Event sourcing for everyone

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Agenda

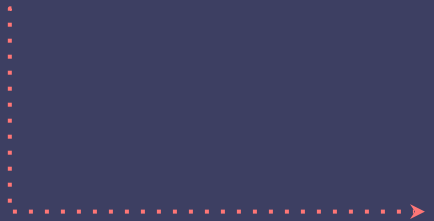
- What & why
- Key components of an event sourced system
- Example 

Account

id	email	is_active	plan_tier	created_at	updated_at

Account#register

```
account = Account.find_or_initialize_by(params[:email])
Account.is_active = true
account.save!
```



id	email	is_active	plan_tier
1	ruby@mail.com	true	free

Account#change_plan

```
account.update(plan_tier: “paid”)
account.save!
```

id	email	is_active	plan_tier
1	ruby@mail.com	true	paid

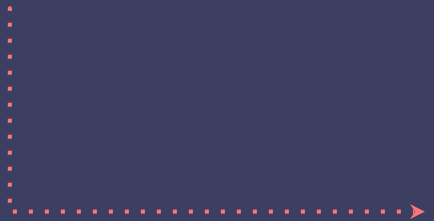
Account#disable

```
account.update(is_active: false)
account.save!
```

id	email	is_active	plan_tier
1	ruby@mail.com	false	paid

Account#register

```
account = Account.find_or_initialize_by(params[:email])
Account.is_active = true
account.save!
```



id	email	is_active	plan_tier
1	ruby@mail.com	true	free

Account#disable

```
account.update(is_active: false)
account.save!
```

id	email	is_active	plan_tier
1	ruby@mail.com	false	paid

Data loss

Logging

```
def change_plan(new_plan_tier:)
  Logger.info("Plan changed from #{plan_tier} to #{new_plan_tier}")
  self.plan_tier = new_plan_tier
end
```

All the columns

id	is_active	disabled_at	disabled_reason
1	false	2018-05-28 15:06:04	payment_required

Account Audit Table

```ruby
class Account < ApplicationRecord
  after_commit :create_account_audit_log
  ...

  def create_account_audit_log
    AccountAudit.create!(
      email: email,
      is_active: is_active,
      plan_tier: plan_tier,
      account_id: id
    )
  end
end
```

Account

id	email	is_active	plan_tier
1	ruby@mail.com	false	paid

AccountAudit

id	account_id	email	is_active	plan_tier
1	1	ruby@mail.com	true	free
2	1	ruby@mail.com	true	paid
3	1	ruby@mail.com	false	paid
4	1	ruby@mail.com	true	free
5	1	ruby@mail.com	false	free

Why did the state change?

“Capture all changes to an application state as a sequence of events.”

— Martin Fowler

Event

as a first class citizen

- Contains all info needed to change from one state to the next
- Immutable, append-only
- Events are persisted, current state is disposable

