPED BEFORE CLASSES BEGUN  
DROPPED BETWEEN BEGINNING OF CLASS AND CENSUS DATE  
DROPS/WITHDRAWALS AT SITES  
ECE ON CAMPUS STUDENTS  
ENROLLMENT CANCELLED  
EOL APPROVED  
EOL MISC  
NEW STUDENT REGISTRATION  
PENDING ON CAMPUS REQUEST  
ON CAMPUS STUDENT NOT APPROVED  
PENDING CASHIER HOLD  
PENDING EOL APPROVAL  
PENDING INSTRUCTOR APPROVAL  
PENDING INTERNATIONAL STUDENT  
PENDING NDS OPEN ENROLLMENT  
PENDING OIS VISA STUDENT  
PENDING PERMANENT RESIDENT  
PENDING TERM ADVISEMENT HOLD  
PENDING TRANSCRIPT  
PENDING TUITION PREPAYMENT  
PREAPPROVED RETURNING  
PROCESSING NDS  
PROCESSING SITE  
PROCESSING Z  
PROJECT MESSAGE - MAE 586  
PROJECT MESSAGE - NE 693  
REGISTERED

REGISTERED  
REGISTERED ASHEVILLE  
REGISTERED HAVELOCK  
REGISTERED WILMINGTON  
SITE APPROVAL: ASHEVILLE  
SITE APPROVAL: HAVELOCK  
SITE APPROVAL: WILMINGTON  
SITE NOT APPROVED  
SWAPPED OUT  
TRANSCRIPT APPROVED  
WITHDRAWN

# SOMETHING HAPPENED

# SOMETHING HAPPENED

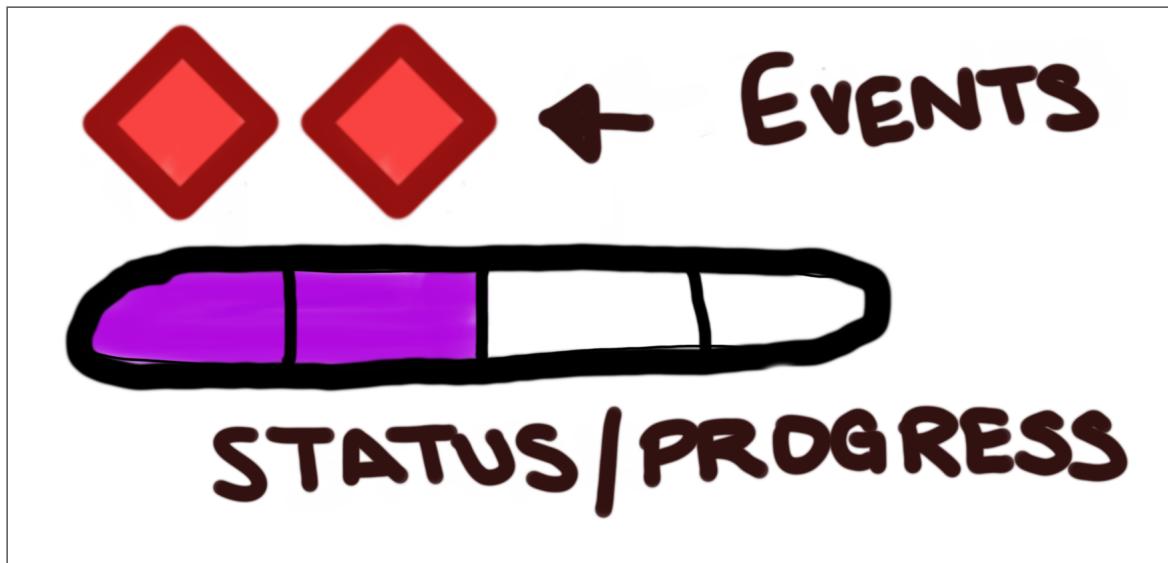
Status is a reflection of something that happened

There is ONE of each status + reasons/details

Events can record what happened



# THE REQUEST DOESN'T GET STUCK



# ENTER EVENT SOURCING

## DEFINITION EVENT SOURCING

The fundamental idea of Event Sourcing is that of ensuring **every change to the state** of an application **is captured in an event object**, and that these event objects are themselves stored in the sequence they were applied for the same lifetime as the application state itself.

