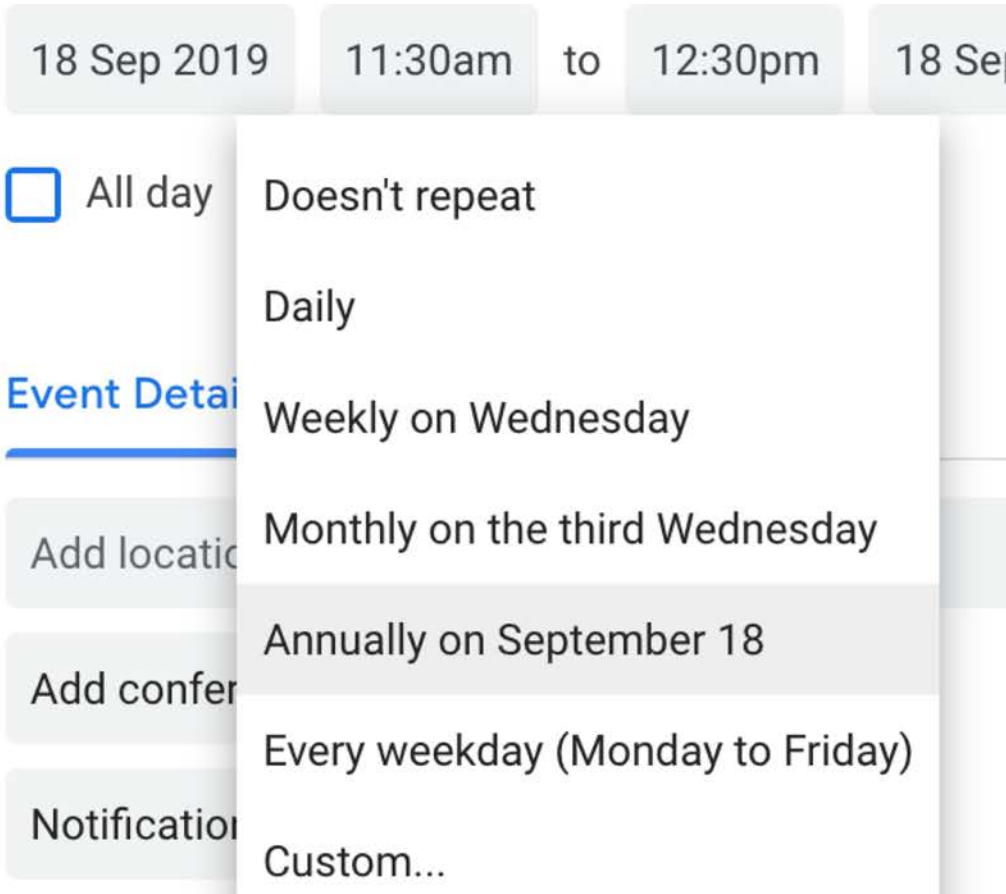
An Ontology Design Pattern for representing Recurrent Events



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WOP @ ISWC2019
Auckland, NZ

What is a recurrent event?

VS

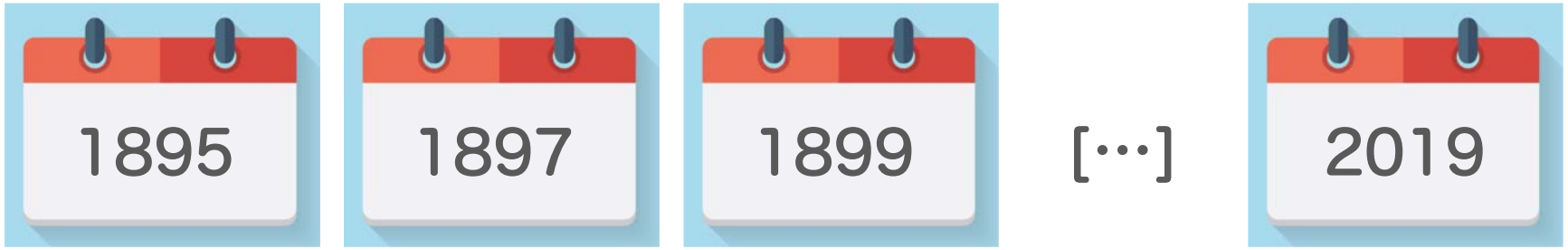
In 1917 Amedeo Modigliani creates an **oil painting** depicting Hanka Zborowska

Art Biennale is held **biennially**

What is a recurrent event?

