

# An Ontological Analysis of the Notion of Treatment

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# The Purposes of Treatments

Treatments are used to improve, maintain, restore or cure some object that is, or can become, malfunctioning



Medical treatments are often divided into

- Curative treatments — aim to cure an illness
- Palliative treatments — aim to relieve symptoms from an illness
- Preventive treatments — aim to prevent the onset of an illness

# Challenges in Modelling Treatments

- Treatments evolve over time
  - A past life history, a present, and a future life to be unfolded
- Treatments have a normative aspect
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  - The level of specificity influences how to determine whether a treatment agreement has been fulfilled
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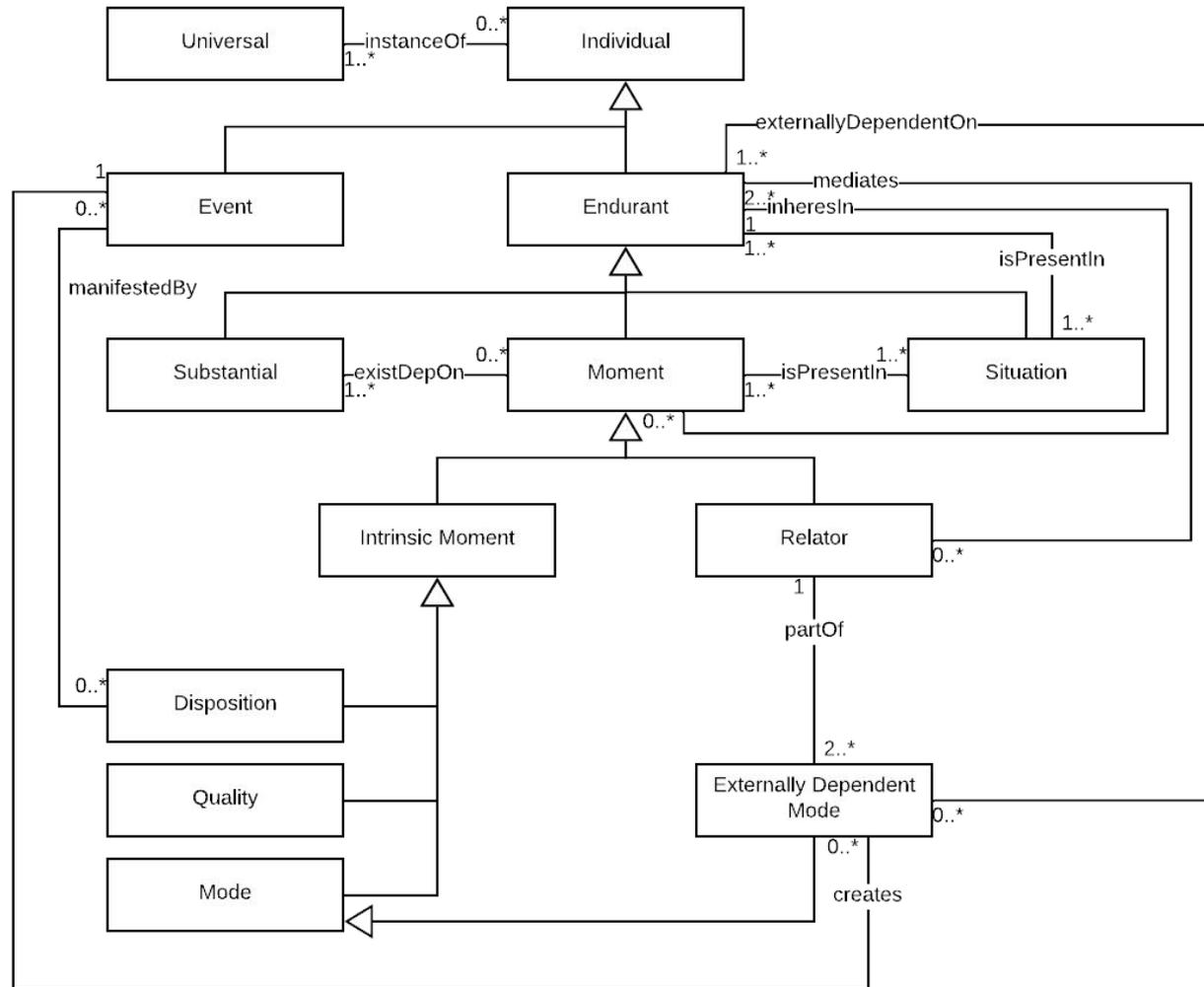
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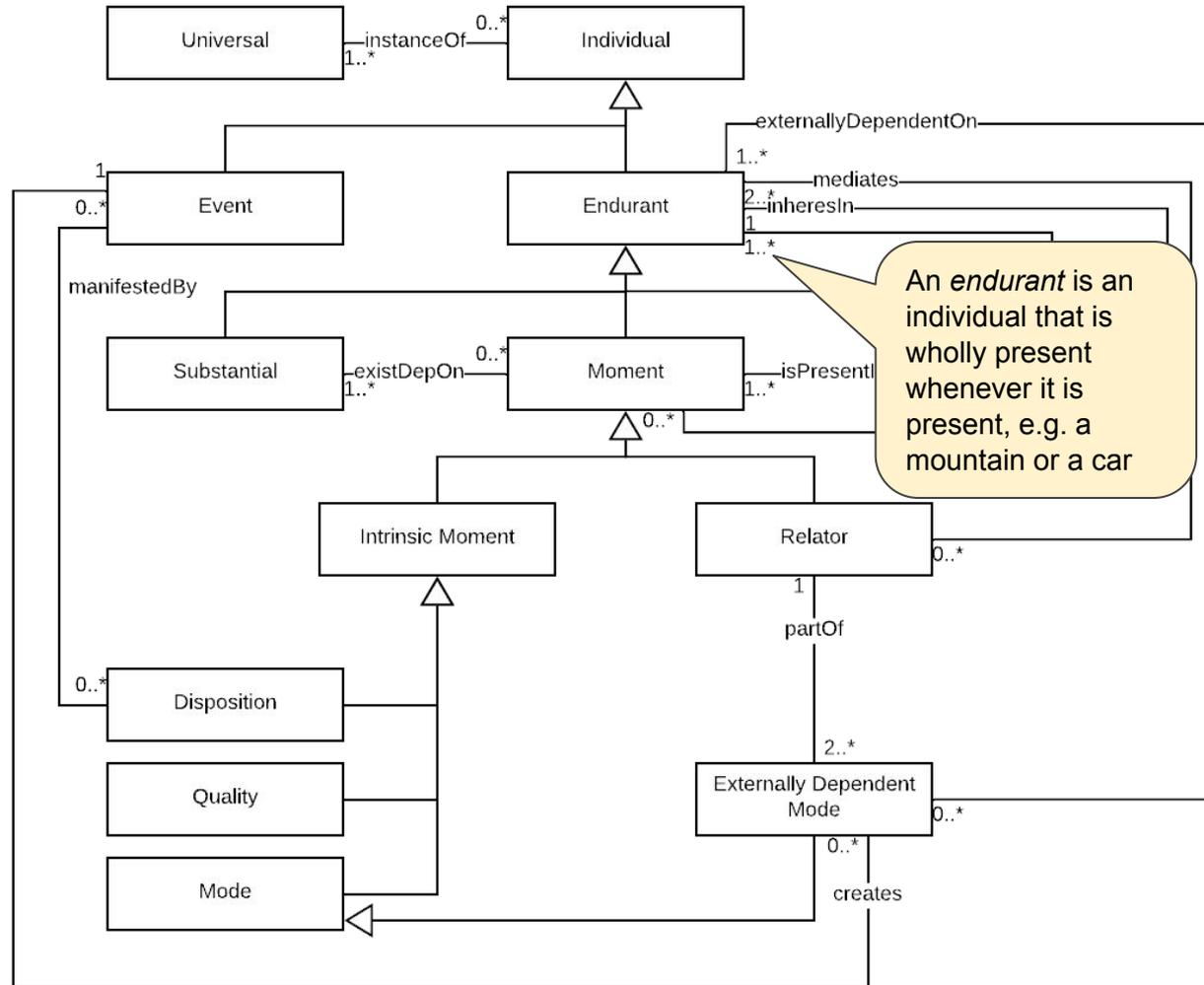
Is a treatment  
an entity, a  
relationship or  
an event, or all  
of these?



