

# STATUS CHANGE: NOW USING EVENT SOURCING

by Emily Stamey

<https://joind.in/talk/c8690>



# HI, I'M EMILY!

I workED at NC State

Our applications support the  
College of Engineering, mostly  
outside of the classroom

We maintain 70 legacy applications



# WHAT WE'LL COVER:

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

# 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.



# BRACE YOURSELF!



© PHOTO BY CIARAN LEE

# RELAX, ENJOY THE RIDE!



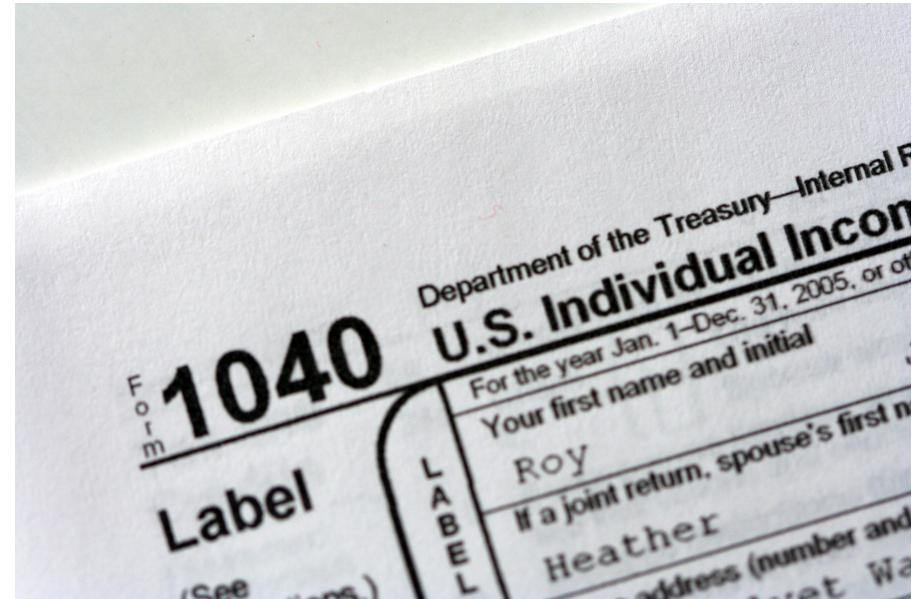
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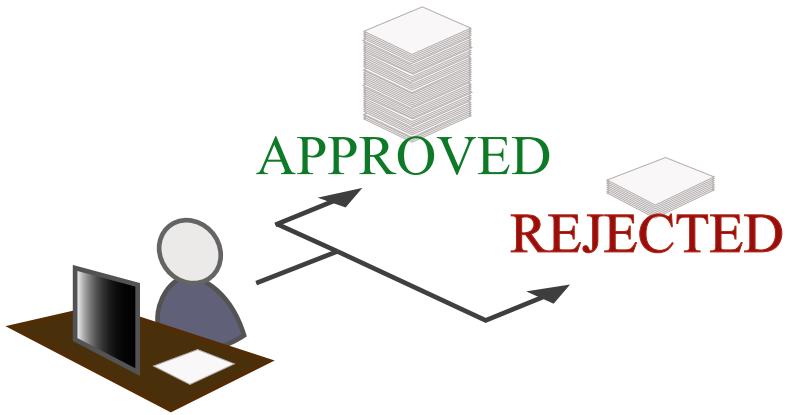
# FORMS