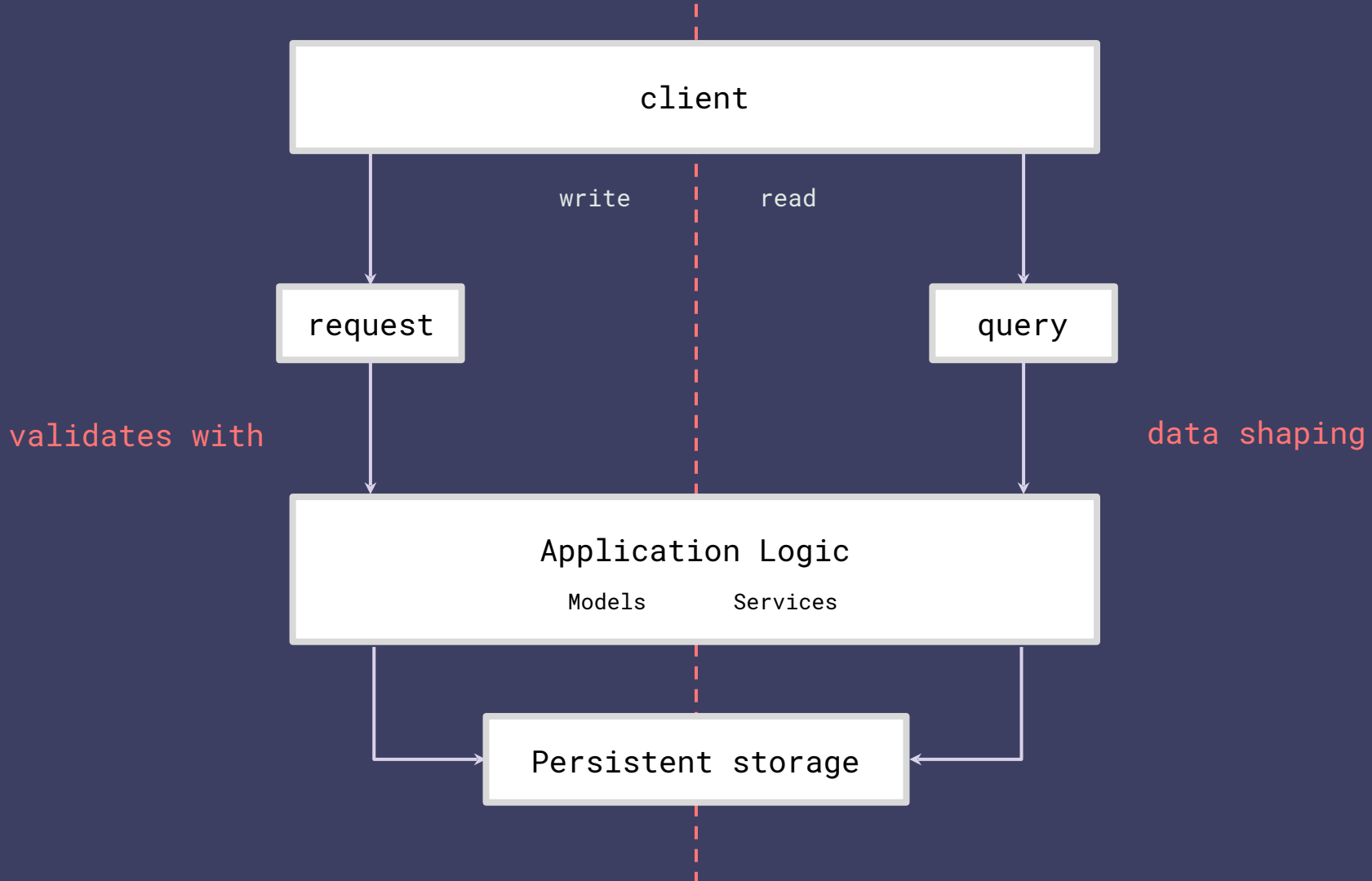
(CQRS: an interlude)