Art Biennale has been held **biennially**, since 1895, and has:

- the **Biennale Foundation** as event organizer
- **Venice** as event place
- the **promotion of new contemporary art trends** as mission
- a time period of **~2 years** between two consecutive occurrences



But also...

International Women's Day

the Nobel Prize Award ceremony

Carnival

Christmas

Ramadan

periodical team meetings

Birthday

air conditioner filter cleaning

physiological needs

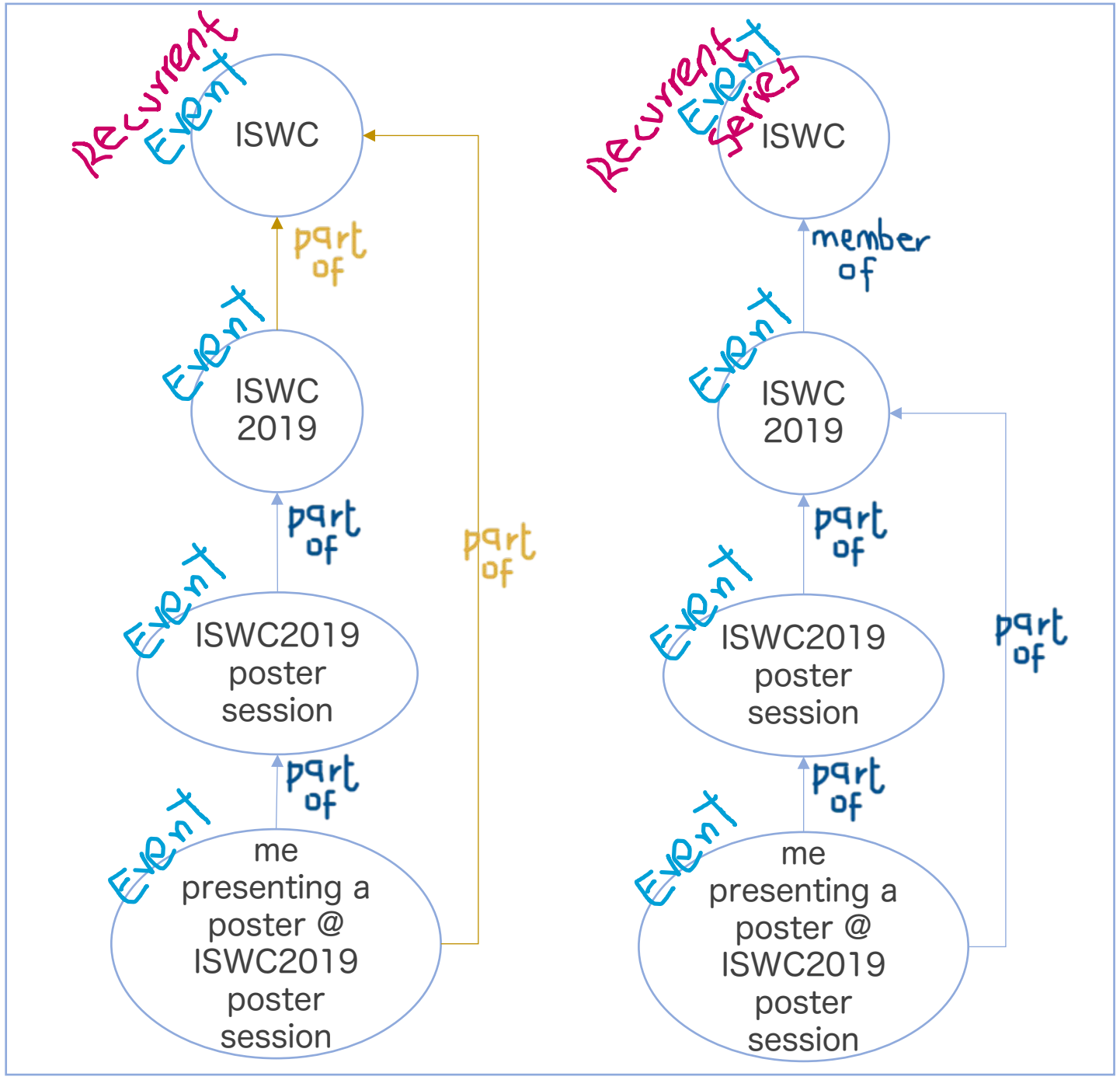
movie showtimes

seasons

medical ultrasound during pregnancy

bus timetable

Looking around



WIKIDATA

Venice Biennale (Q205751)