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



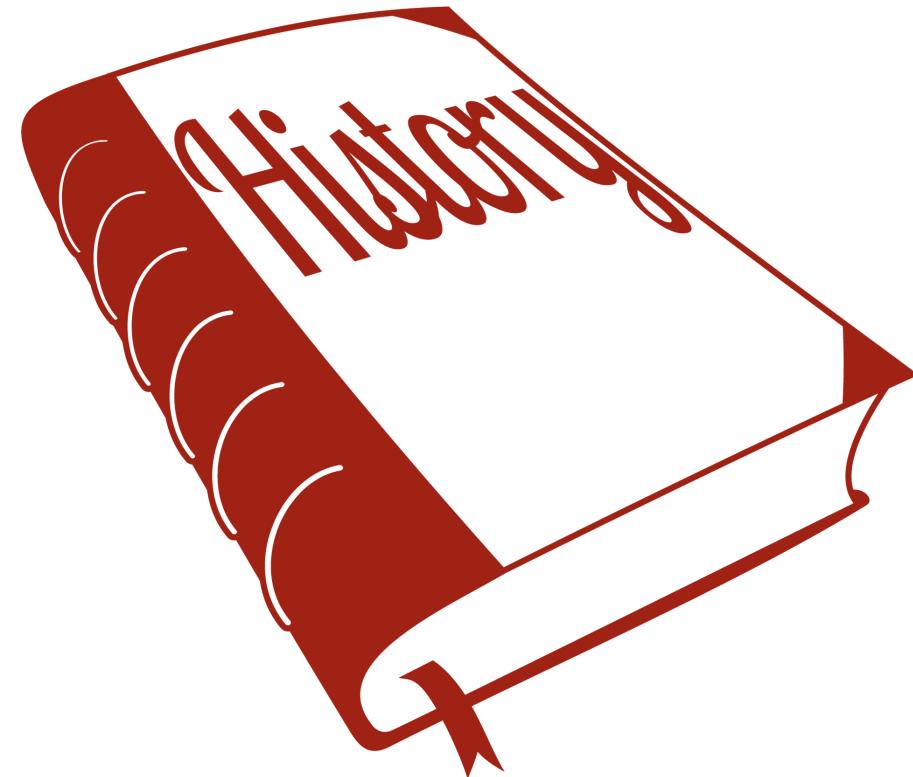
Piles indicate status of the form

# PAPER FORMS HANDLING STATE

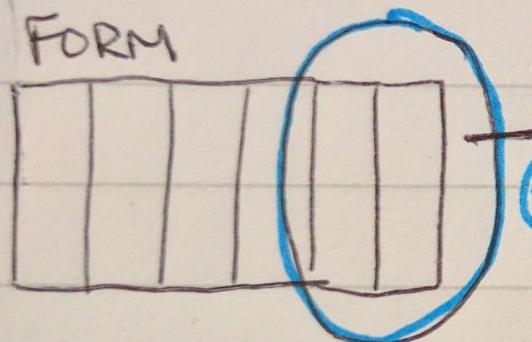


Status doesn't really communicate  
why or what happened

# WHY ARE THEY IN THE CURRENT STATE?

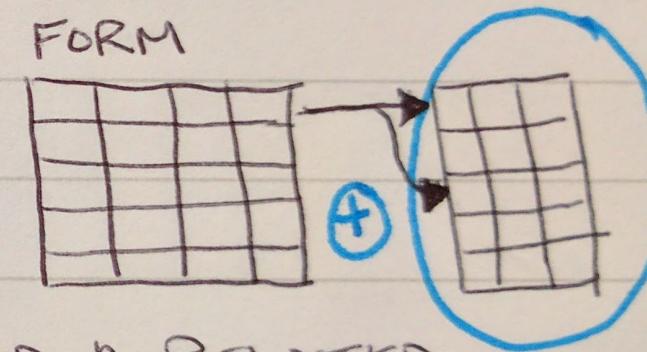