- Martin Fowler

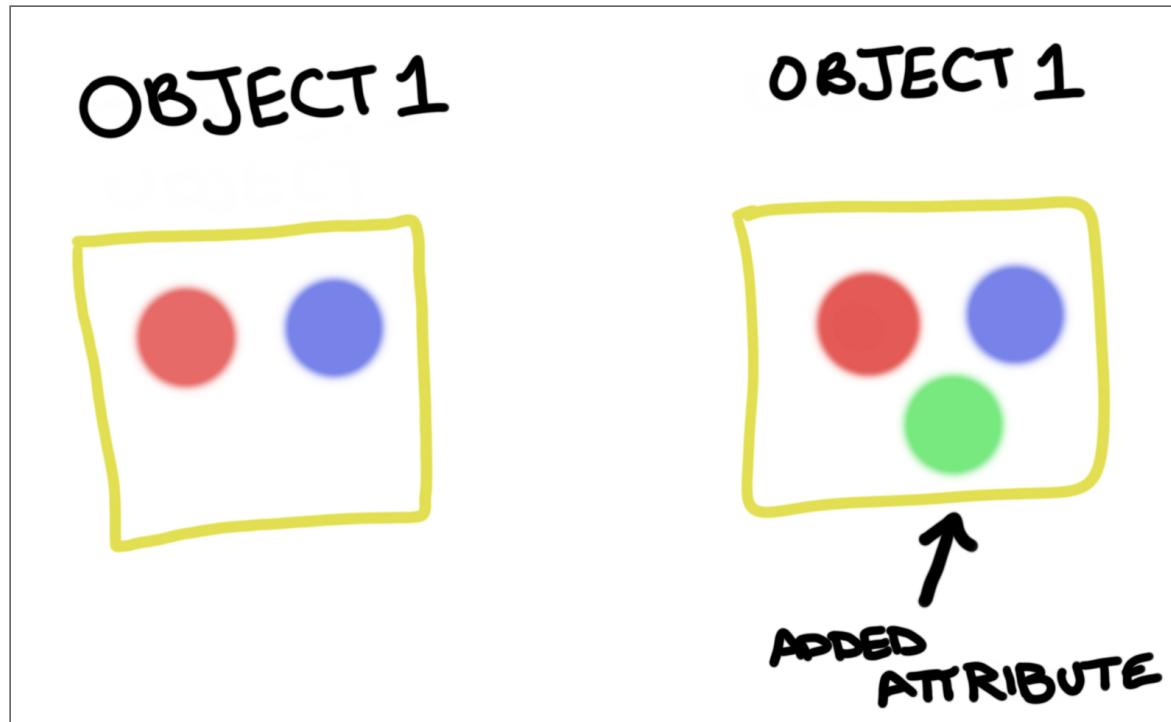
## WHAT'S IMPORTANT ABOUT EVENTS

- Events
- Details of the Event (attributes)
- Order/Sequence

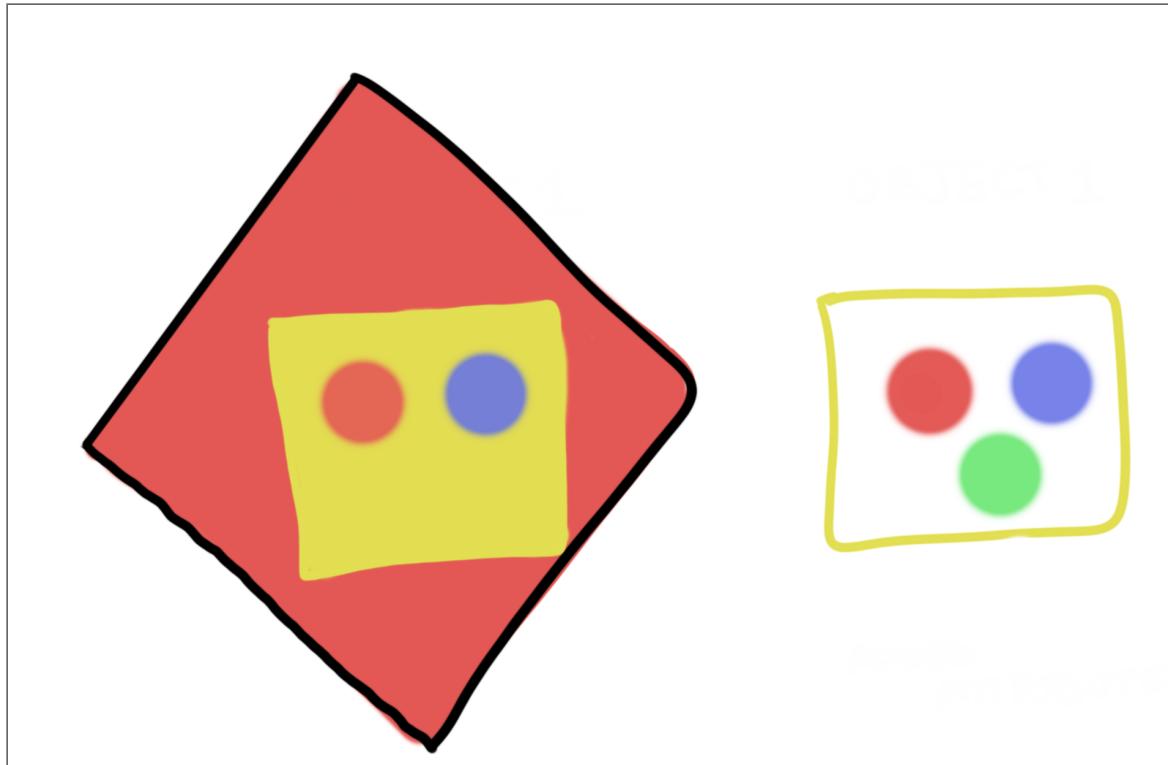
## RULES FOR EVENTS

- Events are usually named as past-tense verbs
- RARELY changed
- Never deleted
- Have attributes that are values
  - never an aggregate root
  - never a model/collection/object

## THE OBJECT COULD CHANGE



## IF WE STORED IT IN AN EVENT...



## EVENTS ARE NOT BIONIC



WE CAN REBUILD HIM

We have the technology.

fakeposters.com

**THE FACT THAT AN EVENT HAPPENED DOESN'T EVER CHANGE EVEN THOUGH THE BEHAVIOR AROUND IT MAY HAVE**

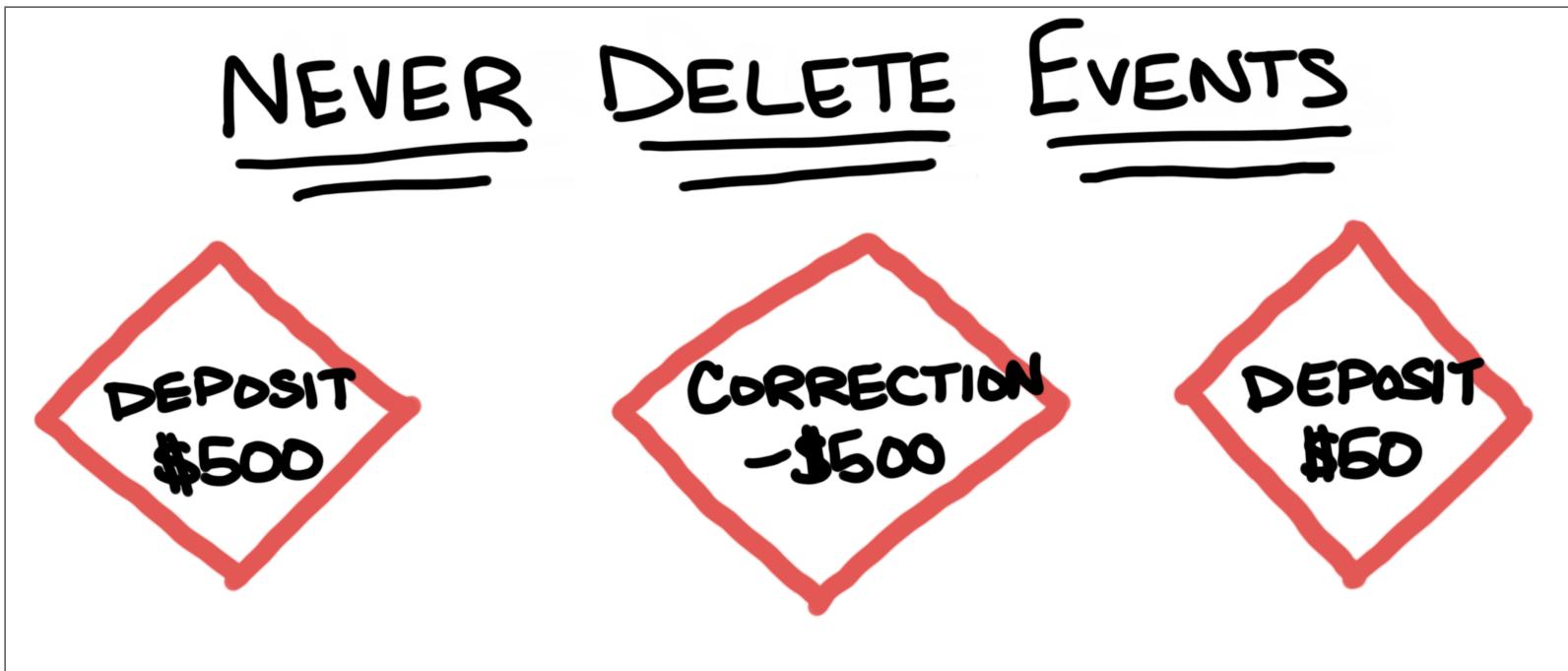
## WHY EVENTS?