instance of → art biennial

subclass of → biennale

instance of → biennial event

time period of periodically occurring event → 2 year

subclass of → recurring event

subclass of → event

has part → recurrent event edition

instance of

transitive property

subclass of → event

Looking around

Proton

C Recurring Event (OWL Class)

Recurring sequence of events, such as Olympic Games, etc..

This class is a sub class of C Happening (OWL Class)

Something that happens.

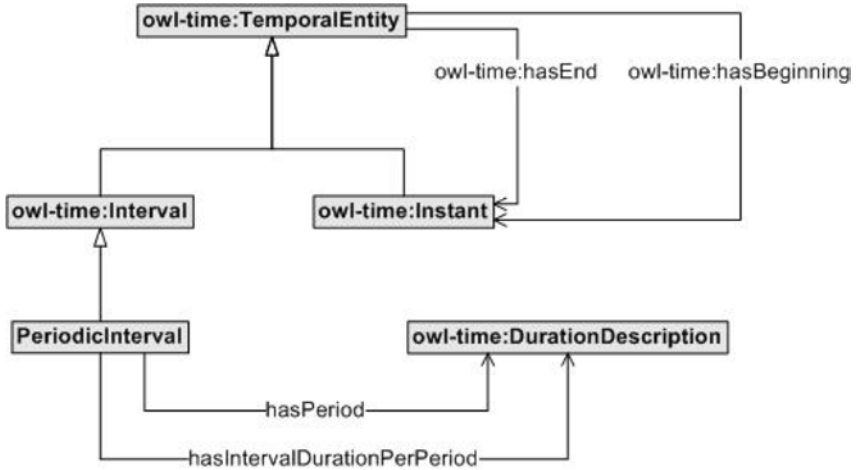
P Current Frequency (Property) DP

The relation between a recurring event and its frequency.

P Recurring Event Instance (Property) OP

C Event (OWL Class)