## COMPENSATING MEASURES



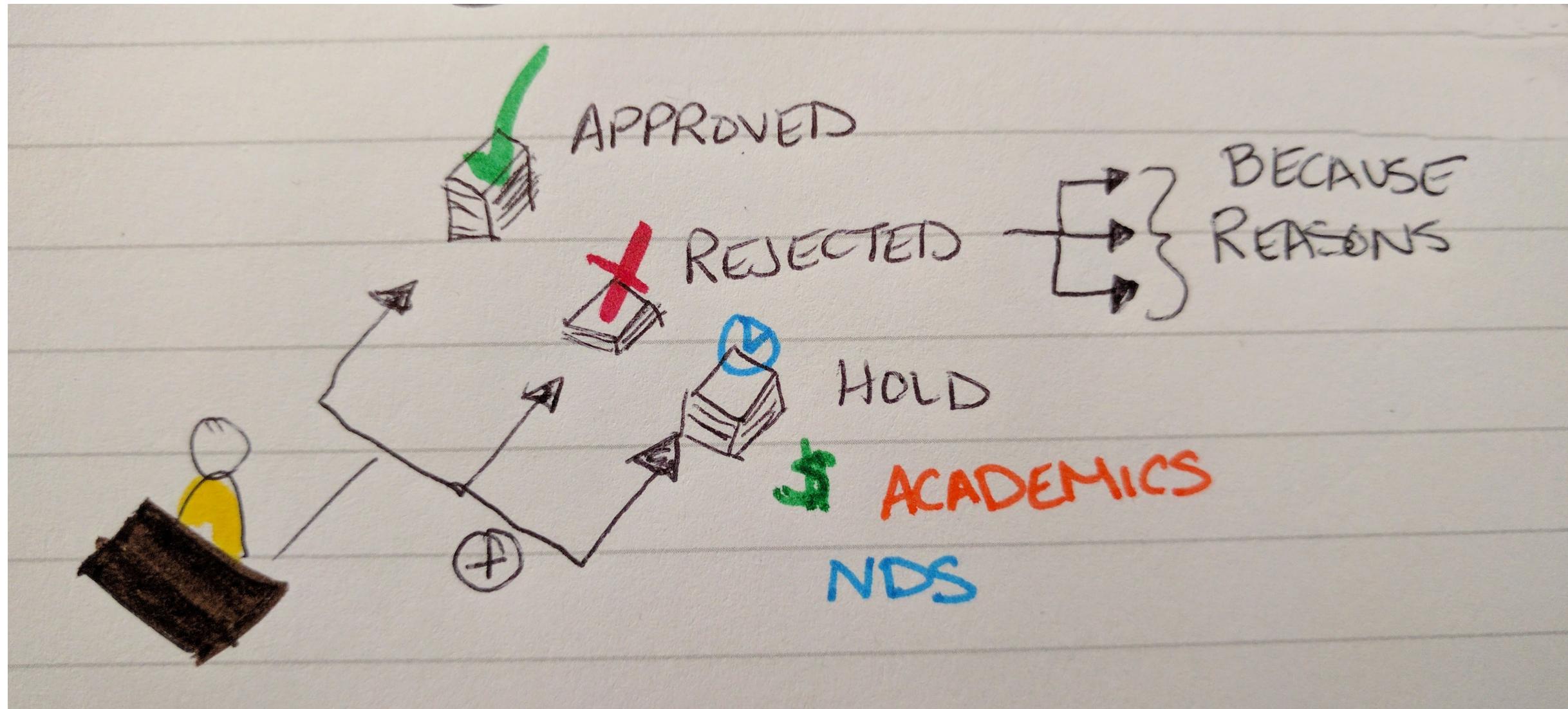
FORM  
ADD COLUMNS  
FOR STATUS

- DR -



FORM  
ADD A RELATED  
TABLE FOR STATUS OR NOTES

# HOW WORKFLOWS BECOME COMPLEX



# A SIMPLE STATUS DROP-DOWN

RECEIVED ▼

# 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 ASHEVILLE
- REGISTERED HALEYLOCK