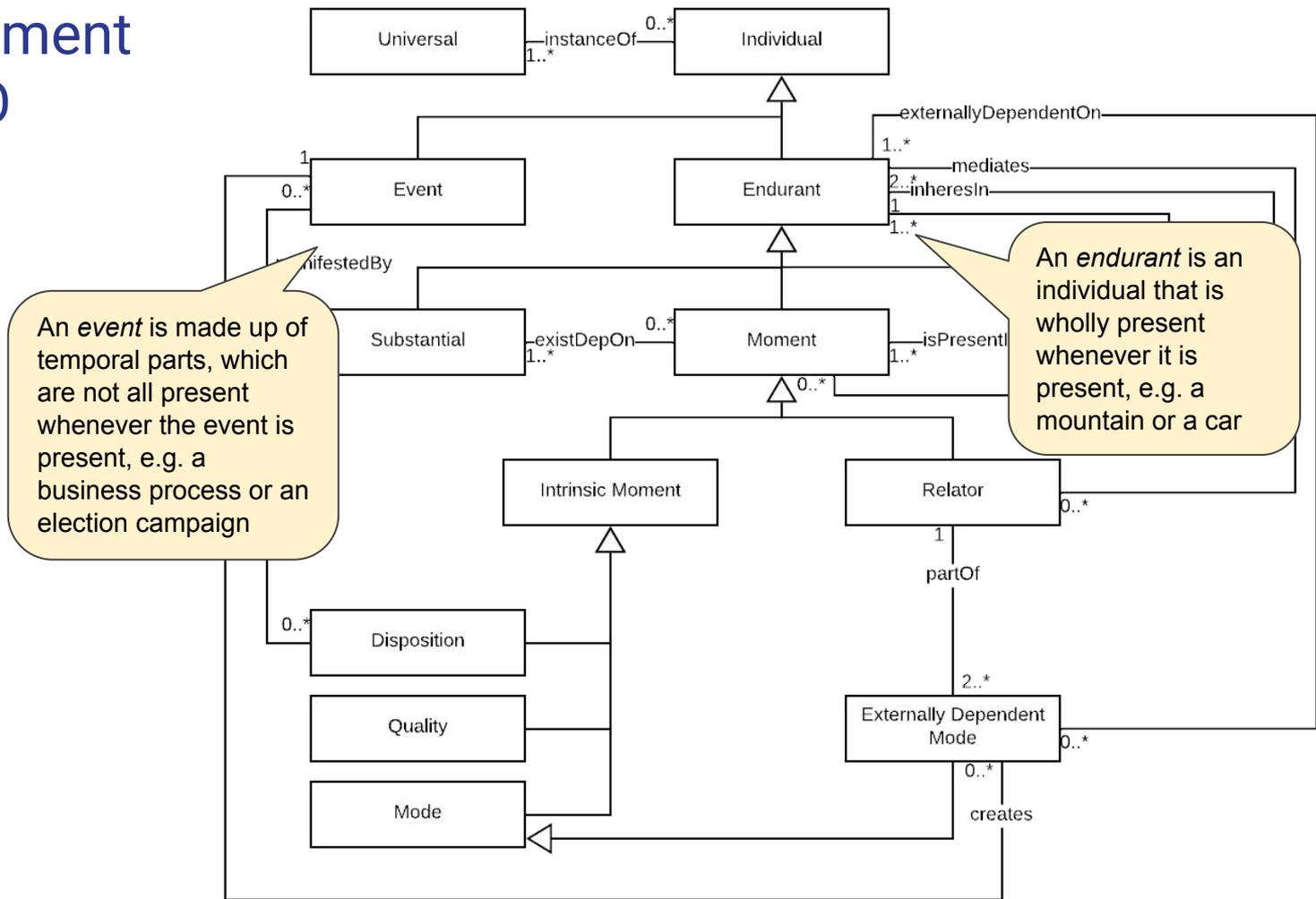
# A Fragment of UFO



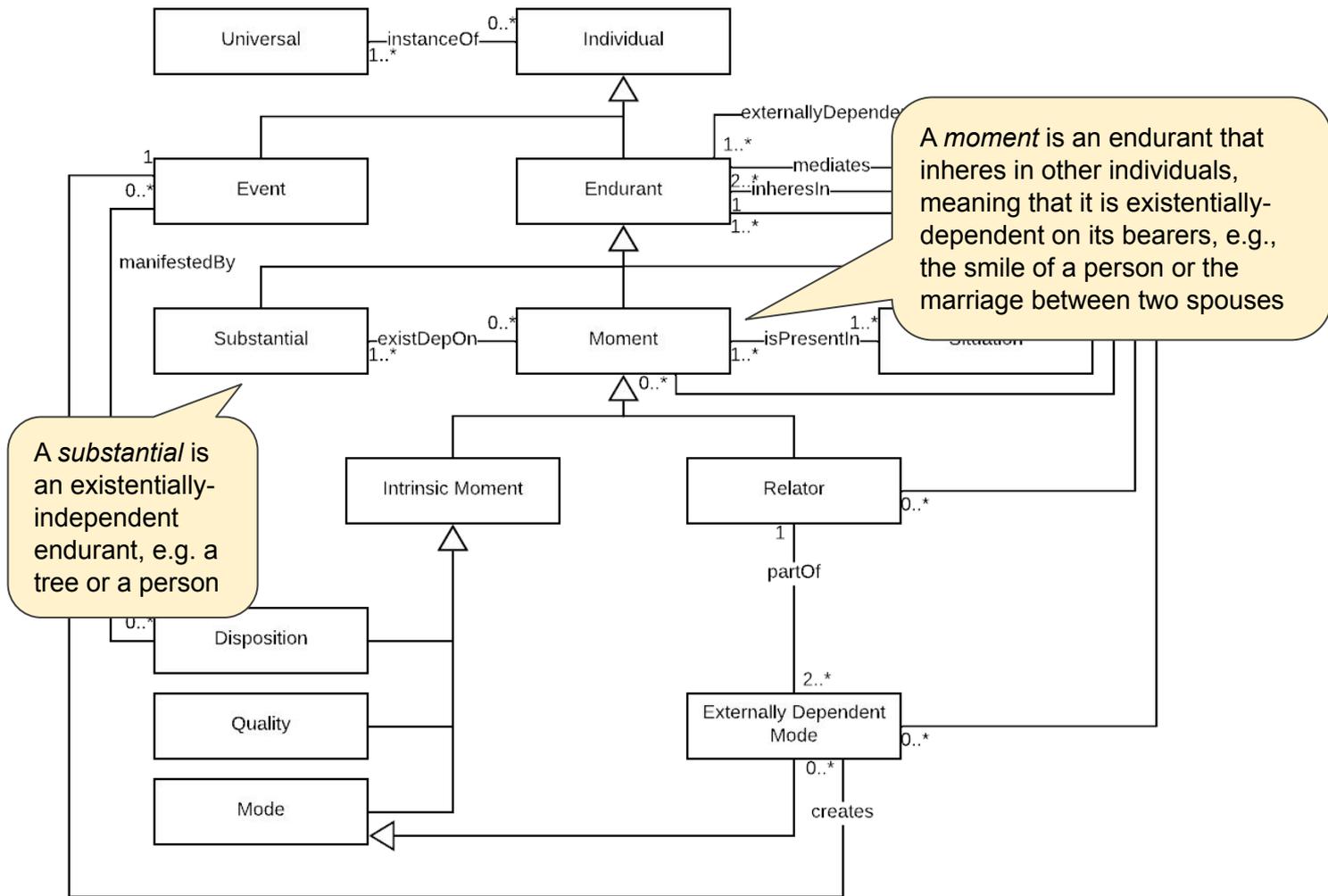
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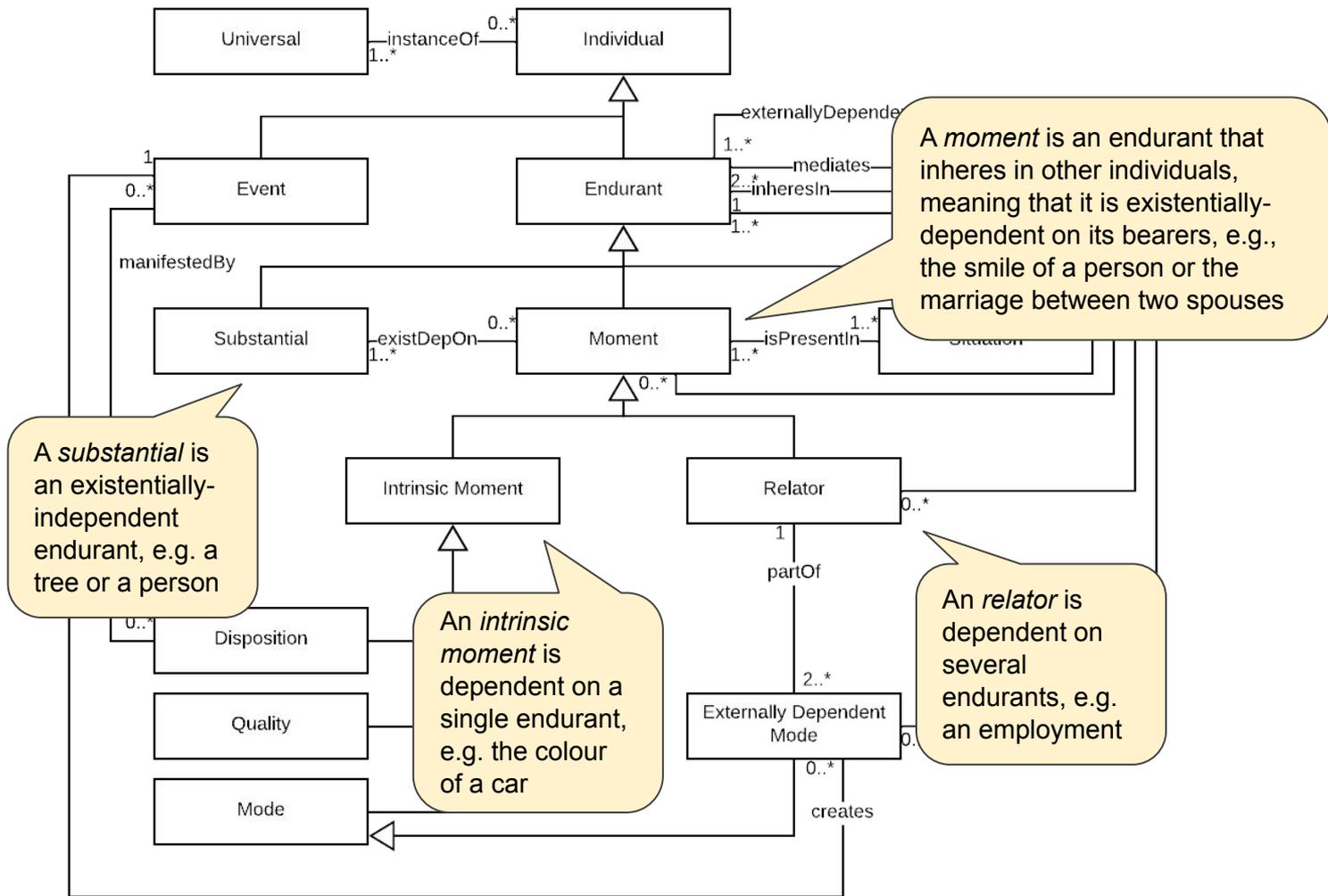
# A Fragment of UFO