Submissions:PeriodicInterval

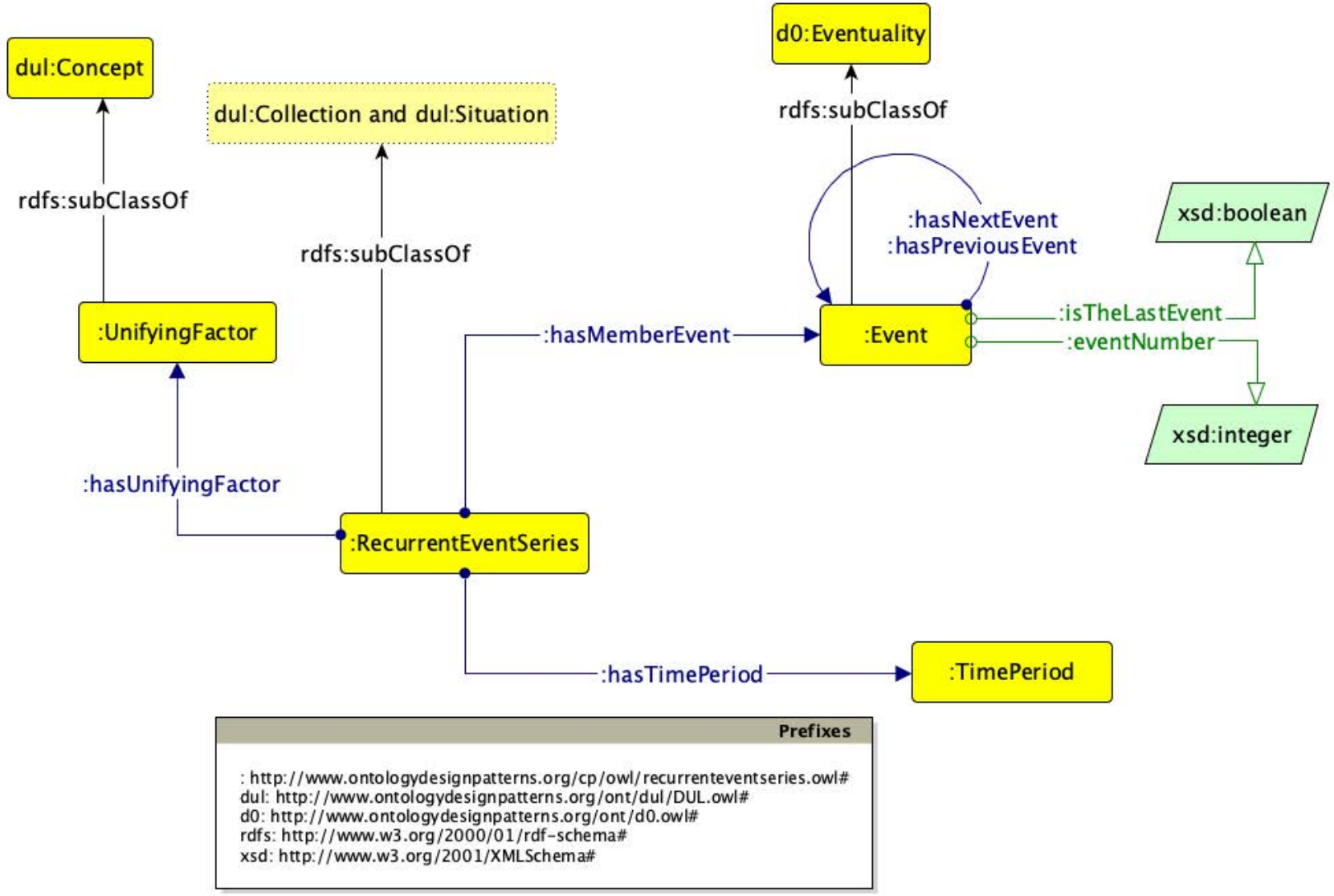


Competency Questions

ID	COMPETENCY QUESTION
CQ1	Which are the **events** of a recurrent event series?
CQ2	Which is the **time period** elapsing between two events of a recurrent event series?
CQ3	What are the **unifying criteria** shared by all the events in a recurrent event series?
CQ4	**Which is the (immediate) next event** in a recurrent event series?
CQ5	**Which is the (immediate) previous event** in a recurrent event series?

ontologydesignpatterns.org/wiki/Submissions:RecurrentEventSeries

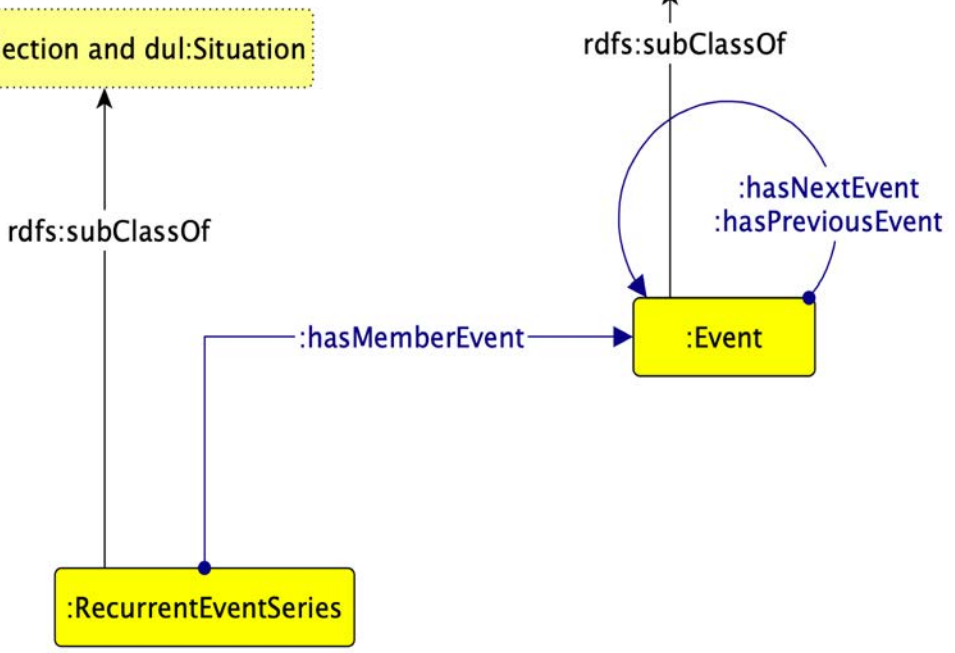
RecurrentEventSeries ODP



:RecurrentEventSeries

Recurrent event series as an **intersection** of **Collection** and **Situation**

its members are of type **Event**



$$\texttt{RecurrentEventSeries} \sqsubseteq \geqslant 0\,\texttt{hasMemberEvent}.\texttt{Event}$$