# 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

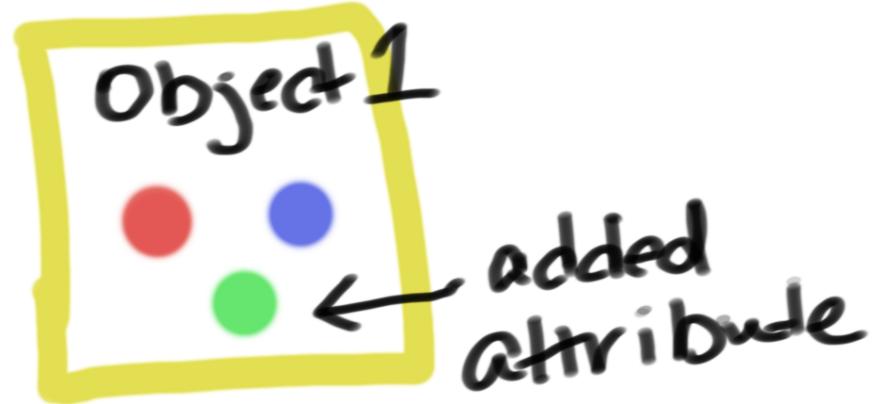
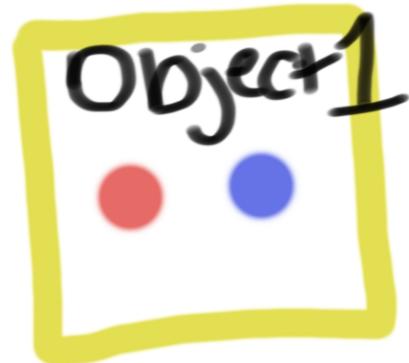
# EVENT SOURCING

1. Every happening is captured in an event object
2. Event objects are stored in the sequence they happened
3. That sequence determines the order they will be applied in your code