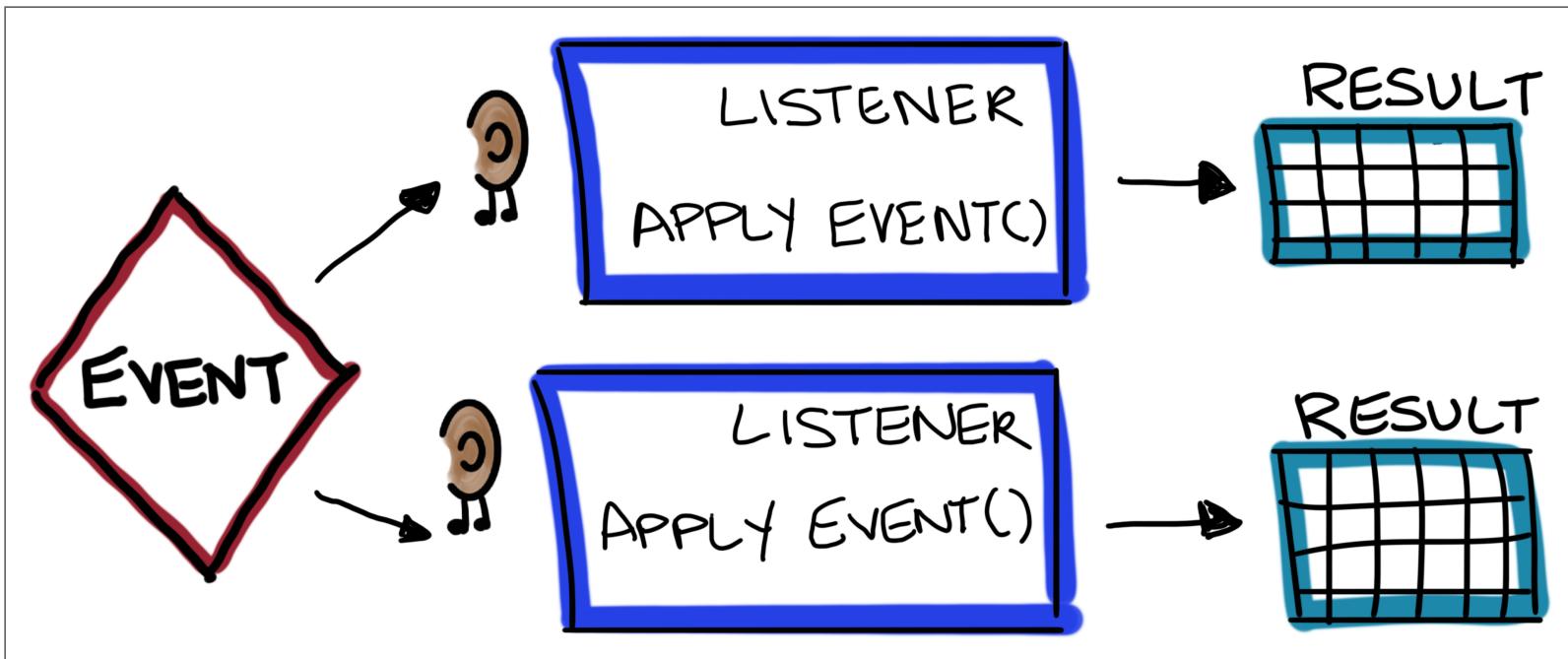
state transitions are important

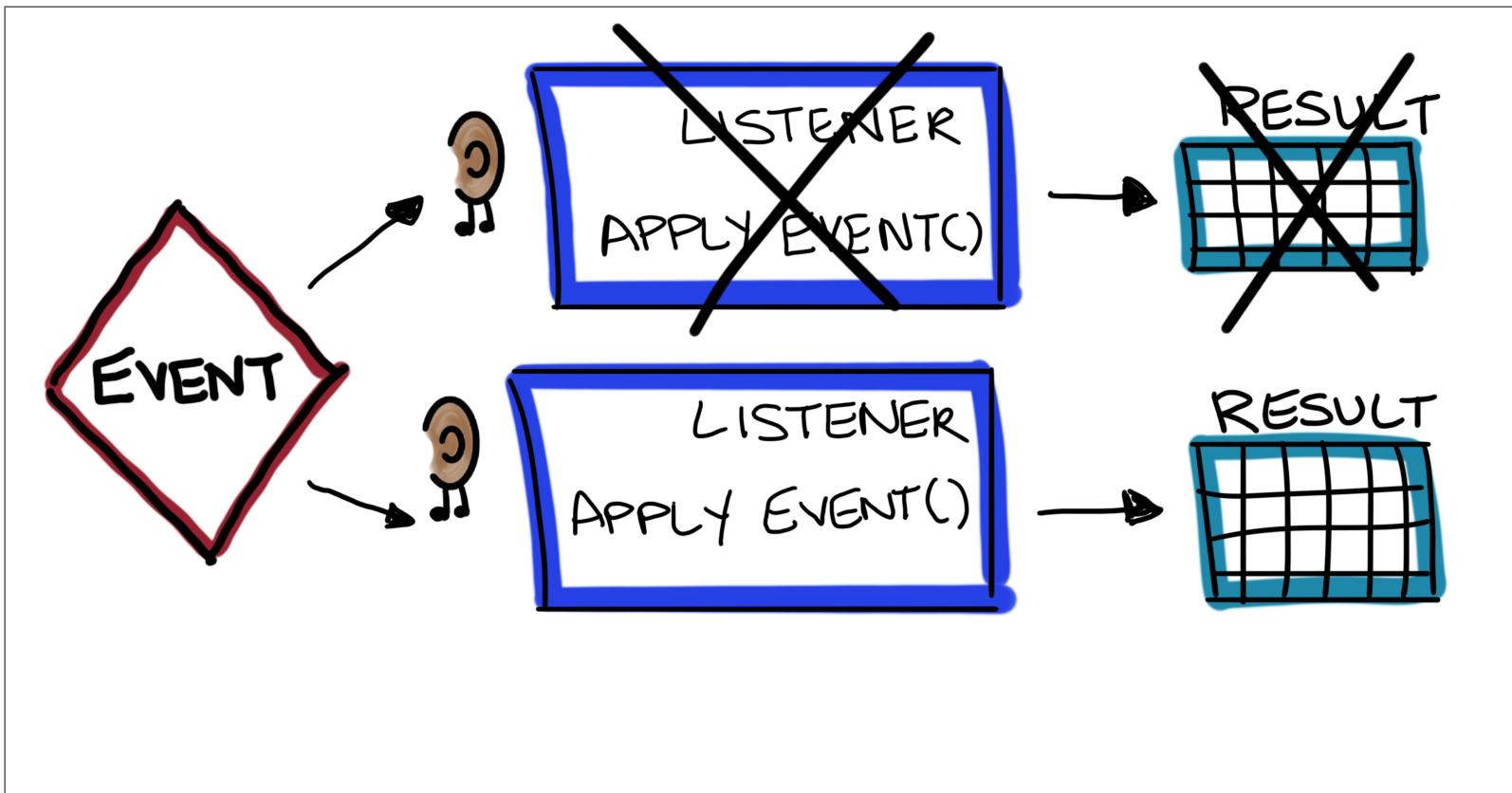
We need an audit log and proof of state

This history is more important than the current state

Able to replay these events to rebuild state