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# Endurants vs Events

## Characteristics of endurants

- They can have both essential and accidental properties
- They can change while keeping their identity
- They can be the subject of counterfactual reasoning

# Endurants vs Events

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- They can have both essential and accidental properties
- They can change while keeping their identity
- They can be the subject of counterfactual reasoning

But could not  
this be true  
also of  
events?



# Endurants vs Events

“Can events genuinely change their properties while remaining the same? Can an event be the bearer of modal properties? In particular, can an event exhibit properties contingently? Can an event be different from what it is?”

Guarino, N. and Guizzardi, G., 2016, November. Relationships and events: towards a general theory of reification and truthmaking. In *Conference of the Italian Association for Artificial Intelligence* (pp. 237-249). Springer, Cham.

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Could we say that:

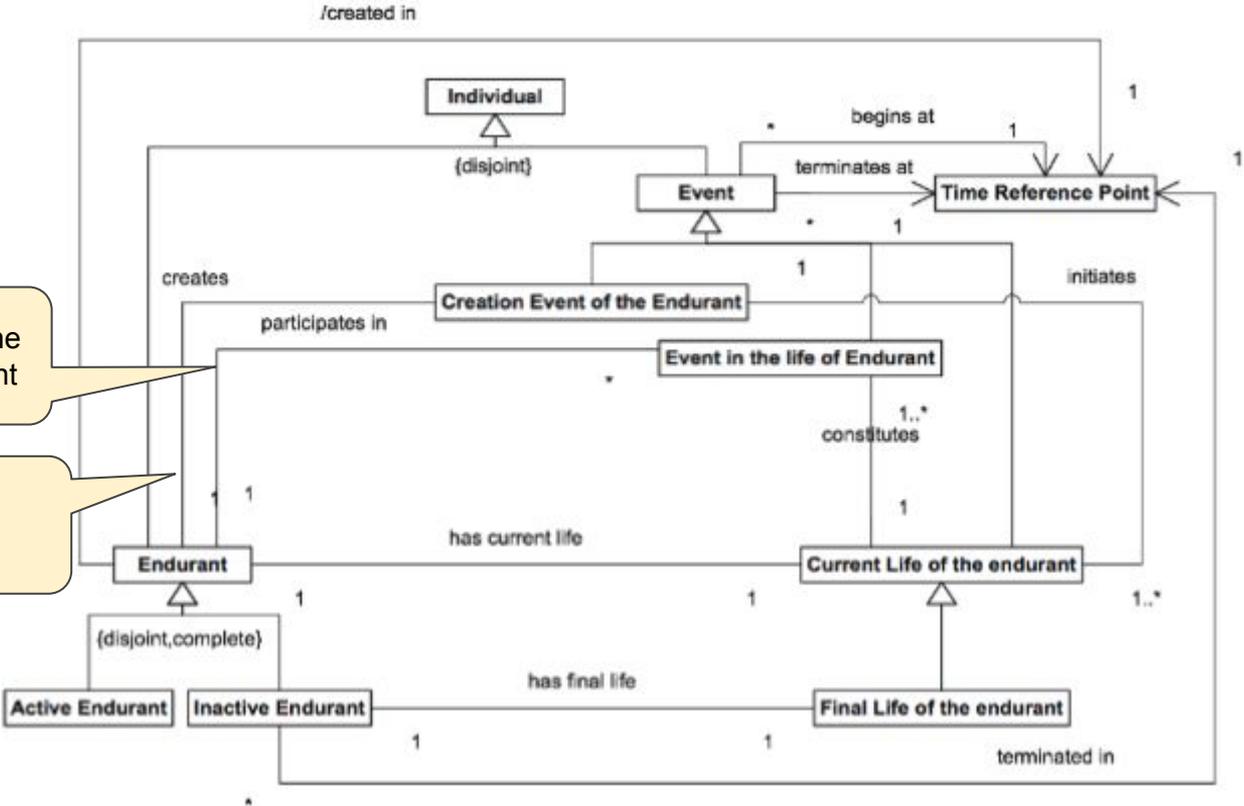
- This marriage is happy
- This marriage was unhappy but is happy now
- This marriage is happy but it could have been unhappy