write

- data integrity
- optimize inserts/update
- write security

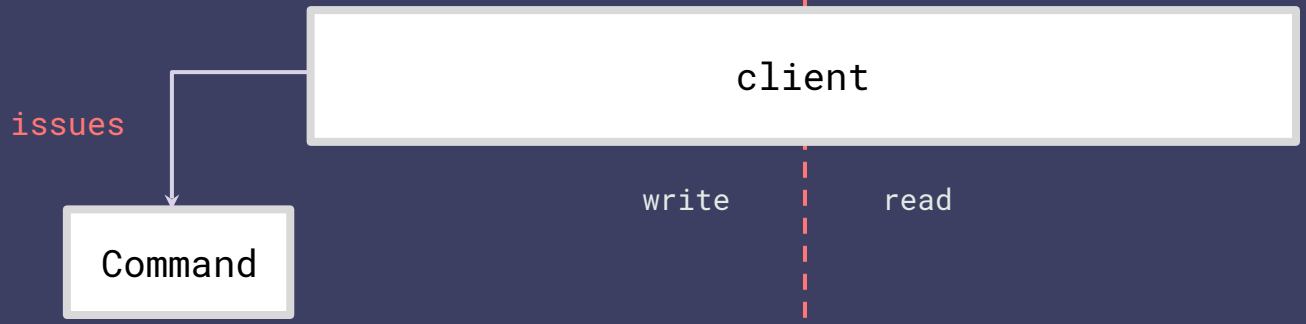
read

- efficient queries
- denormalized data
- read security

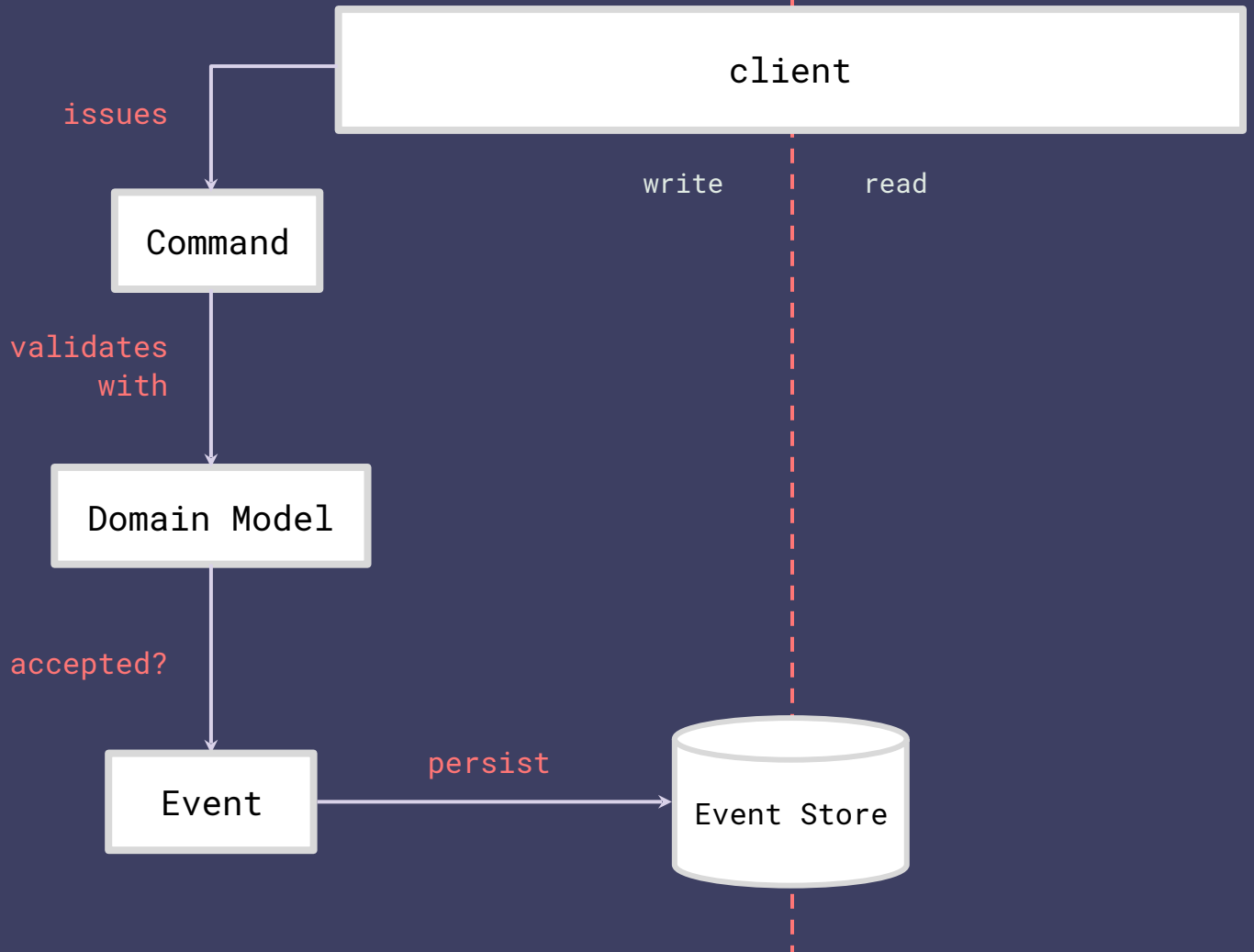

client
write
read
request
query
validates with
data shaping
Application Logic
Models
Services
Persistent storage