## Events don't change

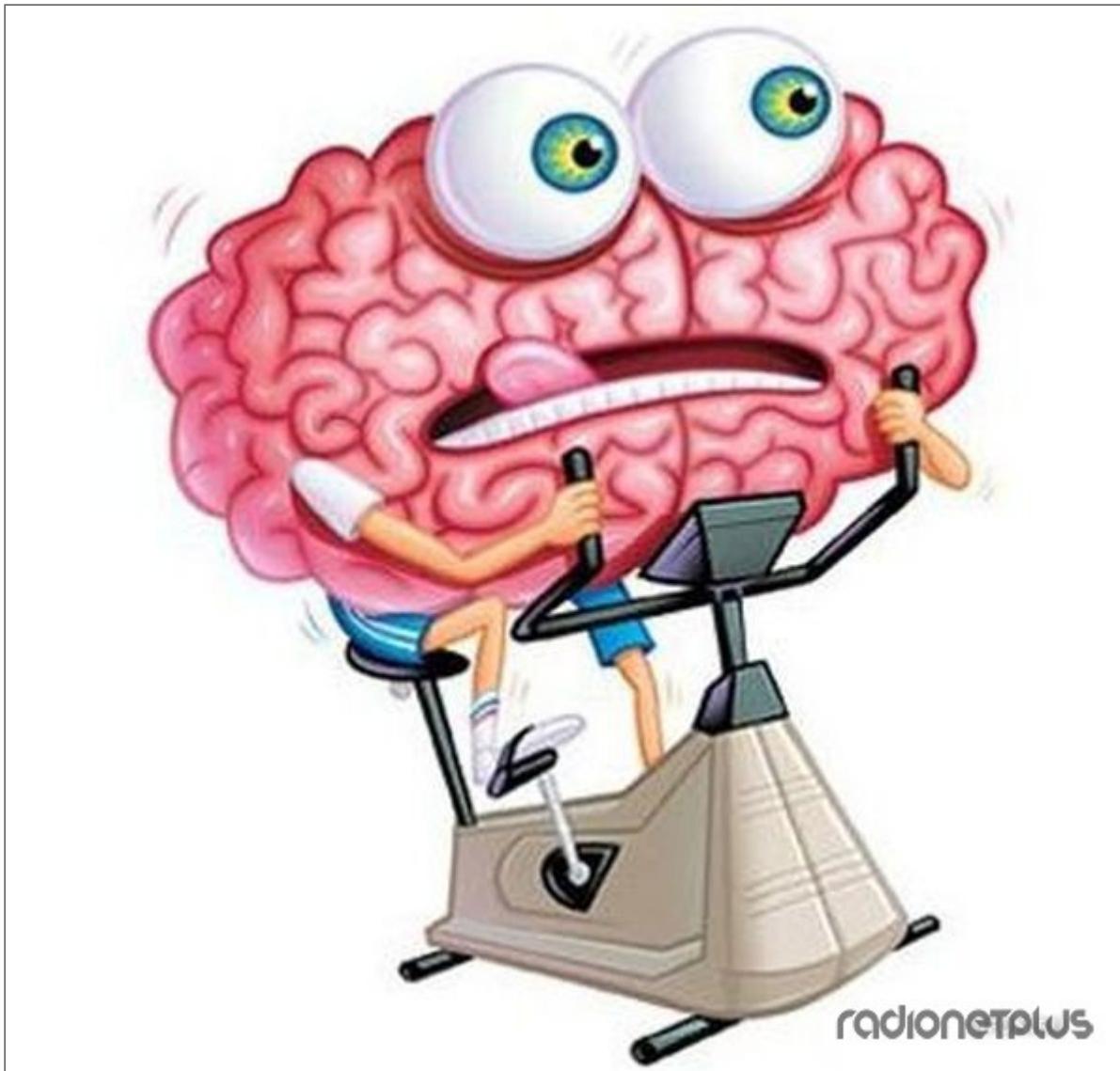
The part of the code that will change is most likely the result that follows that event.

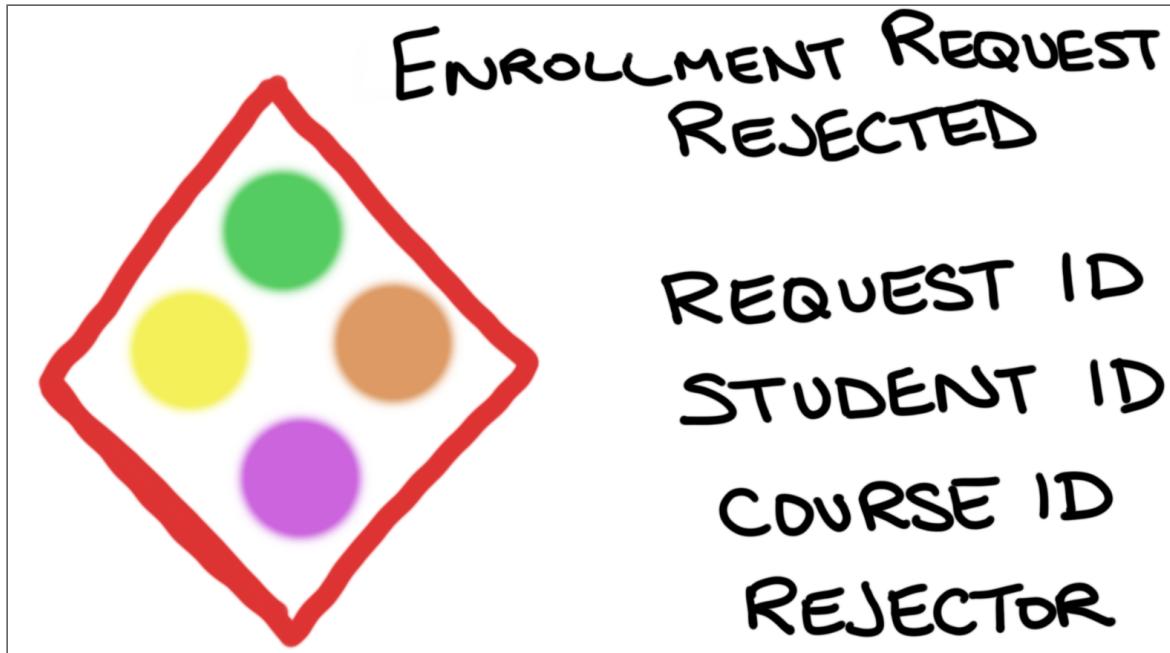
The structure of the resulting data is more likely to change than the behavior

# THE CODE

There are many classes involved:

- Events
- Domain Message
- Classes with Listeners
  - Projections
  - Read Models
- Commands & Handlers (CQRS)





```
<?php

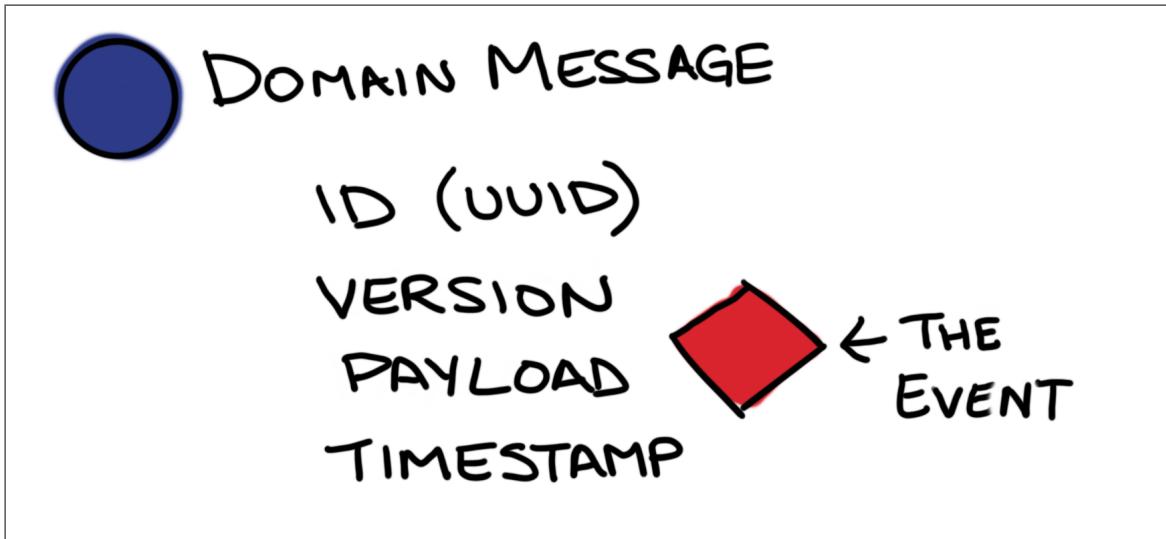
namespace App\Enrollment\Domain\Events;

use App\Enrollment\Domain\CourseOfferingId;
use App\Enrollment\Domain\StudentId;
use App\Support\Domain\Uuid;
use App\Support\EventHandling\Event;

class EnrollmentRequestRejected implements Event
{
    /**
     * @var Uuid
     */
    public $enrollmentRequestId;

    /**
     * @var StudentId
     */
    public $studentId;

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



```
<?php

namespace App\Support\Domain;

use App\Support\EventHandling\Event;
use DateTime;

class DomainMessage
{

    /**
     * @var string
     */
    private $streamId;

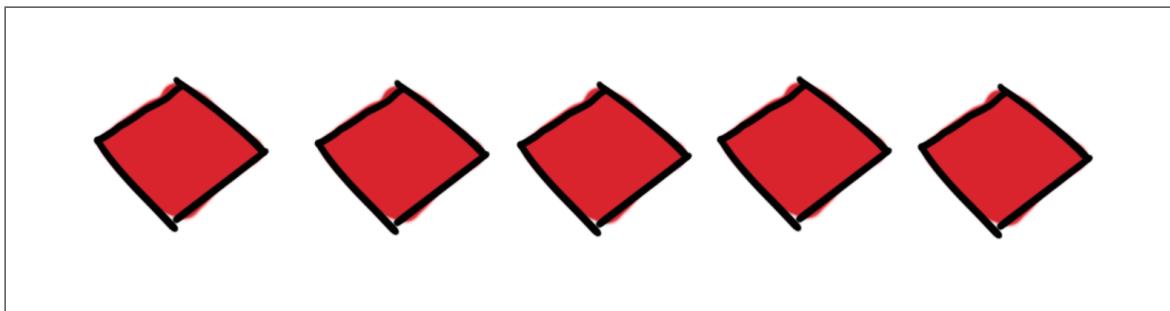
    /**
     * @var int
     */
    private $version;

    /**
     * @var Event
     */
}
```

# EVENT STORE

A domain specific database

A functional database based on a publish-subscribe messages pattern



## EVENTS TABLE - NO WRAPPER

Field	Type	Length	U
id	INT	11	
aggregate_type	VARCHAR	255	
aggregate_id	VARCHAR	255	
payload	LONGBLOB		
occurred_on	TIMESTAMP		

# EVENTS TABLE - NO WRAPPER

id	aggregate_type	aggregate_id	payload
1	ITECS\Scholarships\StudentApplication\Domain\Student\Student	6666661145	O:77:"ITECS\Scholarships\StudentApplication\Domain\Application\A
2	ITECS\Scholarships\StudentApplication\Domain\Student\Student	222222222	O:77:"ITECS\Scholarships\StudentApplication\Domain\Application\A
3	ITECS\Scholarships\StudentApplication\Domain\Student\Student	222222223	O:77:"ITECS\Scholarships\StudentApplication\Domain\Application\A
4	ITECS\Scholarships\StudentApplication\Domain\Student\Student	222222321	O:77:"ITECS\Scholarships\StudentApplication\Domain\Application\A
5	ITECS\Scholarships\StudentApplication\Domain\Student\Student	222222600	O:77:"ITECS\Scholarships\StudentApplication\Domain\Application\A
6	ITECS\Scholarships\StudentApplication\Domain\Student\Student	222222652	O:77:"ITECS\Scholarships\StudentApplication\Domain\Application\A
7	ITECS\Scholarships\StudentApplication\Domain\Student\Student	222222690	O:77:"ITECS\Scholarships\StudentApplication\Domain\Application\A
8	ITECS\Scholarships\StudentApplication\Domain\Student\Student	222223002	O:77:"ITECS\Scholarships\StudentApplication\Domain\Application\A
9	ITECS\Scholarships\StudentApplication\Domain\Student\Student	222222224	O:77:"ITECS\Scholarships\StudentApplication\Domain\Application\A
10	ITECS\Scholarships\StudentApplication\Domain\Student\Student	222222225	O:77:"ITECS\Scholarships\StudentApplication\Domain\Application\A
11	ITECS\Scholarships\StudentApplication\Domain\Student\Student	222222226	O:77:"ITECS\Scholarships\StudentApplication\Domain\Application\A
12	ITECS\Scholarships\StudentApplication\Domain\Student\Student	222222228	O:77:"ITECS\Scholarships\StudentApplication\Domain\Application\A
13	ITECS\Scholarships\StudentApplication\Domain\Student\Student	222222229	O:77:"ITECS\Scholarships\StudentApplication\Domain\Application\A
14	ITECS\Scholarships\StudentApplication\Domain\Student\Student	222222230	O:77:"ITECS\Scholarships\StudentApplication\Domain\Application\A
15	ITECS\Scholarships\StudentApplication\Domain\Student\Student	222222238	O:77:"ITECS\Scholarships\StudentApplication\Domain\Application\A
33	ITECS\Scholarships\StudentApplication\Domain\Student\Student	661878	O:85:"ITECS\Scholarships\Foundation\Domain\IncomeAccount\Initia
34	ITECS\Scholarships\Foundation\Domain\IncomeAccount\IncomeAccount	661878	O:70:"ITECS\Scholarships\Foundation\Domain\IncomeAccount\Amo
35	ITECS\Scholarships\Foundation\Domain\IncomeAccount\IncomeAccount	677730	O:85:"ITECS\Scholarships\Foundation\Domain\IncomeAccount\Initia
36	ITECS\Scholarships\Foundation\Domain\IncomeAccount\IncomeAccount		