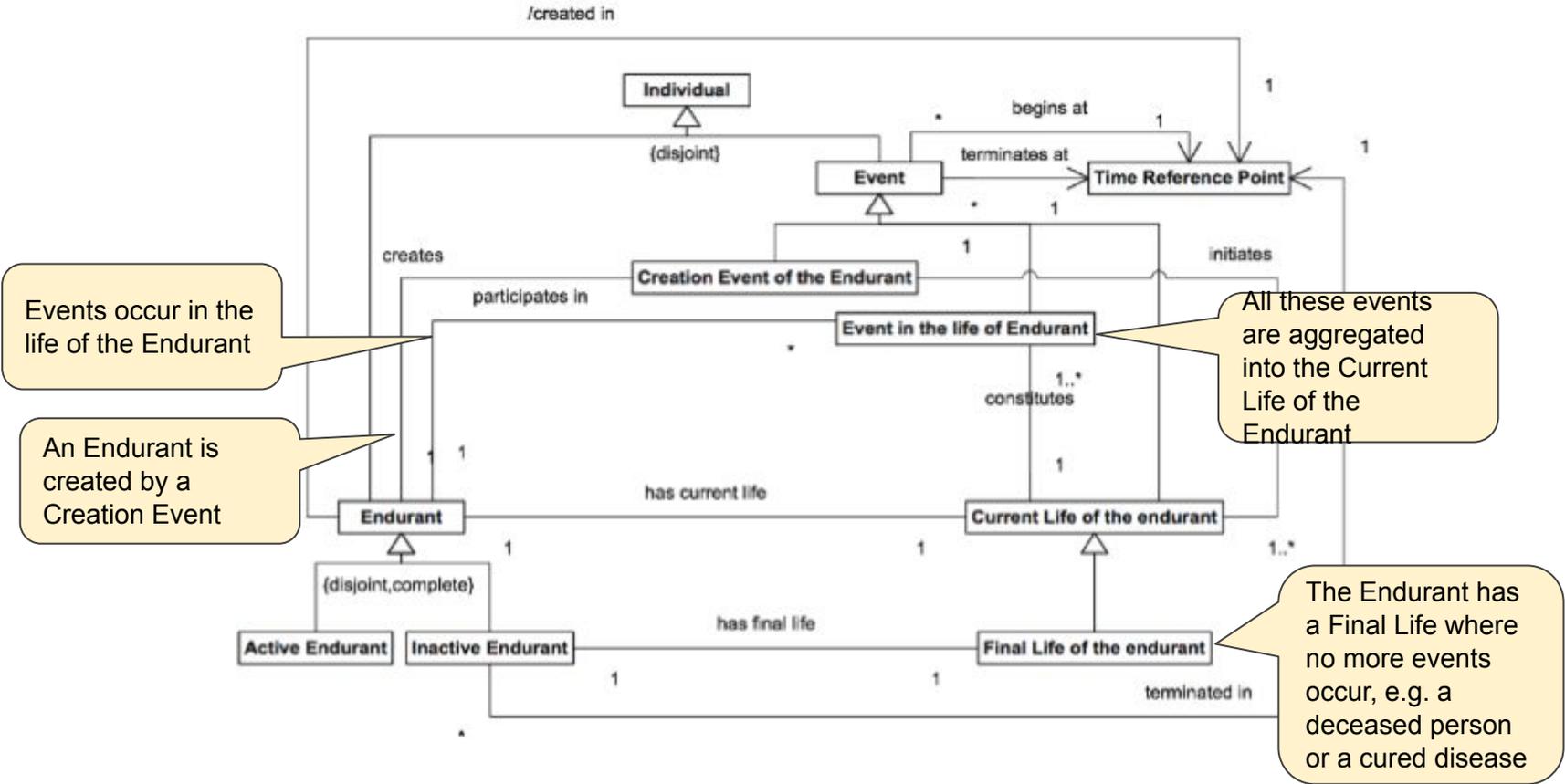
# Events Depend on Endurants

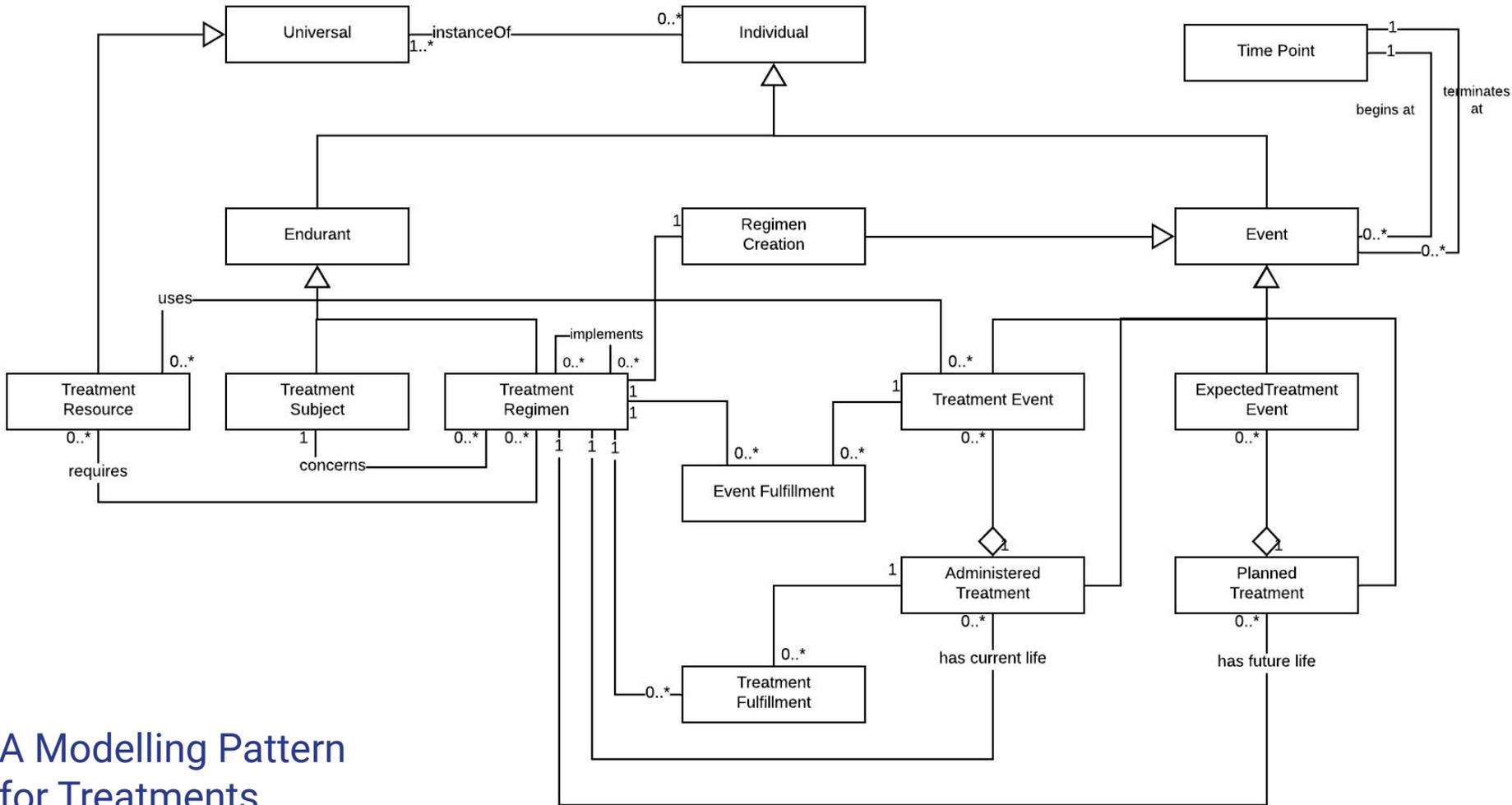
Events occur in the life of the Endurant