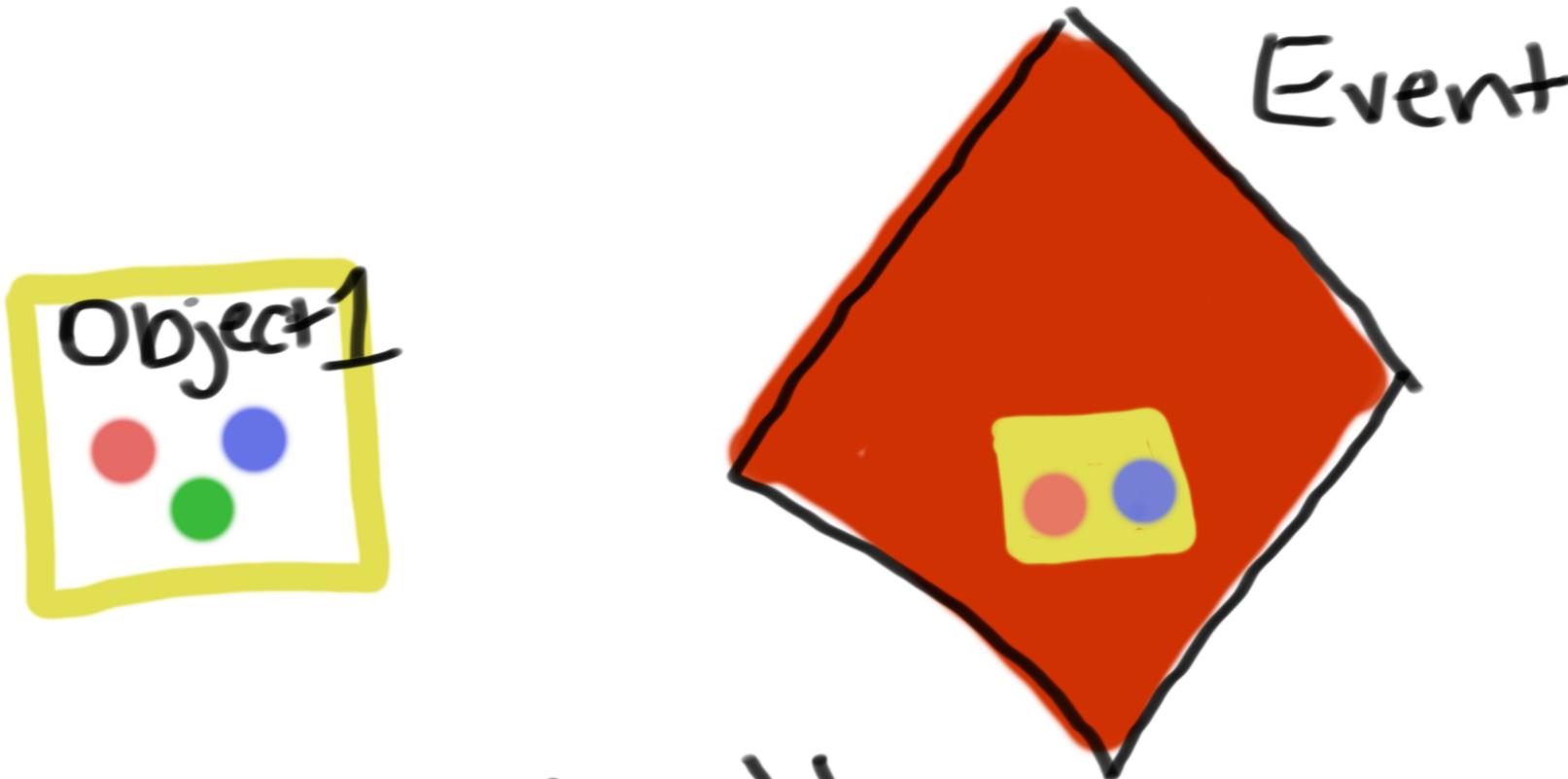
# RULES FOR EVENTS

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

# THE OBJECT CAN CHANGE



# OUR OBJECT DEFINITION CHANGED



Cannot build  
object from this Event

# **EVENTS ARE NOT BIONIC**

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