```
0:92:"ITECS\Scholarships\Selection\Domain\Scholarship\AwardWasAssignedToCandidateByComm
s:6:"amount"      ;0:39:   "ITECS\Scholarships\Common\Values\Amount":1:{  
    s:46:"ITECS\Scholarships\Common\Values\Amountmoney"          ;  
    0:11:       "Money\Money":2:{  
        s:19:"Money\Moneyamount"           ;i:285000            ;s:21:"Money\Money"  
        0:14:         "Money\Currency":1:{  
            s:20:"Money\Currencyname"           ;s:3:"USD"          ;  
        }  
    }  
}    s:11:"applicantId"      ;  
s:9:"222222235"      ;  
s:13:"scholarshipId"      ;  
0:61:      "ITECS\Scholarships\Selection\Domain\Scholarship\ScholarshipId":1:{  
    s:76:"ITECS\Scholarships\Selection\Domain\Scholarship\ScholarshipIdscholarshipI  
    i:360      ;  
}    s:17:"selectionCriteria"    ;0:59:   "ITECS\Scholarships\Selection\Domain\Sch
s:69:"ITECS\Scholarships\Selection\Domain\Scholarship\CriteriaSetcriteria"      ;  
    i:0          ;0:93:         "ITECS\Scholarships\Selection\Domain\Scholarsh
    s:106:"ITECS\Scholarships\Selection\Domain\Scholarship\SelectionCriteria\Me  
    i:0          ;0:43:         "ITECS\Scholarships\Co
    s:50:"ITECS\Scholarships\Support\Types\CodedValueLabel"
}
```

# EVENTS TABLE - WITH DOMAIN MESSAGE

Field	Type	Length
id	INT	10
stream_id	VARCHAR	255
version	INT	10
payload	TEXT	
recorded_on	INT	10
type	VARCHAR	255

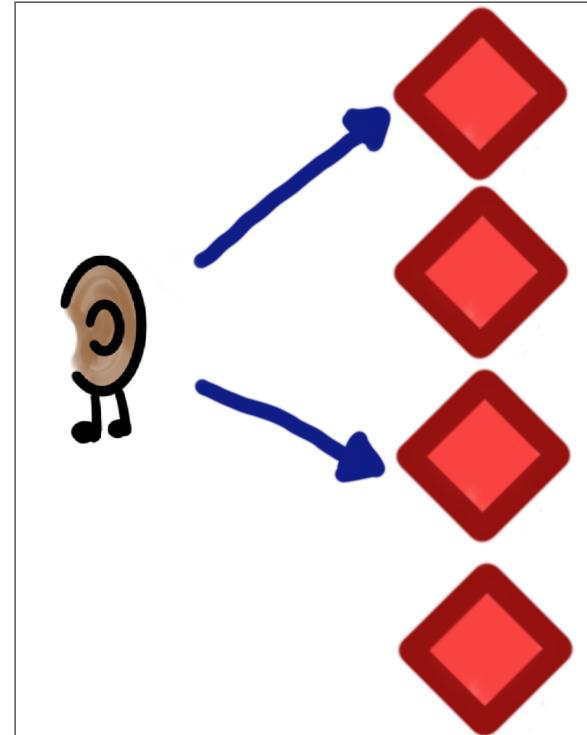
# EVENTS TABLE - WITH DOMAIN MESSAGE

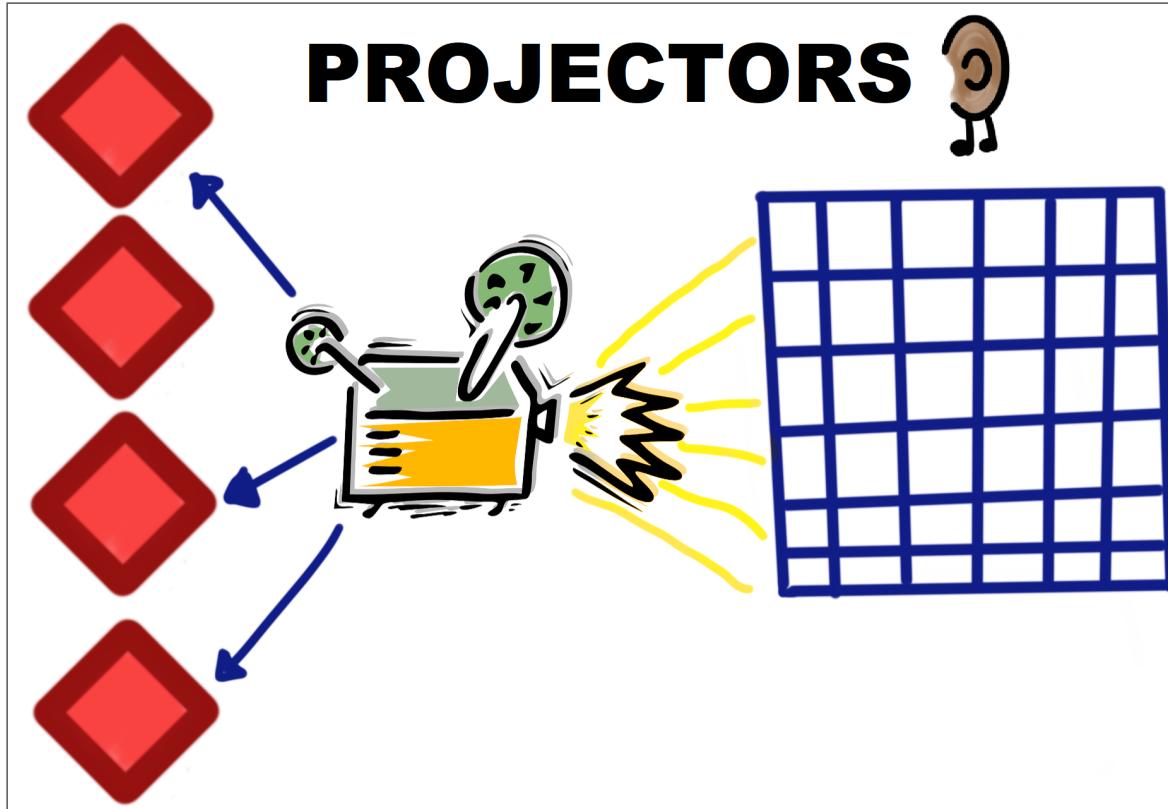
id	stream_id	version	payload	recorded_on	type
1	sis.students	0	{"namespace":"App\\StudentInformation\\Entities\\Student","identity":"ophe...}	1469491200	App\StudentInformation\Domain\Events\EntityCreated
2	sis.students	1	{"namespace":"App\\StudentInformation\\Entities\\Student","identity":"mari...}	1469491200	App\StudentInformation\Domain\Events\EntityCreated
3	sis.students	2	{"namespace":"App\\StudentInformation\\Entities\\Student","identity":"breit...}	1469491200	App\StudentInformation\Domain\Events\EntityCreated
4	sis.students	3	{"namespace":"App\\StudentInformation\\Entities\\Student","identity":"russ...}	1469491200	App\StudentInformation\Domain\Events\EntityCreated
5	sis.students	4	{"namespace":"App\\StudentInformation\\Entities\\Student","identity":"smit...}	1469491200	App\StudentInformation\Domain\Events\EntityCreated
6	sis.students	5	{"namespace":"App\\StudentInformation\\Entities\\Student","identity":"kiera...}	1469491200	App\StudentInformation\Domain\Events\EntityCreated
7	sis.students	6	{"namespace":"App\\StudentInformation\\Entities\\Student","identity":"zack...}	1469491200	App\StudentInformation\Domain\Events\EntityCreated
8	sis.students	7	{"namespace":"App\\StudentInformation\\Entities\\Student","identity":"rand...}	1469491200	App\StudentInformation\Domain\Events\EntityCreated
9	sis.students	8	{"namespace":"App\\StudentInformation\\Entities\\Student","identity":"broo...}	1469491200	App\StudentInformation\Domain\Events\EntityCreated
10	sis.students	9	{"namespace":"App\\StudentInformation\\Entities\\Student","identity":"moh...}	1469491200	App\StudentInformation\Domain\Events\EntityCreated