An Endurant is created by a Creation Event

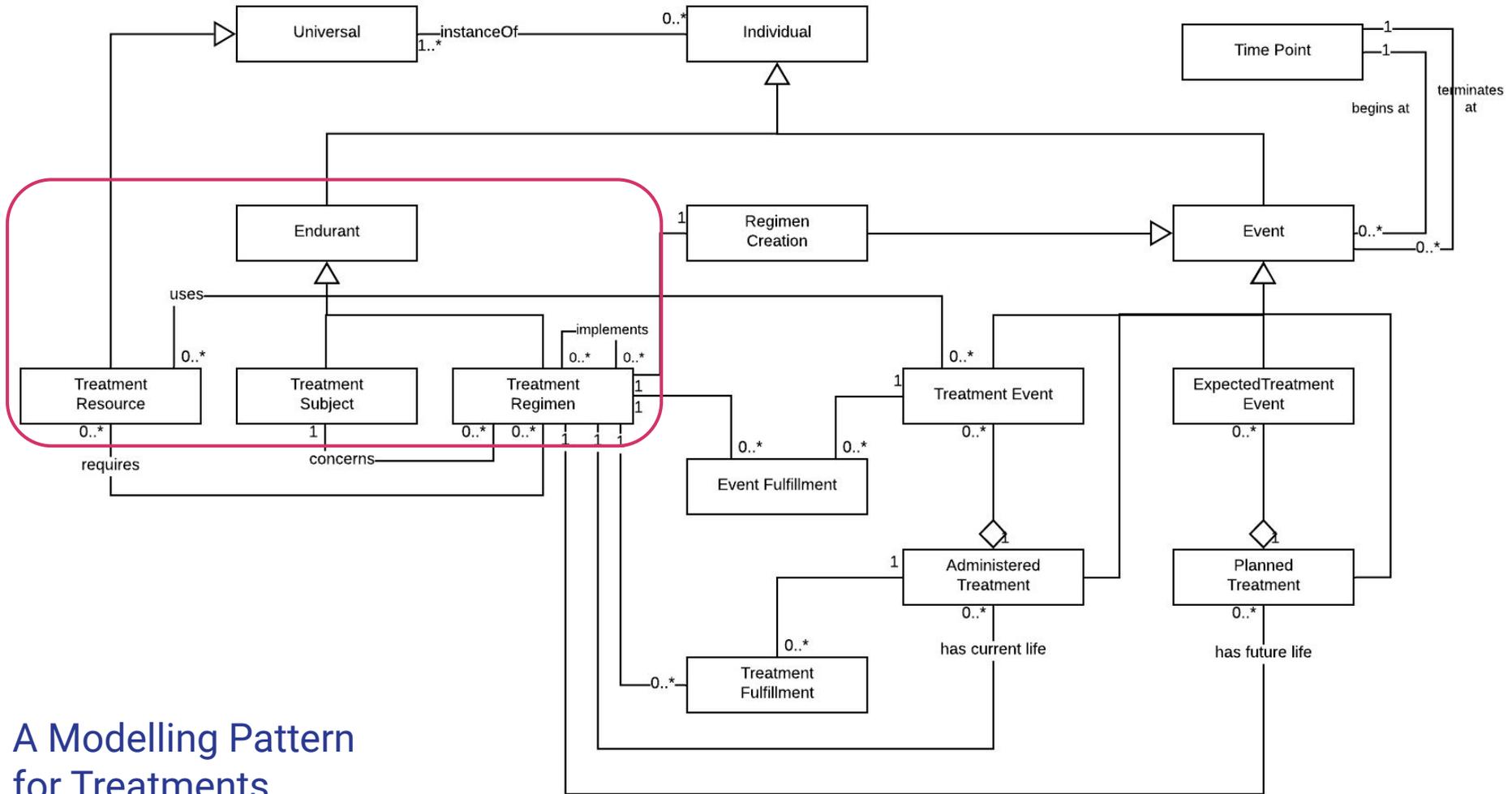


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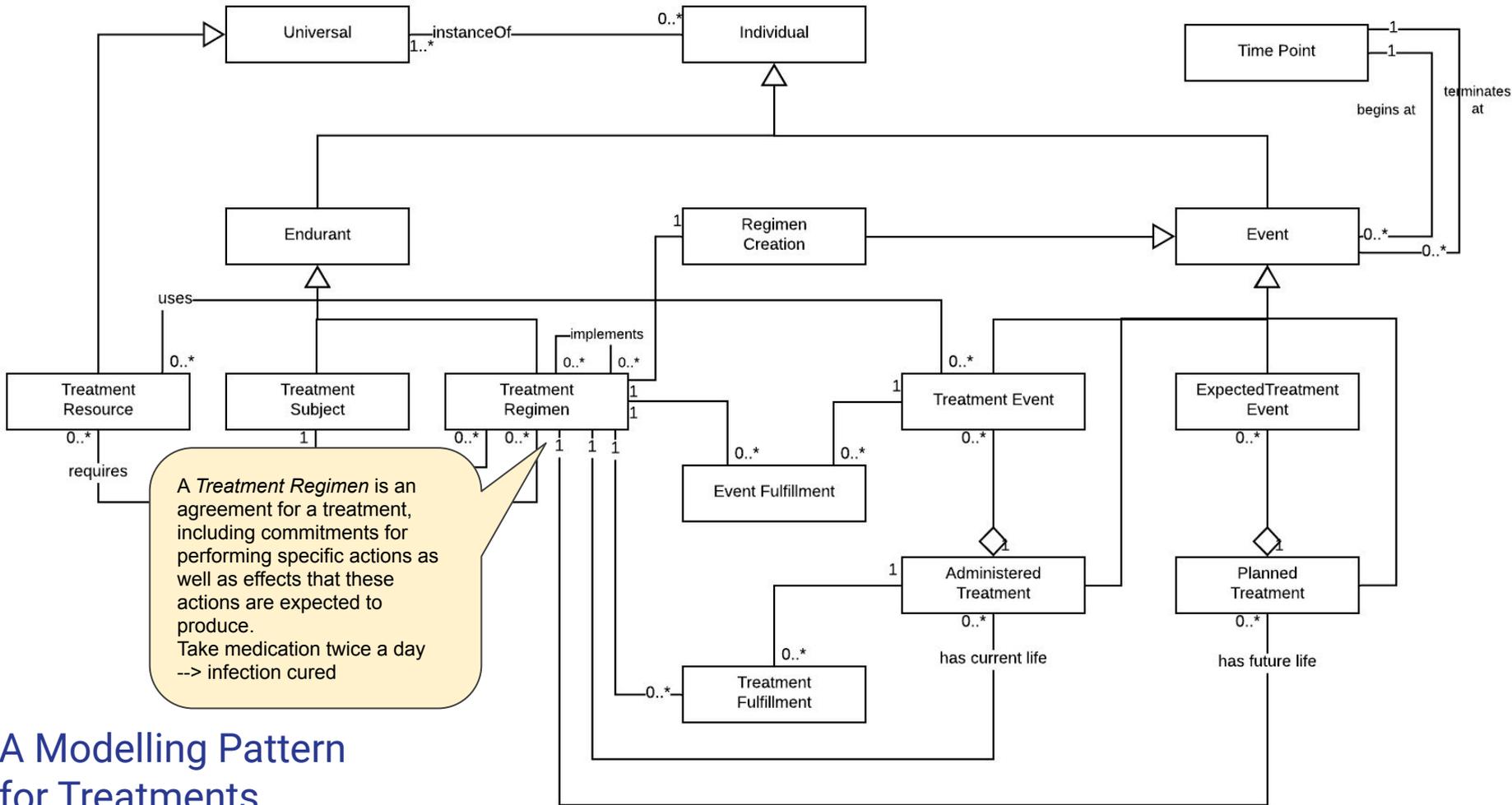