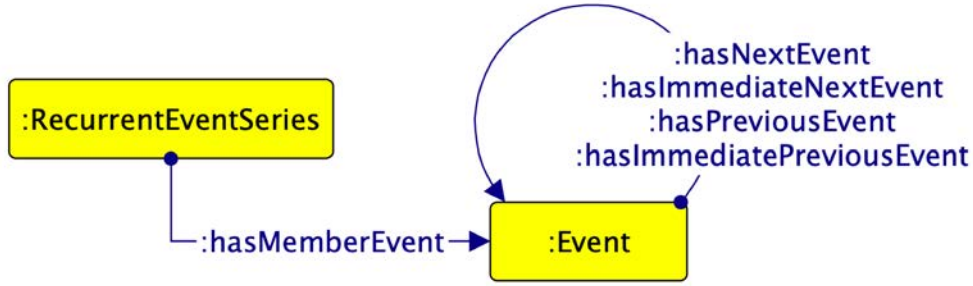
$$\texttt{Event} \sqsubseteq \mathit{d0{:}Eventuality}$$

$$\texttt{RecurrentEventSeries} \sqsubseteq \mathit{dul{:}Collection} \sqcap \mathit{dul{:}Situation}$$

$$\texttt{RecurrentEventSeries} \equiv \exists \texttt{hasMemberEvent}.$$
$$(\geqslant 0\,\texttt{hasNextEvent}.\texttt{Event} \sqcup$$
$$\geqslant 0\,\texttt{hasPreviousEvent}.\texttt{Event})$$

:hasNextEvent, :hasPreviousEvent

The member events are **in sequence**



These properties relate only events **member of the same** recurrent event series

if not, running queries like this generates triples asserting local inconsistencies

example for :hasNextEvent

```
PREFIX recurrentevent: <http://www.ontologydesignpatterns.org/cp/
                                        owl/recurrenteventseries.owl#>
CONSTRUCT {?re1 recurrentevent:isLocallyInconsistentWith ?re2}
WHERE {
       ?re1 recurrentevent:hasMemberEvent ?event1 .
       ?re2 recurrentevent:hasMemberEvent ?event2 .
       ?event1 recurrentevent:hasNextEvent ?event2 .
       filter not exists {?re1 owl:sameAs+ ?re2}
       filter (?re1 != ?re2)
       filter (?event1 != ?event2)
      }
```

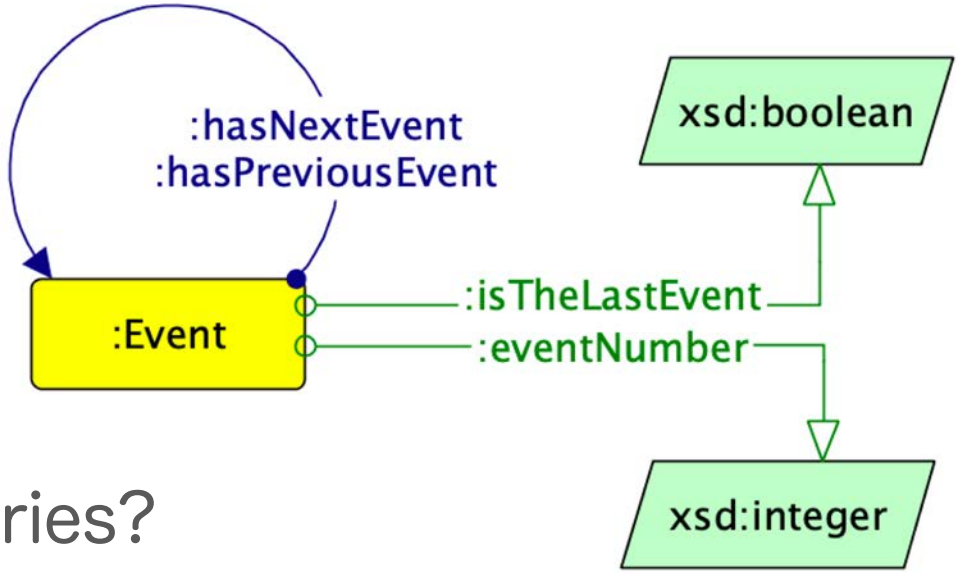
:isTheLastEvent

Is this event the last event of the series, or not?