```
{  
    "namespace": "App\\StudentInformation\\Entities\\Student",  
    "identity": "ophelia.zieme",  
    "data": {  
        "id": "ophelia.zieme",  
        "ferpa": "0",  
        "personal": {  
            "first_name": "Evan",  
            "middle_name": "Jalon",  
            "last_name": "Armstrong",  
            "dob": "2007-06-16",  
            "gender": "M"  
        },  
        "contact": {  
            "student_id": "000811740",  
            "username": "ophelia.zieme",  
            "email": "ophelia.zieme@ncsu.edu",  
            "phone": "935-516-1228"  
        },  
        "address": {  
            "physical": {  
                "street1": "707 Nasir Pass",  
                "street2": "Jett Loop",  
                "street3": null  
            }  
        }  
    }  
}
```

# LISTENERS

- Have methods that handle the events they care about
- Ignore the rest
- Each handle method outlines the steps to follow after an event occurs





# PROJECTOR

```
<?php

namespace App\Enrollment\ReadModel;

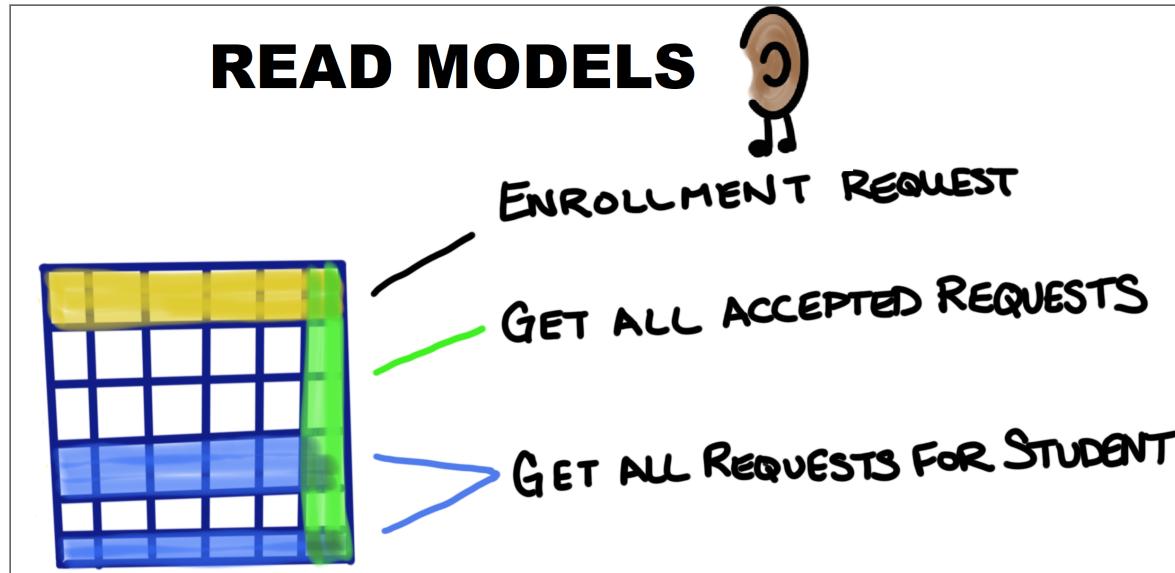
use App\Enrollment\Domain\Events\EnrollmentRequestRejected;
use App\Enrollment\Domain\Events\StudentRequestedEnrollment;
use App\Support\ReadModel\Replayable;
use App\Support\ReadModel\SimpleProjector;
use Illuminate\Database\Schema\Blueprint;
use Illuminate\Database\Connection;

class EnrollmentRequestProjector extends SimpleProjector implements Replayable
{

    /**
     * @var Connection
     */
    private $connection;

    /**
     * @var string table we're playing events into
     */
}
```





# READ MODEL