A Modelling Pattern for Treatments

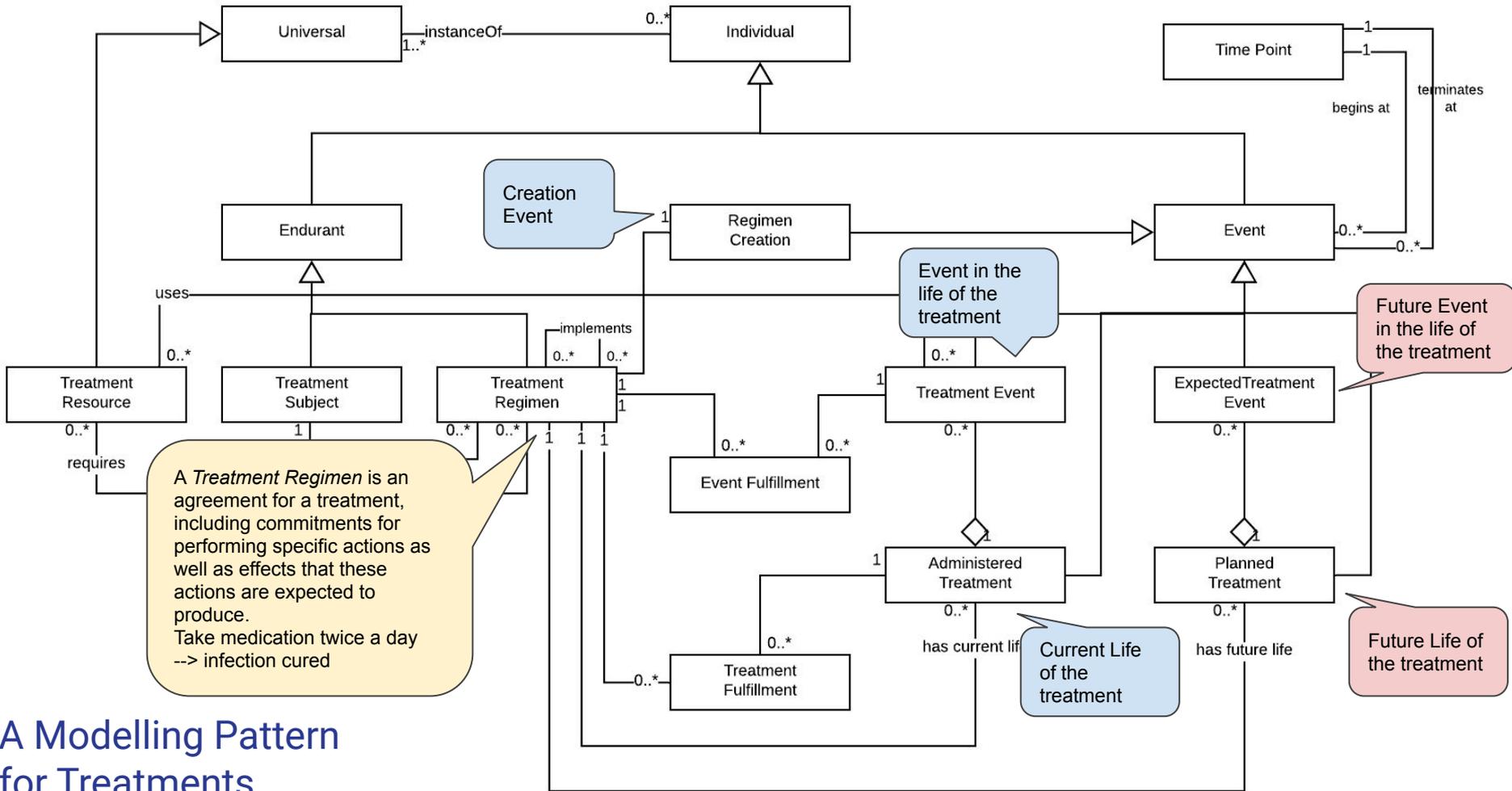


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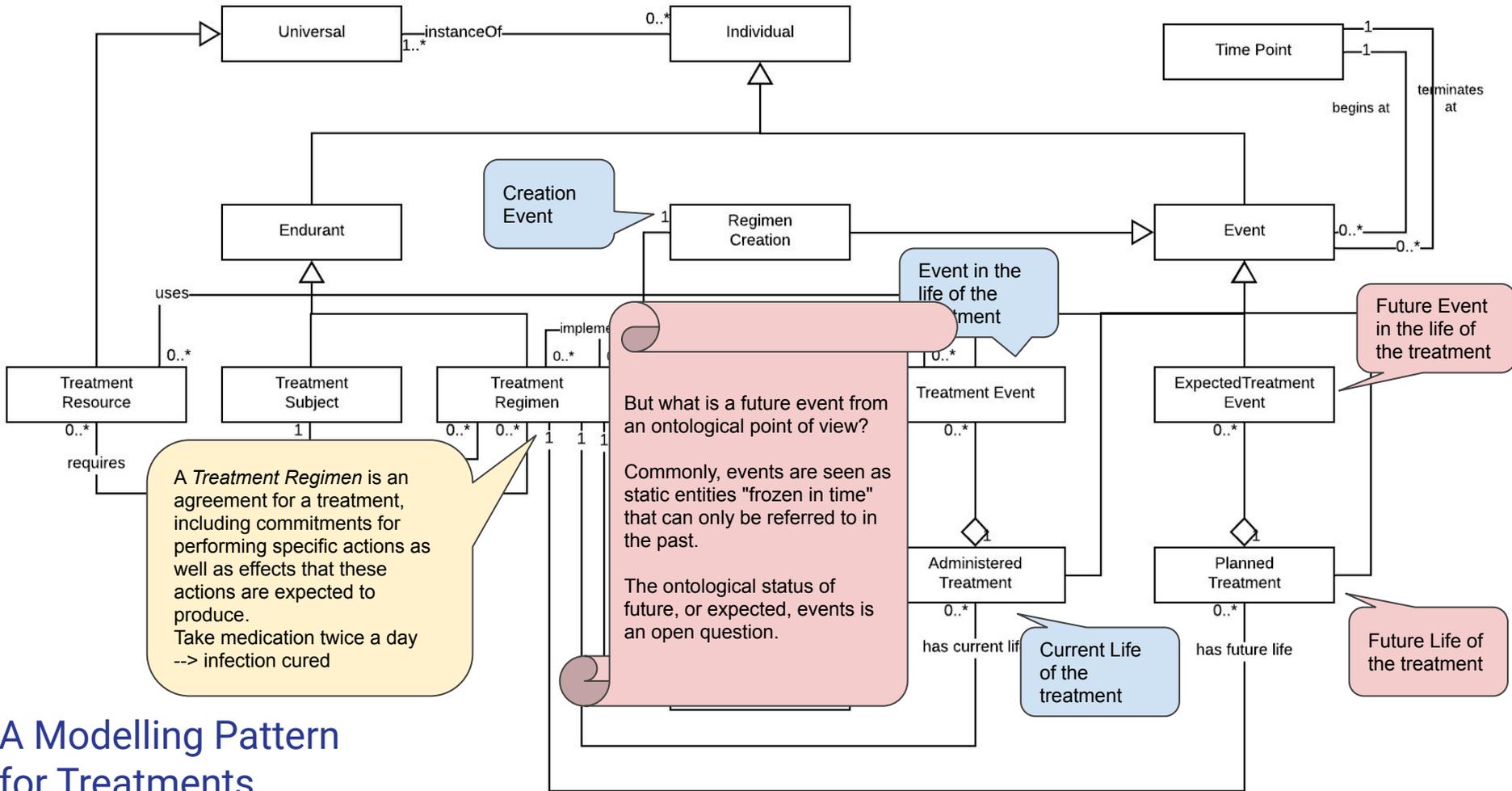