# WHY EVENTS?

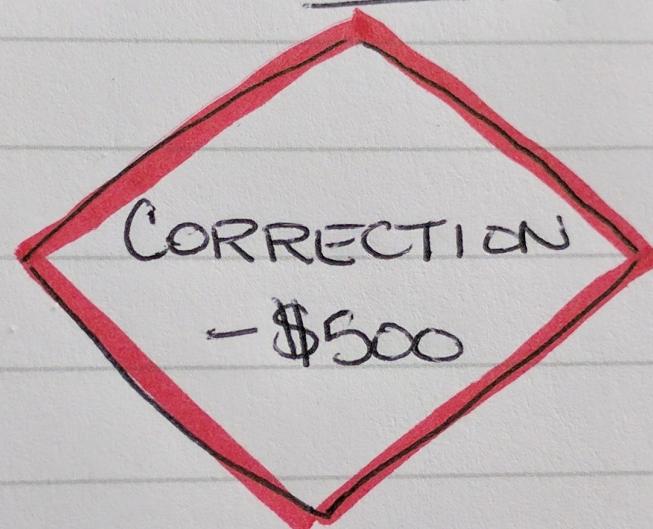
state transitions are important

We need an audit log and proof of state

This history is more important than the current state

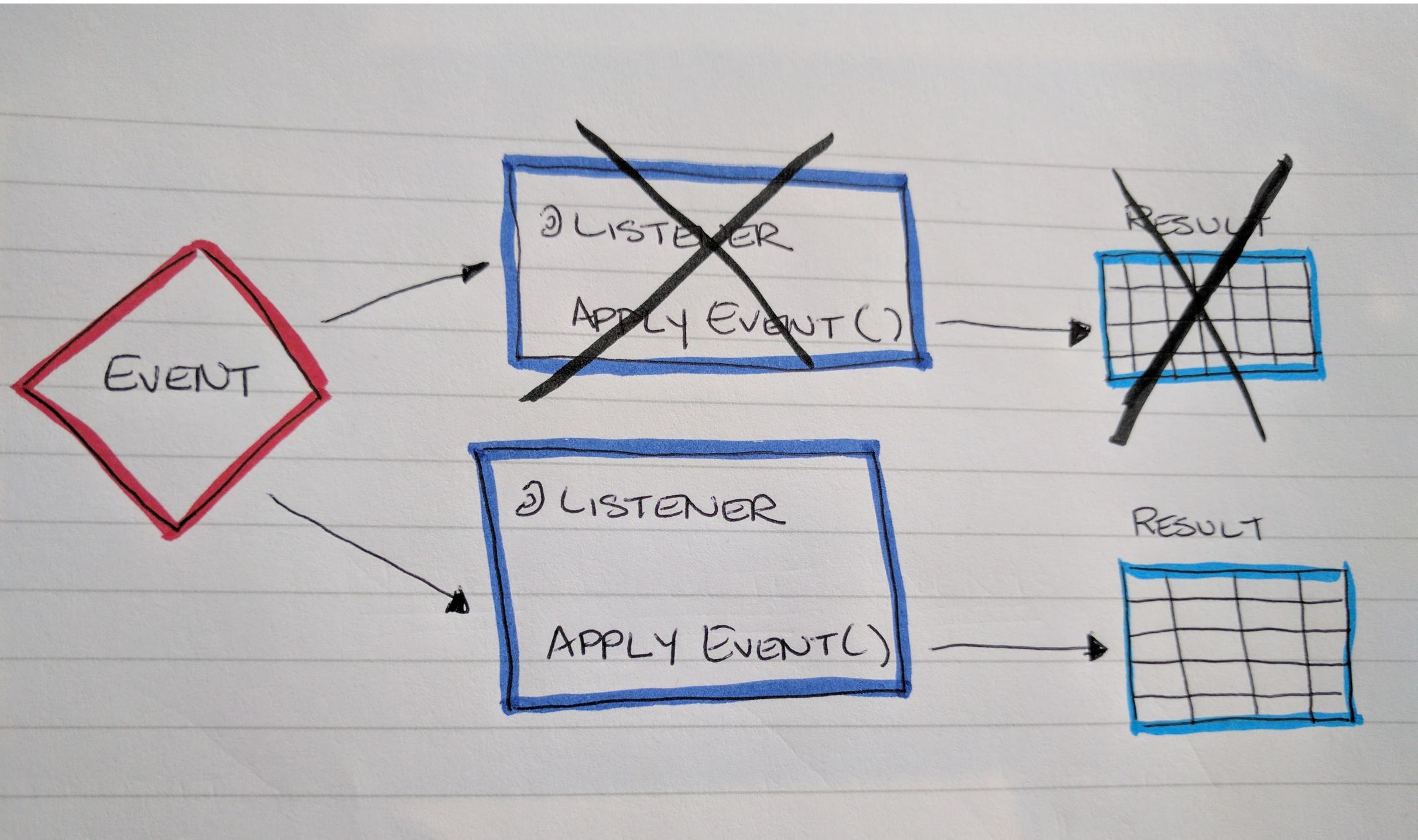
Able to replay these events to rebuild state

NEVER DELETE EVENTS



(mostly)