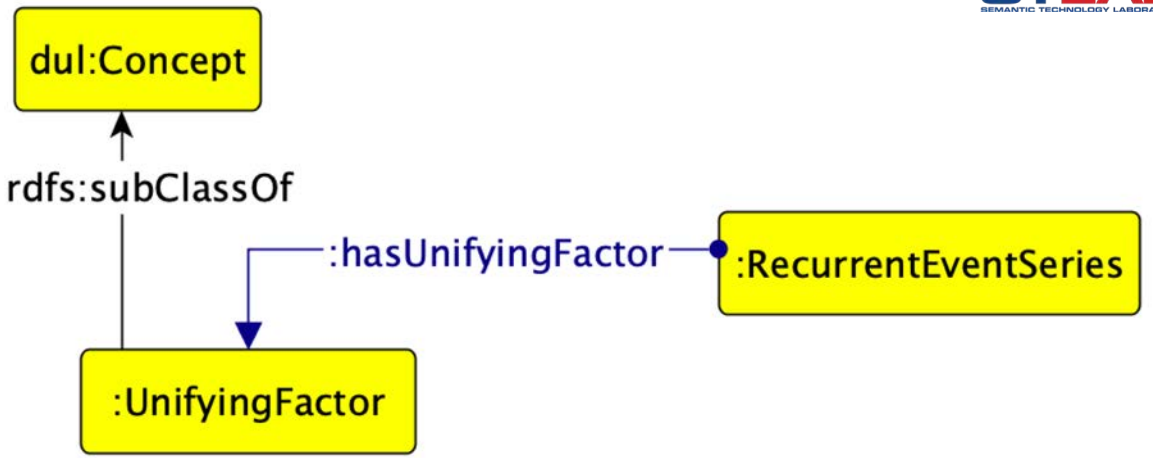
:eventNumber

Which position this event has in the series?

1, 2, 3, …



:UnifyingFactor



at least one **element**
or **property**
occurs in each event member
with some degree of flexibility

$$\texttt{RecurrentEventSeries} \sqsubseteq \exists \texttt{hasUnifyingFactor}.\texttt{UnifyingFactor}$$

$$\texttt{UnifyingFactor} \sqsubseteq \textit{dul:}\texttt{Concept}$$

e.g.

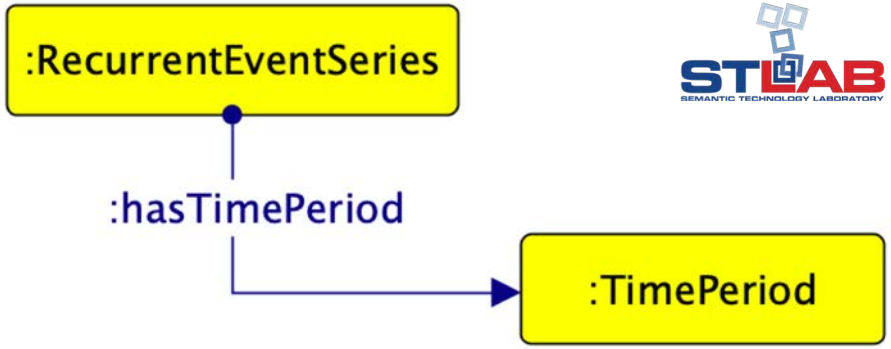
topic

place

organizer

...