## A Modelling Pattern for Treatments



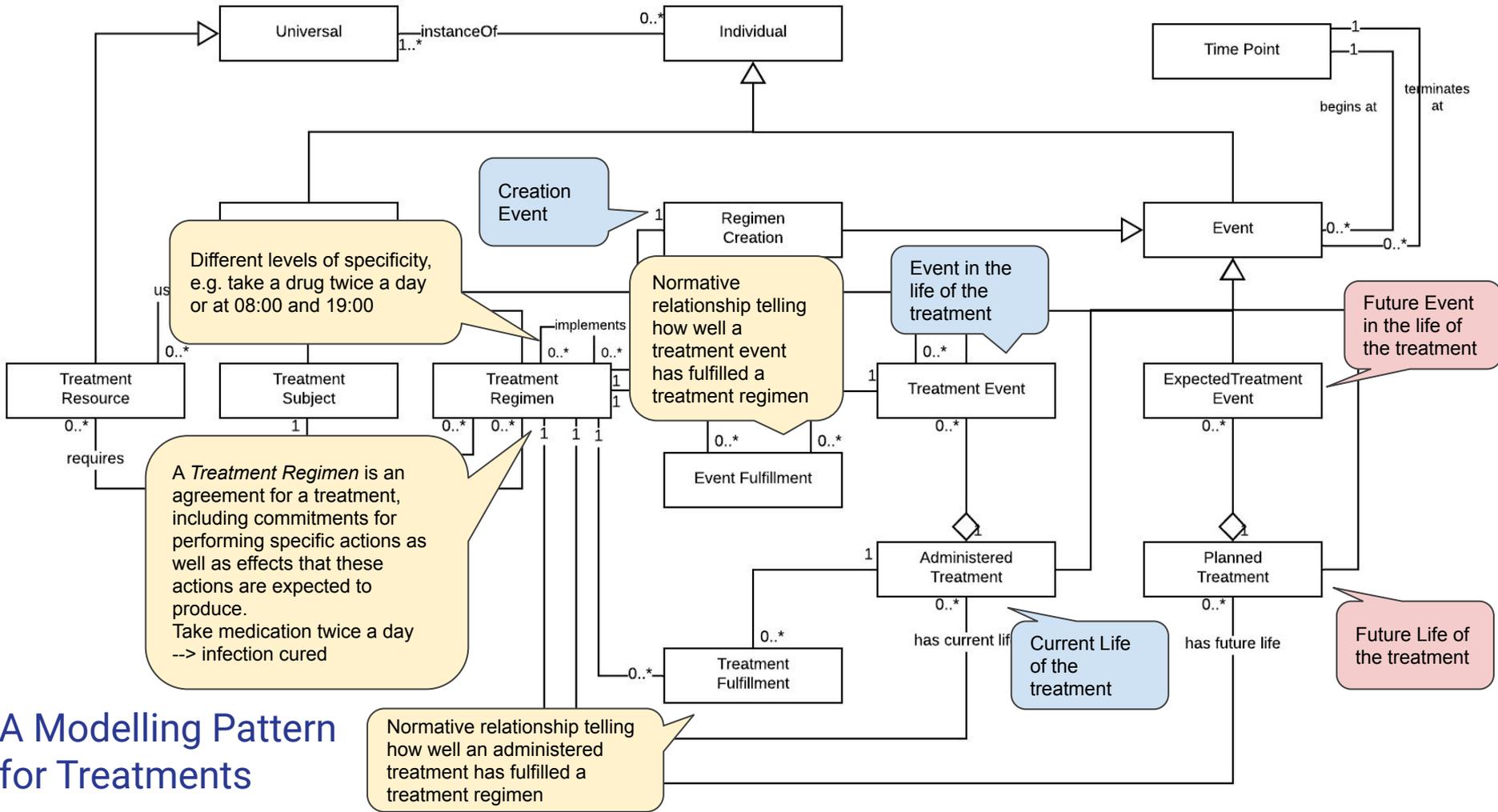


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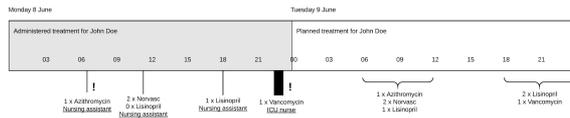
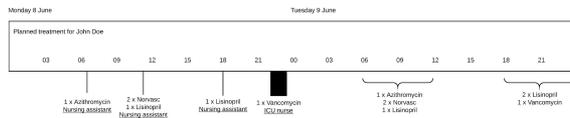
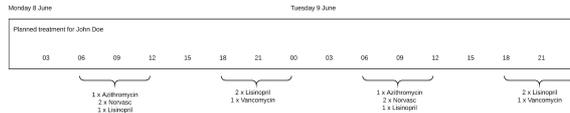


## A Modelling Pattern for Treatments

# Visualizing Treatments

“No syntax without semantics”

No graphical elements without corresponding modelling constructs



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“No syntax without semantics”

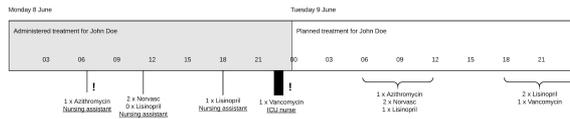
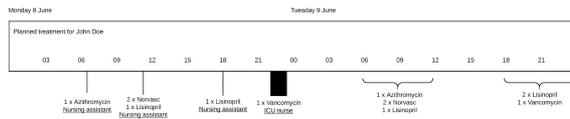
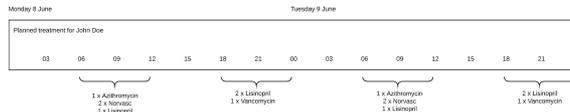
No graphical elements without corresponding modelling constructs

Administered and Planned Treatments represented as rectangles

Treatment Events represented as bars or parentheses

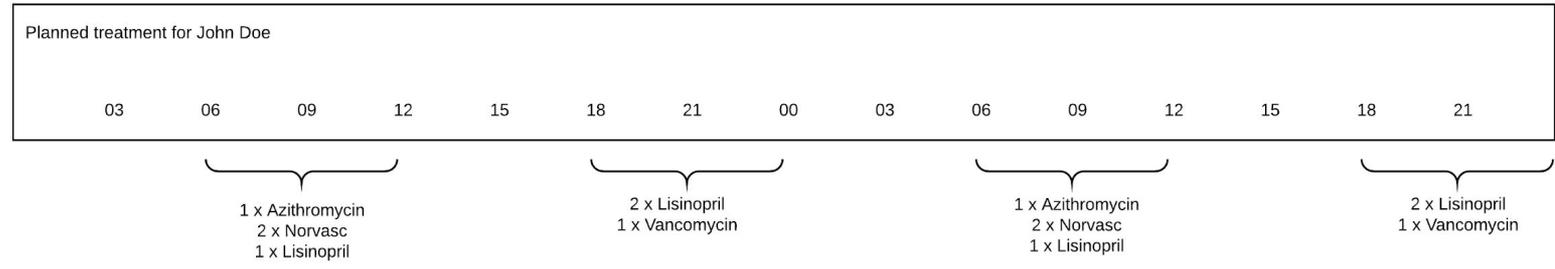
Administered vs Planned Treatments indicated with grayscale

Fulfilment issues represented as exclamation marks



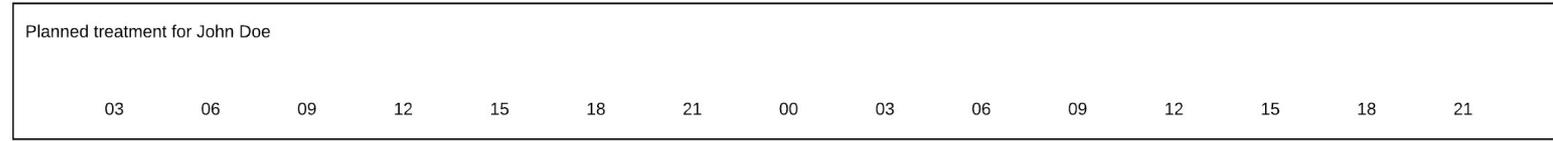
Monday 8 June

Tuesday 9 June



Monday 8 June

Tuesday 9 June



Low level of specificity

1 x Azithromycin  
2 x Norvasc  
1 x Lisinopril

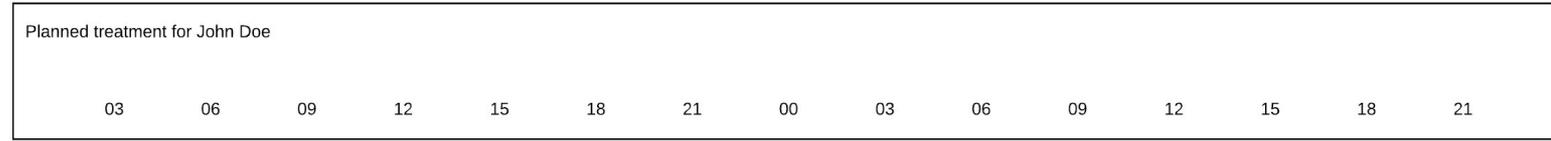
2 x Lisinopril  
1 x Vancomycin

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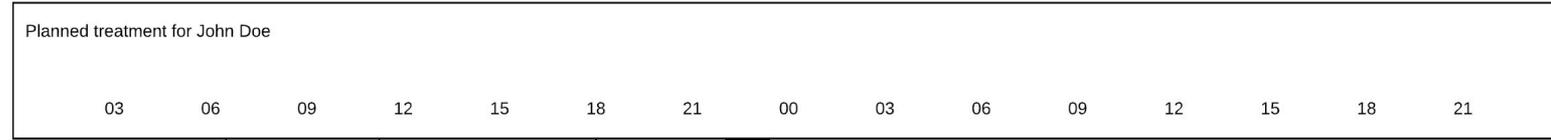
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Monday 8 June