Events don't change

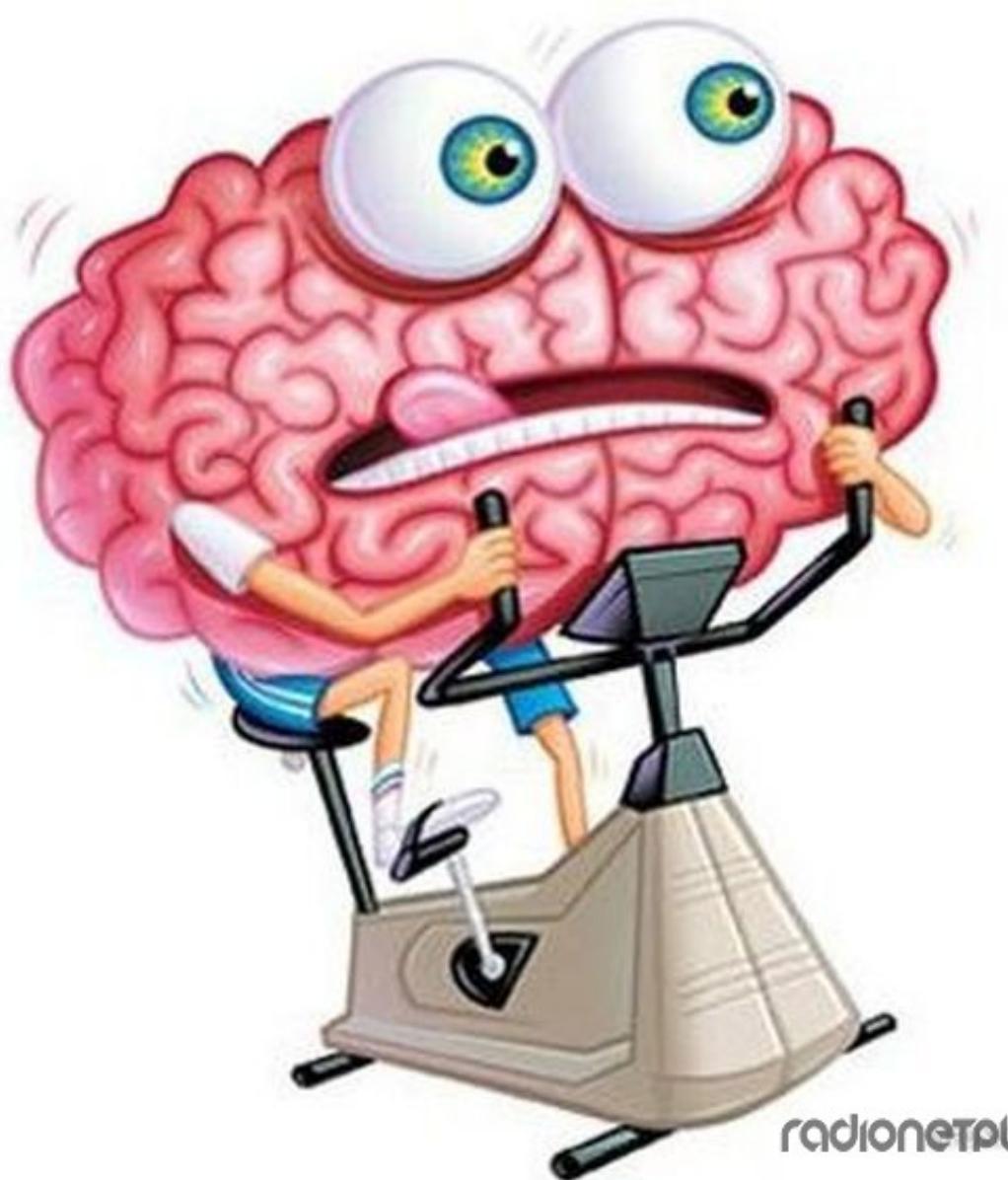
The part of the code that will change is most likely the result that follows that event.

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)



radionetplus

# ENROLLMENT REQUEST REJECTED (EVENT)

- request id
- student id
- course offering id

```
<?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
     */
}
```

# DOMAIN MESSAGE WRAPPER (CLASS)

Event can be wrapped by Domain message

This contains a version, timestamp, id, and the event itself

- stream id
- version
- payload (The Event)
- recorded on

```
<?php

namespace App\Support\Domain;

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

class DomainMessage
{

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

# SIMPLE EVENT LISTENER

Handles Event Listening

**getHandleMethod()** -

uses the Event name to identify the handle method

# SIMPLE EVENT LISTENER

```
<?php

namespace App\Support\EventHandling;

use App\Support\Domain\DomainMessage;