:TimePeriod



It represents the **recurrence** of a Recurrent Event Series

approximated temporal distance

between one member event and the next and the previous ones

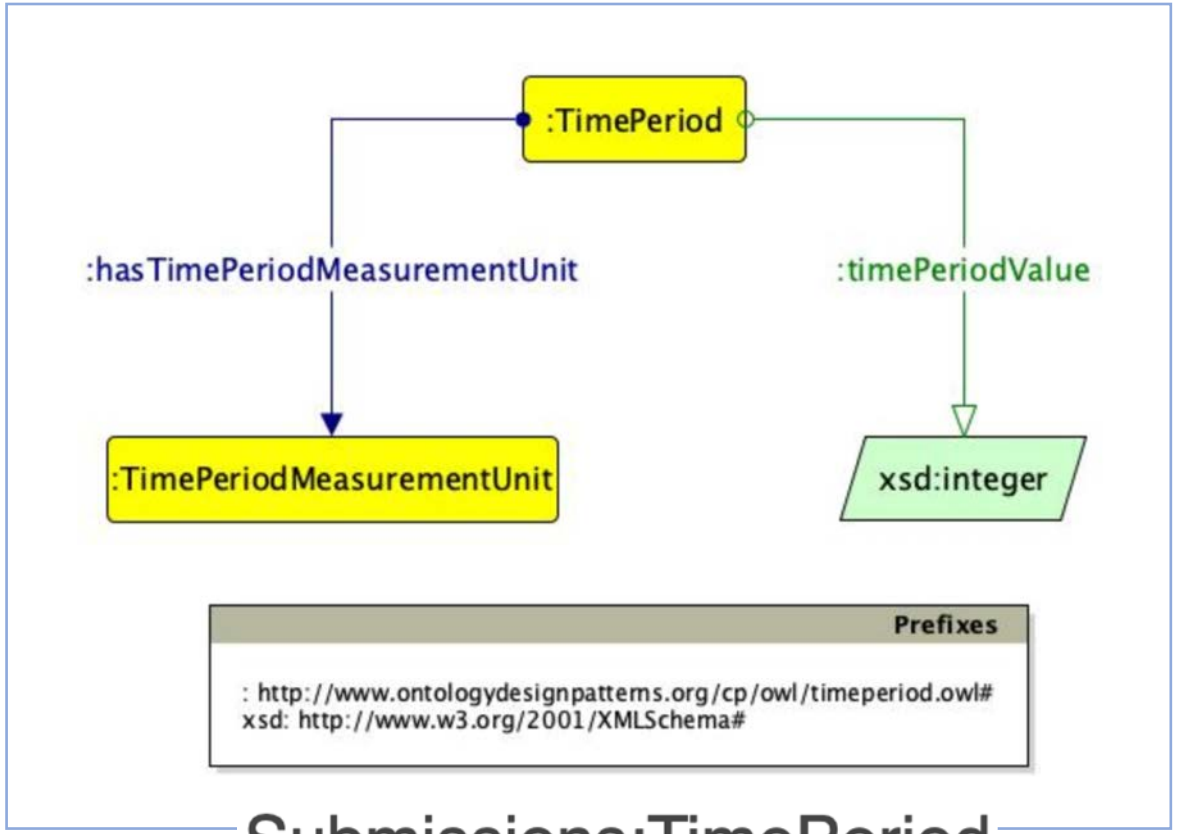
$$\texttt{RecurrentEventSeries} \sqsubseteq \exists \texttt{hasTimePeriod}.\texttt{TimePeriod}$$

It works as a parameter — region of valid values

future work

Estimated or Observed time period?