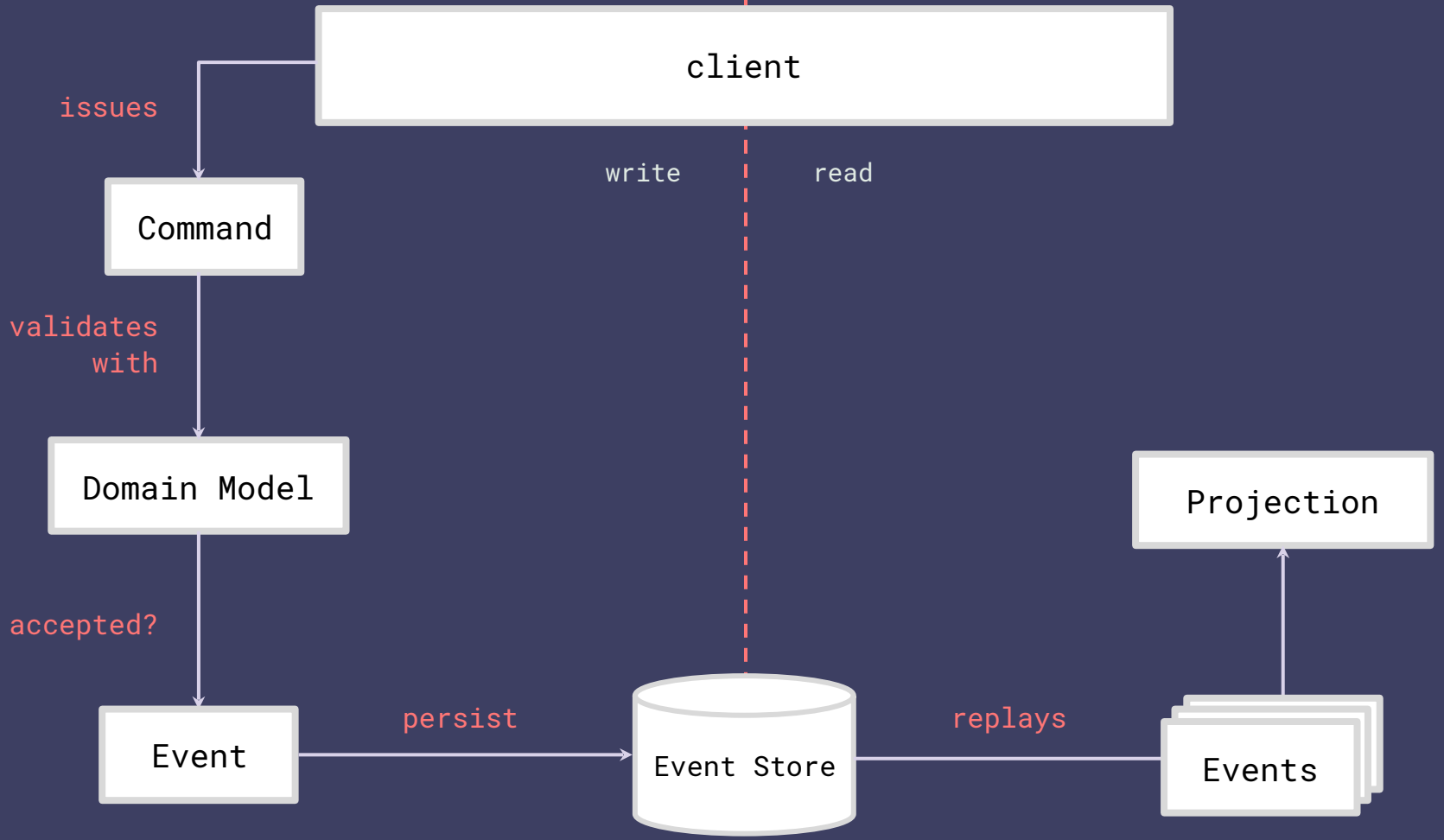
write

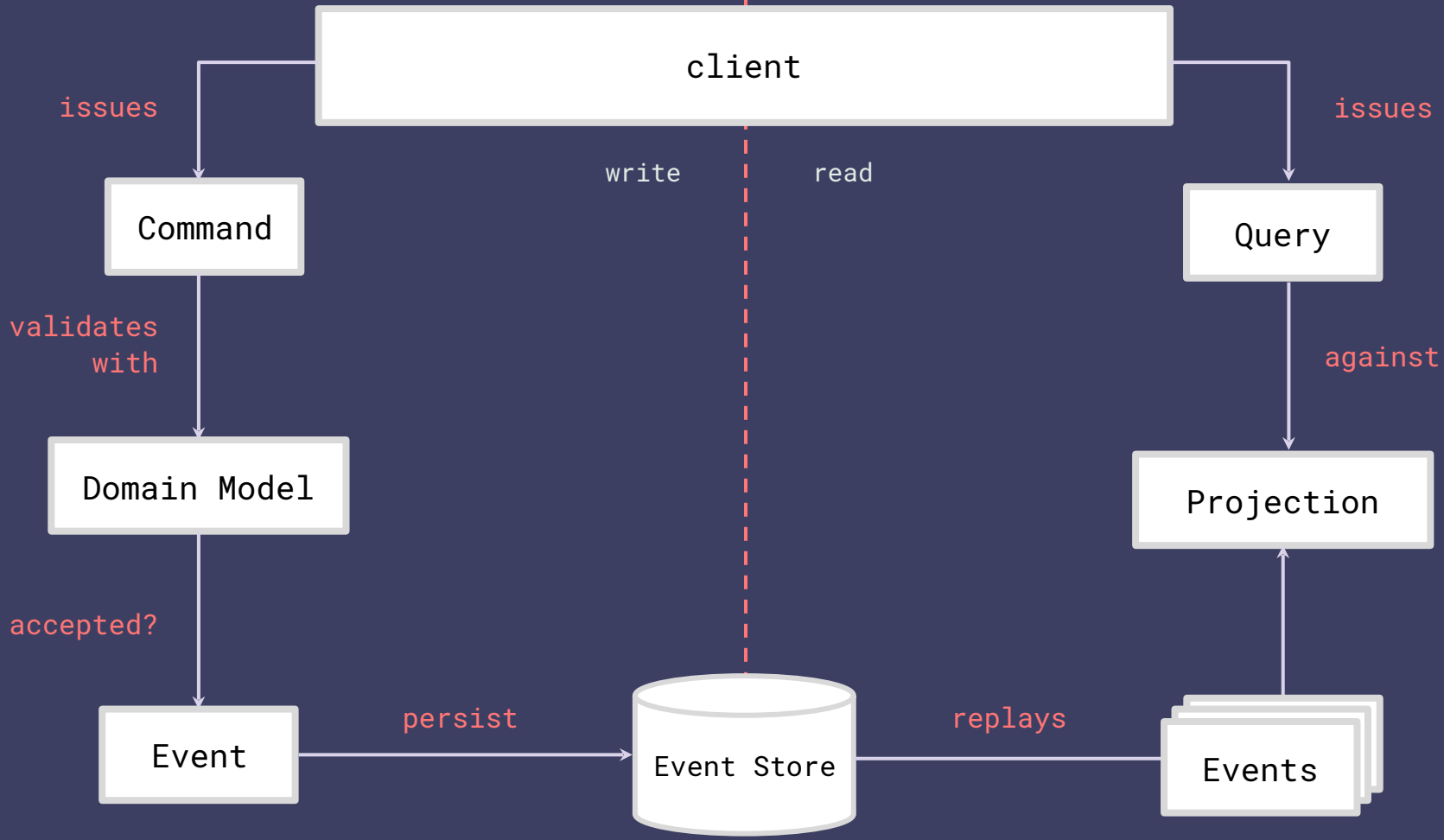
read


client
issues
Command
write
read


client
issues
write
read
Command
validates
with
Domain Model


client
issues
write
read
Command
validates
with
Domain Model
accepted?
Event
persist
Event Store


client
issues
write
read
Command
validates
with
Domain Model
Projection
accepted?
Event
persist
Event Store
replays
Events


client
issues
issues
write
read
Command
Query
validates
with
against
Domain Model
Projection
accepted?
persist
replays
Event
Event Store
Events