```
<?php

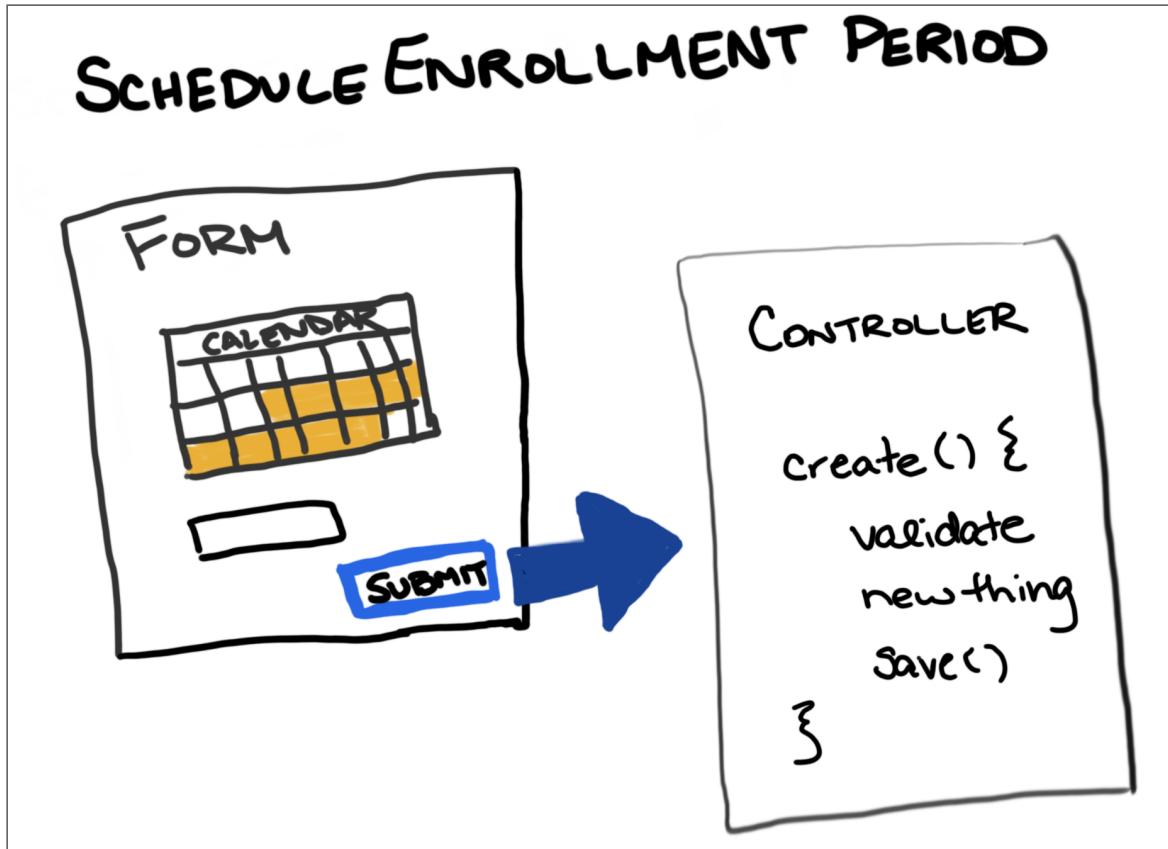
namespace App\Enrollment\ReadModel;

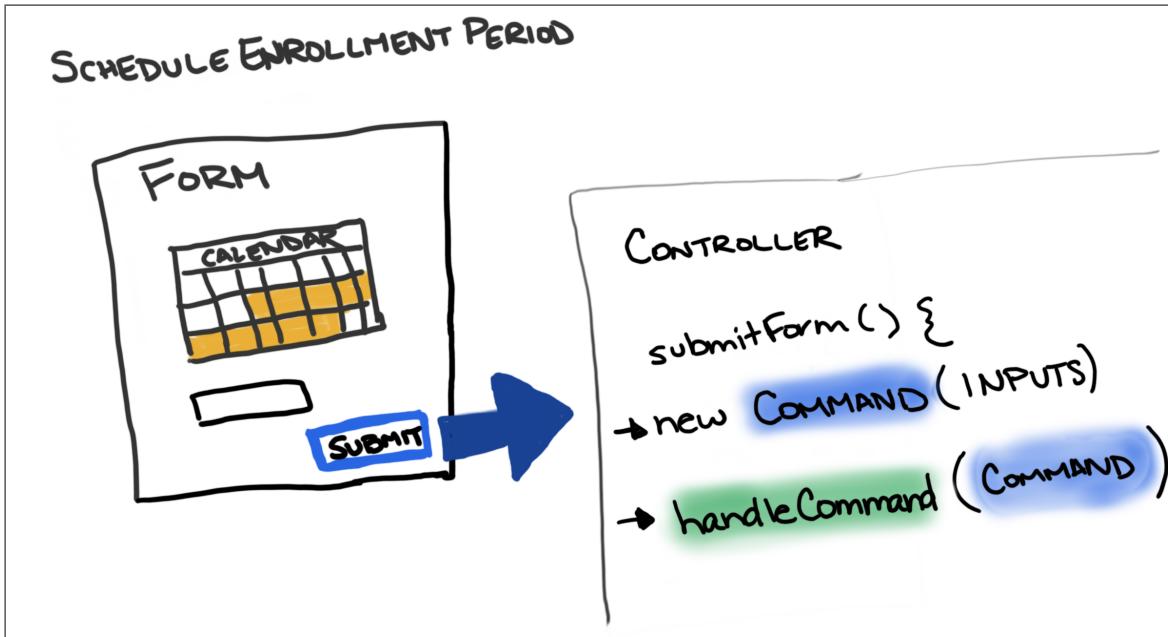
use Carbon\Carbon;
use Illuminate\Database\Eloquent\Model;

/**
 * @codeCoverageIgnore
 */
class EnrollmentRequest extends Model
{
    protected $table = 'proj_enrollment_requests';
    public $incrementing = false;
    public $timestamps = false;

    public static function current()
    {
        return static::where('student_id', auth()->user()->name)->get();
    }

    public static function lookupRequestsFor($username)
    {
        return static::where('student_id', $username)->get();
    }
}
```





# COMMANDS

```
<?php

namespace App\Enrollment\Commands;

use App\Support\CommandHandling\Command;
use App\Common\SemesterTerm;
use DateTime;
use Illuminate\Http\Request;

class ScheduleEnrollmentPeriod implements Command
{
    const DATE_FORMAT = DateTime::ATOM;

    /**
     * @var DateTime
     */
    public $open;

    /**
     * @var DateTime
     */
    public $close;
```



# HANDLER

```
<?php

namespace app\Enrollment\Commands;

use App\Enrollment\Domain\EnrollmentPeriod;
use App\Enrollment\IdentityProvider;
use App\Support\CommandHandling\CommandHandler;
use App\Support\Repository\EventSourcingRepository;
use Illuminate\Auth\Access\AuthorizationException;

class EnrollmentPeriodHandler extends CommandHandler
{
    /**
     * @var IdentityProvider
     */
    private $auth;

    /**
     * @var EventSourcingRepository
     */
    private $repository;

    public function construct(IdentityProvider $auth, EventSourcingRepository $repository)
    {
        $this->repository = $repository;
        $this->auth = $auth;
    }

    public function handle(EnrollmentPeriod $command)
    {
        if ($this->auth->check($command->user_id, 'enrollment')) {
            $this->repository->create($command);
        } else {
            throw new AuthorizationException('User is not authorized to perform this action');
        }
    }
}
```

## PROS

- maps closely to the process
- flexible to changes in process
- meaning of events can change without altering history
- scholarships; able to back up all events to roll over a new year.  
Didn't need to preserve full database.

## CONS

- a lot of classes
- more design patterns to adjust to (complicated)



## LINKS FOR FURTHER READING

- [Greg Young CQRS and Event Sourcing](#)
- [Greg Young - long class](#)
- [Greg Young - A Decade of DDD, CQRS, Event Sourcing](#)
- [PHP Round Table - Event Sourcing \(+2 more\)](#)
- [Broadway - framework for CQRS and ES](#)

# THANK YOU!



Emily Stamey [@elstamey](#)

Joind.in: <https://joind.in/talk/aoc6e>

@elstamey <https://joind.in/talk/aoc6e>