Tuesday 9 June



High level of specificity

1 x Azithromycin  
Nursing assistant

2 x Norvasc  
1 x Lisinopril  
Nursing assistant

1 x Lisinopril  
Nursing assistant

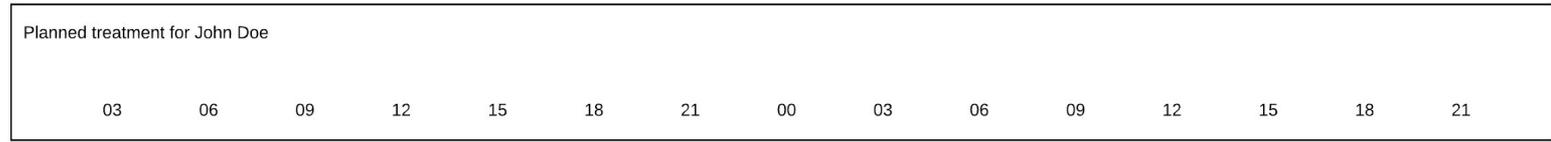
1 x Vancomycin  
ICU nurse

1 x Azithromycin  
2 x Norvasc  
1 x Lisinopril

2 x Lisinopril  
1 x Vancomycin

Monday 8 June

Tuesday 9 June

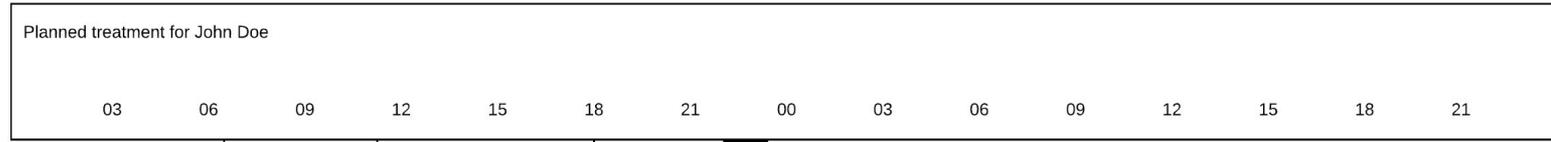


Low level of specificity

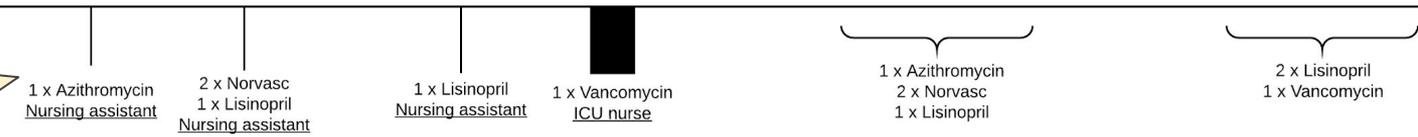


Monday 8 June

Tuesday 9 June

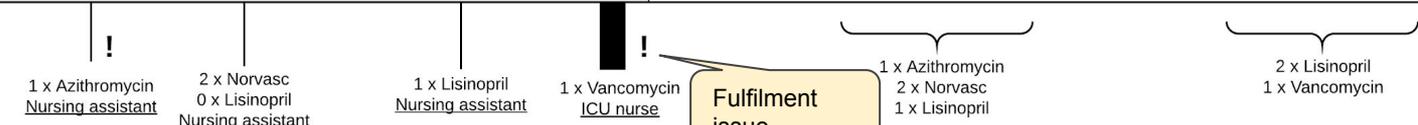
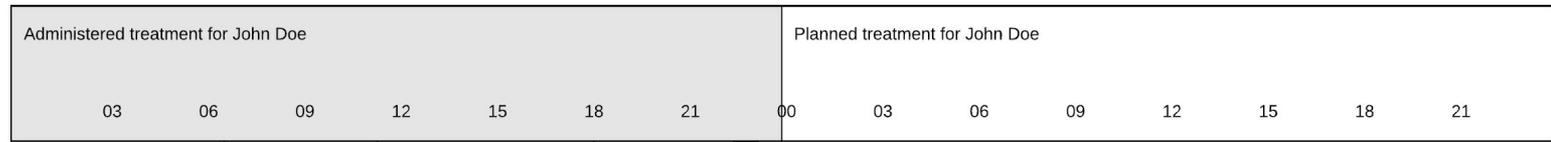


High level of specificity



Monday 8 June

Tuesday 9 June



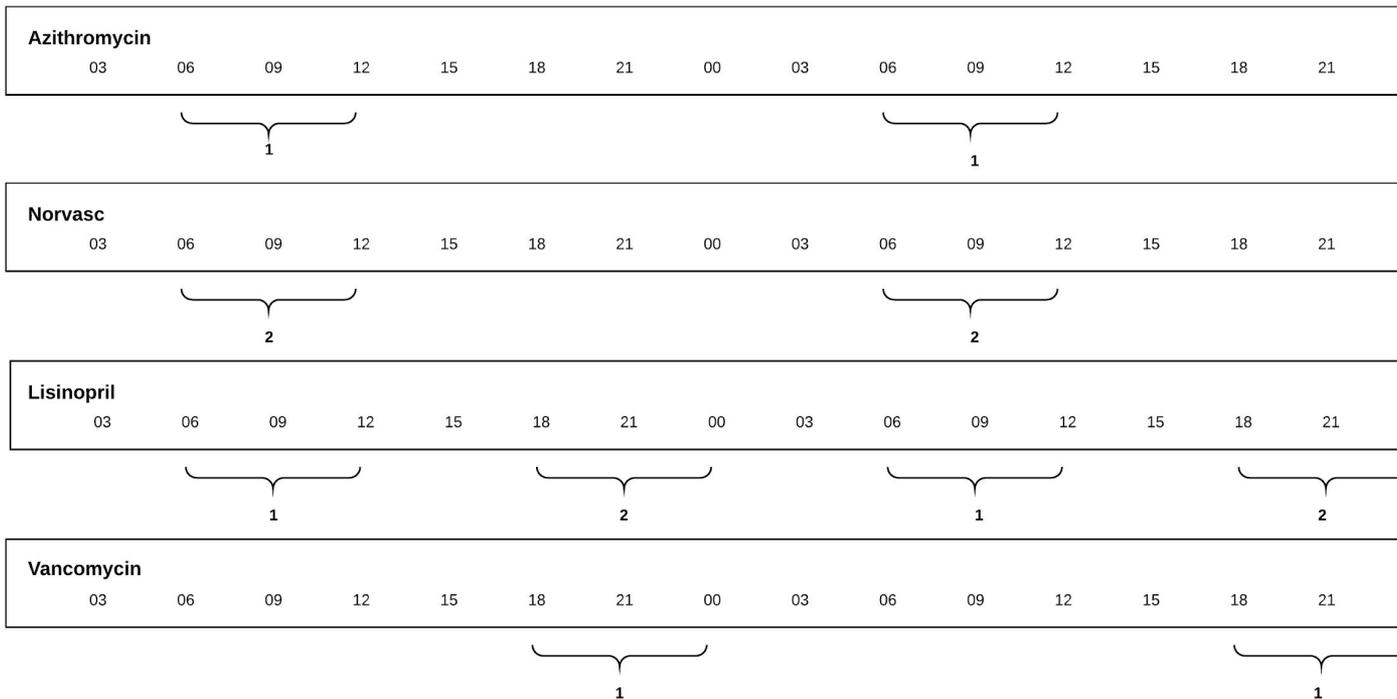
Fulfilment issue

# Subtreatments

## Planned treatments for John Doe

Monday 8 June

Tuesday 9 June



# Summary and Future Work

Treatments as endurants (Treatment Regimen)

Treatments as events (Administered Treatment and Planned Treatment)

Fulfilment relationship between Administered Treatment and Treatment Regimen, allowing for evaluations

Treatment Regimens on different levels of specificity

Basis for visualizations

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Basis for visualizations

Ontological status of future events

Investigate treatments in context: monitoring, evaluation, modification

Generalize to plans