Components

Command:

- communicates intent
- can be rejected

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Domain model:

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- holds business logic

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Command:

- communicates intent
- can be rejected

Domain model:

- the ‘nouns’ of your system
- holds business logic

Event:

- all the information needed to change from one state to another
- append-only

Projection:

- read-only
- current state

Show me the code

```ruby
# account.rb
class Account < ApplicationRecord

  def register(params = {})
    raise ArgumentError, 'Email is required' unless params[:email].present?
    self.email = params[:email]
    self.is_active = true
  end

  def change_plan(new_plan_tier:)
    if self.plan_tier == 'free' && plan_tier == 'advanced'
      raise ArgumentError, 'illegal plan transition'
    end

    self.plan_tier = new_plan_tier
  end

  def disable(reason:)
    self.is_active = false

    if reason == DISABLED_REASONS[:manually_disabled]
      SendSorryToSeeYouGoEmailJob.new(self.id)
    end
  end
end
```

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  def register(params = {})
    raise ArgumentError, 'Email is required' unless params[:email].present?
    self.email = params[:email]
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    end

    self.plan_tier = new_plan_tier
  end

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    if self.plan_tier == 'free' && plan_tier == 'advanced'
      raise ArgumentError, 'illegal plan transition'
    end

    self.plan_tier = new_plan_tier
  end

  def disable(reason:)
    self.is_active = false

    if reason == DISABLED_REASONS[:manually_disabled]
      SendSorryToSeeYouGoEmailJob.new(self.id)
    end
  end
end
```

```ruby
# account.rb
class Account < ApplicationRecord

  def register(params = {})
    raise ArgumentError, 'Email is required' unless params[:email].present?
    self.email = params[:email]
    self.is_active = true
  end

end
```

1. command

```ruby
# account.rb
class Account < ApplicationRecord

  def register(params = {})
    raise ArgumentError, 'Email is required' unless params[:email].present?
    self.email = params[:email]
    self.is_active = true
  end

end
```

2. validations

```ruby
# account.rb
class Account < ApplicationRecord

  def register(params = {})
    raise ArgumentError, 'Email is required' unless params[:email].present?
    self.email = params[:email]
    self.is_active = true
  end

end
```

3. some stuff

```ruby
# account.rb
class Account < ApplicationRecord

  def register(params = {})
    raise ArgumentError, 'Email is required' unless params[:email].present?
    self.email = params[:email]
    self.is_active = true
  end

end
```

```ruby
# account.rb
class Account < ApplicationRecord

  def register(params = {})
    raise ArgumentError, 'Email is required' unless params[:email].present?
    account_registered(params)
  end

  ...

  private

  def account_registered(params = {})
    self.email = params[:email]
    self.is_active = true
  end
end
```

```ruby
# account.rb
class Account < ApplicationRecord

  def disable(reason:)
    account_disabled(reason)
  end

  ...

  private

  def account_disabled(reason)
    self.is_active = false

    if reason == DISABLED_REASONS[:manually_disabled]
      SendSorryToSeeYouGoEmailJob.new(self.id)
    end
  end
end
```

```ruby
class Account < ApplicationRecord

  def change_plan(new_plan_tier:)
    if self.plan_tier == 'free' && plan_tier == 'advanced'
      raise ArgumentError, 'illegal plan transition'
    end

    plan_changed(new_plan_tier)
  end

  ...

  private

  def plan_changed(new_plan_tier)
    self.plan_tier = new_plan_tier
  end
end
```

```ruby
class Account < ApplicationRecord

  def change_plan(new_plan_tier:)
    if self.plan_tier == 'free' && plan_tier == 'advanced'
      raise ArgumentError, 'illegal plan transition'
    end

    plan_changed()
  end

  ...