abstract class SimpleEventListener implements EventListener
{
    /**
     * @param DomainMessage $message
     */
    public function handle(DomainMessage $message)
    {
        $event = $message->getPayload();
        $method = $this->getHandleMethod($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	22222222	O:77:"ITECS\Scholarships\StudentApplication\Domain\Application"\A
3	ITECS\Scholarships\StudentApplication\Domain\Student\Student	22222223	O:77:"ITECS\Scholarships\StudentApplication\Domain\Application"\A
4	ITECS\Scholarships\StudentApplication\Domain\Student\Student	22222231	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	22222224	O:77:"ITECS\Scholarships\StudentApplication\Domain\Application"\A
10	ITECS\Scholarships\StudentApplication\Domain\Student\Student	22222225	O:77:"ITECS\Scholarships\StudentApplication\Domain\Application"\A
11	ITECS\Scholarships\StudentApplication\Domain\Student\Student	22222226	O:77:"ITECS\Scholarships\StudentApplication\Domain\Application"\A
12	ITECS\Scholarships\StudentApplication\Domain\Student\Student	22222228	O:77:"ITECS\Scholarships\StudentApplication\Domain\Application"\A
13	ITECS\Scholarships\StudentApplication\Domain\Student\Student	22222229	O:77:"ITECS\Scholarships\StudentApplication\Domain\Application"\A
14	ITECS\Scholarships\StudentApplication\Domain\Student\Student	22222230	O:77:"ITECS\Scholarships\StudentApplication\Domain\Application"\A
15	ITECS\Scholarships\StudentApplication\Domain\Student\Student	ITECS\Scholarships\StudentApplication\Domain\Student\Student\llication\Domain\Application"\A	
33	ITECS\Scholarships\StudentApplication\Domain\Student\Student	22222238	O:77:"ITECS\Scholarships\StudentApplication\Domain\Application"\A
34	ITECS\Scholarships\Foundation\Domain\IncomeAccount\IncomeAccount	661878	O:85:"ITECS\Scholarships\Foundation\Domain\IncomeAccount\Initia
35	ITECS\Scholarships\Foundation\Domain\IncomeAccount\IncomeAccount	661878	O:70:"ITECS\Scholarships\Foundation\Domain\IncomeAccount\Amo
36	ITECS\Scholarships\Foundation\Domain\IncomeAccount\IncomeAccount	677730	O:85:"ITECS\Scholarships\Foundation\Domain\IncomeAccount\Initia

```
o:92:"ITECS\Scholarships\Selection\Domain\Scholarship\AwardWasAssignedToCandidateBy
    s:6:"amount"      ;o:39:    "ITECS\Scholarships\Common\Values\Amount":1:{  

        s:46:"ITECS\Scholarships\Common\Values\Amountmoney"          ;  

        o:11:      "Money\Money":2:{  

            s:19:"Money\Moneyamount"           ;i:285000           ;s:21:"Money\M  

            o:14:      "Money\Currency":1:{  

                s:20:"Money\Currencyname"           ;s:3:"USD"  

            }  

        }  

    }  

    s:11:"applicantId"      ;  

    s:9:"22222235"      ;  

    s:13:"scholarshipId"      ;  

    o:61:    "ITECS\Scholarships\Selection\Domain\Scholarship\ScholarshipId":1:{  

        s:76:"ITECS\Scholarships\Selection\Domain\Scholarship\ScholarshipIdscholars
```

# EVENTS TABLE - WITH DOMAIN MESSAGE

Field	Type	Length
<code>id</code>	INT	10
<code>stream_id</code>	VARCHAR	255
<code>version</code>	INT	10
<code>payload</code>	TEXT	
<code>recorded_on</code>	INT	10
<code>type</code>	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
11	sis.students	10	{"namespace":"App\\StudentInformation\\Entities\\Student","identity":"juli...}	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": {  
    }  
}
```

# EVENT STORE

```
<?php

namespace App\Support\EventStore;

use App\Support\Domain\DomainMessage;
use Illuminate\Database\Connection;
use Illuminate\Database\QueryException;
use Illuminate\Database\Schema\Blueprint;

class DatabaseEventStore implements EventStore
{
    /**
     * @var string
     */
    protected $tableClass;
```

# LISTENERS (CLASS)

- create listeners that listen to certain events and determine what they mean
- StudentProfileProjector
- EnrollmentRequests Read Model

# 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
{
```

# 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;
```

# 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
```

# 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
     */
}
```



# 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)



memegenerator.net

# 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

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