e.g. possible implementation



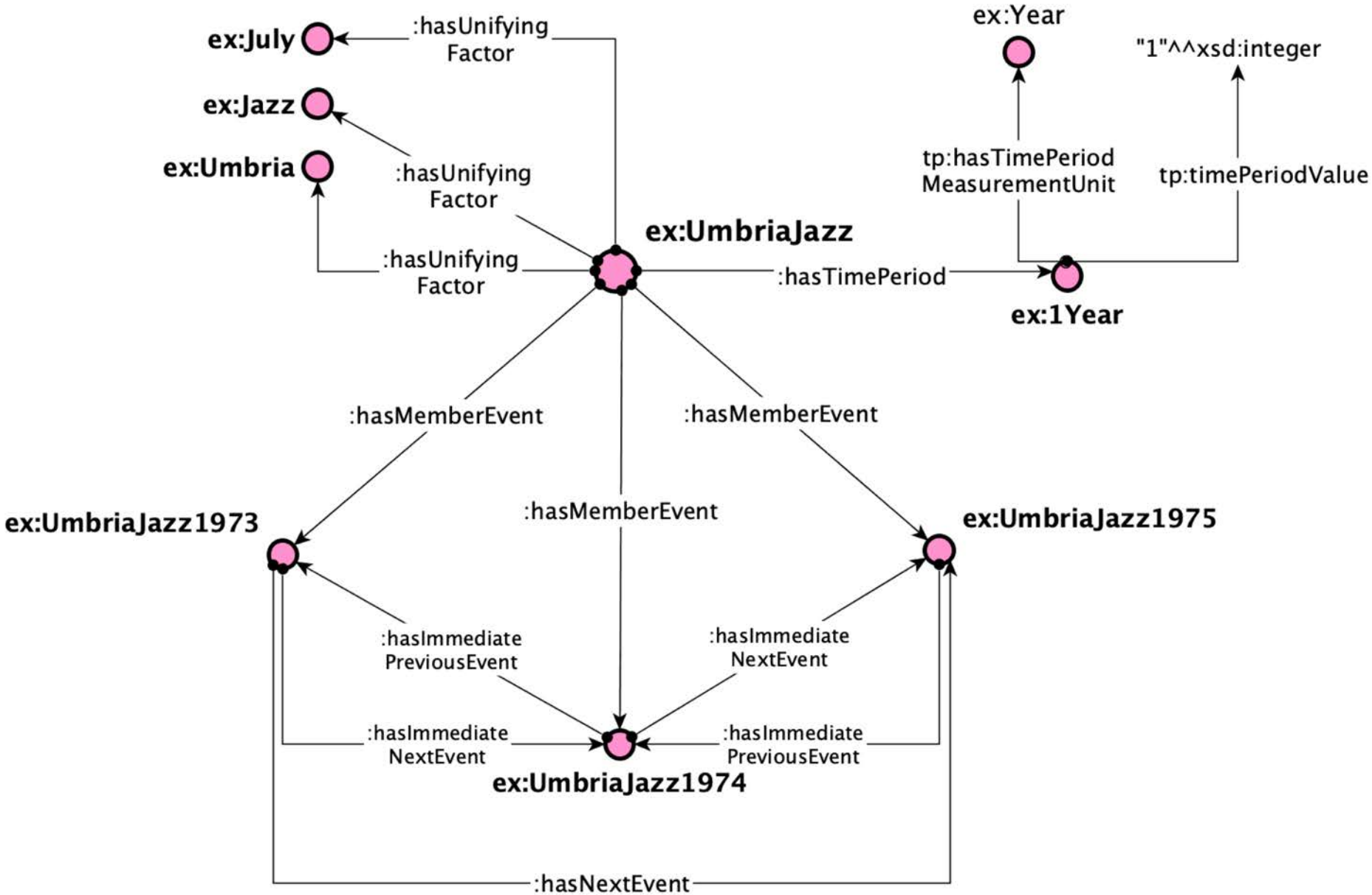
Example

Umbria Jazz has been held **annually**, since 1973, and has:

- the musical genre **jazz** as topic
- **Umbria** as event place
- **July** as month in which it **usually*** takes place
- a time period of **~1 year** between two consecutive occurrences

[...]

* always since 1976
  1974 and 1975 started in July and ended on August 1st
  1973 was held in August


ex:July
:hasUnifying Factor
ex:Jazz
ex:Umbria
:hasUnifying Factor
:hasUnifying Factor
ex:UmbriaJazz
ex:Year
"1"^^xsd:integer
tp:hasTimePeriod MeasurementUnit
tp:timePeriodValue
:hasTimePeriod
ex:1Year
:hasMemberEvent
:hasMemberEvent
:hasMemberEvent
ex:UmbriaJazz1973
ex:UmbriaJazz1975
:hasImmediate PreviousEvent
:hasImmediate NextEvent
:hasImmediate NextEvent
:hasImmediate PreviousEvent
ex:UmbriaJazz1974
:hasNextEvent
Prefixes
: http://www.ontologydesignpatterns.org/cp/owl/recurrenteventseries.owl#
tp: http://www.ontologydesignpatterns.org/cp/owl/timeperiod.owl#
ex: http://example.org/

Future work

- Traditional ceremonies, festivals, cultural events, but also:

- sunrise
- periodic migrations of animals

natural origin

- world days
- train schedule

set by humans

- medical prescriptions
- periodical supply of services

part of a workflow

- Recurrent Event as a fluent?

Thank you!

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