  private

  def plan_changed()
    self.plan_tier = new_plan_tier
  end
end
```

```ruby
class Account < ApplicationRecord

  def change_plan(new_plan_tier:)
    if self.plan_tier == 'free' && new_plan_tier == 'advanced'
      raise ArgumentError, 'illegal plan transition'
    end

    plan_changed(
      Events::Account::PlanChanged.new(
        object_reference_id: self.uuid,
        object_type: self.class.to_s,
        payload: {
          old_plan: self.plan_tier,
          new_plan: new_plan_tier
        }
      )
    )
  end

  private

  def plan_changed(event)
    self.plan_tier = event.payload[:new_plan]
  end
end
```

```ruby
class Account < ApplicationRecord

  def change_plan(new_plan_tier:)
    if self.plan_tier == 'free' && new_plan_tier == 'advanced'
      raise ArgumentError, 'illegal plan transition'
    end

    plan_changed(
      Events::Account::PlanChanged.new(
        object_reference_id: self.uuid,
        object_type: self.class.to_s,
        payload: {
          old_plan: self.plan_tier,
          new_plan: new_plan_tier
        }
      )
    )
  end

  private

  def plan_changed(event)
    self.plan_tier = event.payload[:new_plan]
  end
end
```

```ruby
class Account < ApplicationRecord
  include Domain::BaseObject

  def change_plan(new_plan_tier:)
    if self.plan_tier == 'free' && new_plan_tier == 'advanced'
      raise ArgumentError, 'illegal plan transition'
    end

    apply(
      Events::Account::PlanChanged.new(
        object_reference_id: self.uuid,
        object_type: self.class.to_s,
        payload: {
          old_plan: self.plan_tier,
          new_plan: new_plan_tier
        }
      )
    )
  end

  private

  def plan_changed(event)
    self.plan_tier = event.payload[:new_plan]
  end
end
```

```ruby
# domain/base_object.rb
def apply(event, is_new_event: true)
  handle(event)
  publish(event, is_new_event)
end

private

def handle(event)
  handler = event.handler
  if self.respond_to? handler
    public_send(handler, event)
  end
end

def publish(event, is_new_event)
  EventStore.save(event) if is_new_event
end
```

```ruby
# domain/base_object.rb
def apply(event, is_new_event: true)
  handle(event)
  publish(event, is_new_event)
end

private

def handle(event)
  handler = event.handler
  if self.respond_to? handler
    public_send(handler, event)
  end
end

def publish(event, is_new_event)
  EventStore.save(event) if is_new_event
end
```

e.g. `:account_registered`

```ruby
# domain/base_object.rb
def apply(event, is_new_event: true)
  handle(event)
  publish(event, is_new_event)
end

private

def handle(event)
  handler = event.handler
  if self.respond_to? handler
    public_send(handler, event)
  end
end

def publish(event, is_new_event)
  EventStore.save(event) if is_new_event
end
```

```ruby
# events/event_store.rb
class EventStore
  @@event_streams={}

  def self.save(event)
    current_stream = @@event_streams[event.object_reference_id] || []
    current_stream << event
    @@event_streams[event.object_reference_id] = current_stream
  end

  def self.load(klass, uuid = nil)
    object = klass.new
    object.uuid = uuid
    events = @@event_streams[uuid]
    object.rebuild(events) if events.present?
    object
  end
end
```

```ruby
# events/event_store.rb
class EventStore
  @@event_streams={}

  def self.save(event)
    current_stream = @@event_streams[event.object_reference_id] || []
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  def self.load(klass, uuid = nil)
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end
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# events/event_store.rb
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  def self.save(event)
    current_stream = @@event_streams[event.object_reference_id] || []
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  end

  def self.load(klass, uuid = nil)
    object = klass.new
    object.uuid = uuid
    events = @@event_streams[uuid]
    object.rebuild(events) if events.present?
    object
  end
end
```

```ruby
# domain/base_object.rb
def apply(event, is_new_event: true)
  handle(event)
  publish(event, is_new_event)
end

def rebuild(events)
  events.each do |event|
    apply(event, is_new_event: false)
  end
end

private

def handle(event)
  handler = event.handler
  if self.respond_to? handler
    public_send(handler, event)
  end
end

def publish(event, is_new_event)
  EventStore.save(event) if is_new_event
end
```

```ruby
# domain/base_object.rb
def apply(event, is_new_event: true)
  handle(event)
  publish(event, is_new_event)
end

...
private

def publish(event, is_new_event)
  EventStore.save(event) if is_new_event
  notify_subscribers(event, is_new_event)
end

def notify_subscribers(event, is_new_event)
  SubscriberManager.notify_subscribers(event, is_new_event)
end
```

```ruby
# subscribers/subscriber_manager.rb
class SubscriberManager
  def self.notify_subscribers(event, is_new_event)
    ALL_SUBSCRIBERS.each do |subscriber|
      subscriber.new.process(event, is_new_event)
    end
  end

  ALL_SUBSCRIBERS = [
    Reactors::DisabledAccountEmailSender,
    Projectors::AllAccounts,
  ]
end
```

```ruby
# reactors/disabled_account_email_sender.rb
module Reactors
  class DisabledAccountEmailSender
    def process(event, is_new_event)
      return unless is_new_event
      if event.payload[:reason] == Account::DISABLED_REASONS[:manually_disabled]
        SendSorryToSeeYouGoEmailJob.perform_later(event.object_reference_id)
      end
    end
  end
end
```

```ruby
# subscribers/projectors/all_accounts.rb
module Projectors
  class AllAccounts
    def process(event, is_new_event)
      projector = projector(event)
      send(projector, event) if projector
    end

    ...
    private

    def create_account(event)
      account = Account.find_or_create_by!(uuid: event.object_reference_id)
      account.update(is_active: true, email: event.payload[:email])
    end

    def change_plan(event)
      account = Account.find_by(uuid: event.object_reference_id)
      account.update(plan_tier: event.payload[:new_plan]) if account
    end

    def mark_account_disabled(event)
      account = Account.find_by(uuid: event.object_reference_id)
      account.update(is_active: false) if account
    end
  end
end
```


I IMMEDIATELY REGRET THIS DECISION
memegenerator.net

write:

```
class Domain::AccountObject
```

read:

```
class Account << ApplicationRecord
```

write:

```
class Domain::AccountObject
```

read:

```
class Account << ApplicationRecord
class ActiveAccounts << ApplicationRecord
class PlanTierCounts << ApplicationRecord
class DisabledAccountReasons << ApplicationRecord
```

```ruby
module Domain
  class AccountObject
    def register(params = {})
      apply(
       ...
      )
    end

    def change_plan(new_plan_tier:)
      apply(
        ...
      )
    end

    def disable(reason:)
      apply(
        ...
      )
    end
  end
end
```

```ruby
module Commands
  module Account
    module Register
      class Command < BaseCommand
        attr_reader :args
        def initialize(args = {})
          @args = args
          validate!
        end

        def validate!
          raise ArgumentError, 'email is missing' if args[:email].nil?
        end
      end
    end
  end
end
```

```
class CommandHandler
  def handle(command)
    account = EventStore.load(Domain::AccountObject)
    account.apply(
      Events::Account::Registered.new(
        object_reference_id: account.uuid,
        payload: {
          is_active: command.args[:is_active],
          email: command.args[:email]
        }
      )
    )
  end
end
```

What's easy?

- Modelling business logic
- Communicating with interdisciplinary team
- Scaling reads/writes without coupling
- Traceability & audits

What's hard?

- Naming ALL THE THINGS
- More work for implementing simple logic
- Schema changes
- Eventual consistency
- Side effects on replaying events
- Creating lots of data

Monoliths

A simple arrangement of complex things

Event sourcing

A complex arrangement of simple things

— Sebastian von Conrad

On the shoulders of giants 🙏

github.com/jennaleeb/
event_sourcing_for_everyone