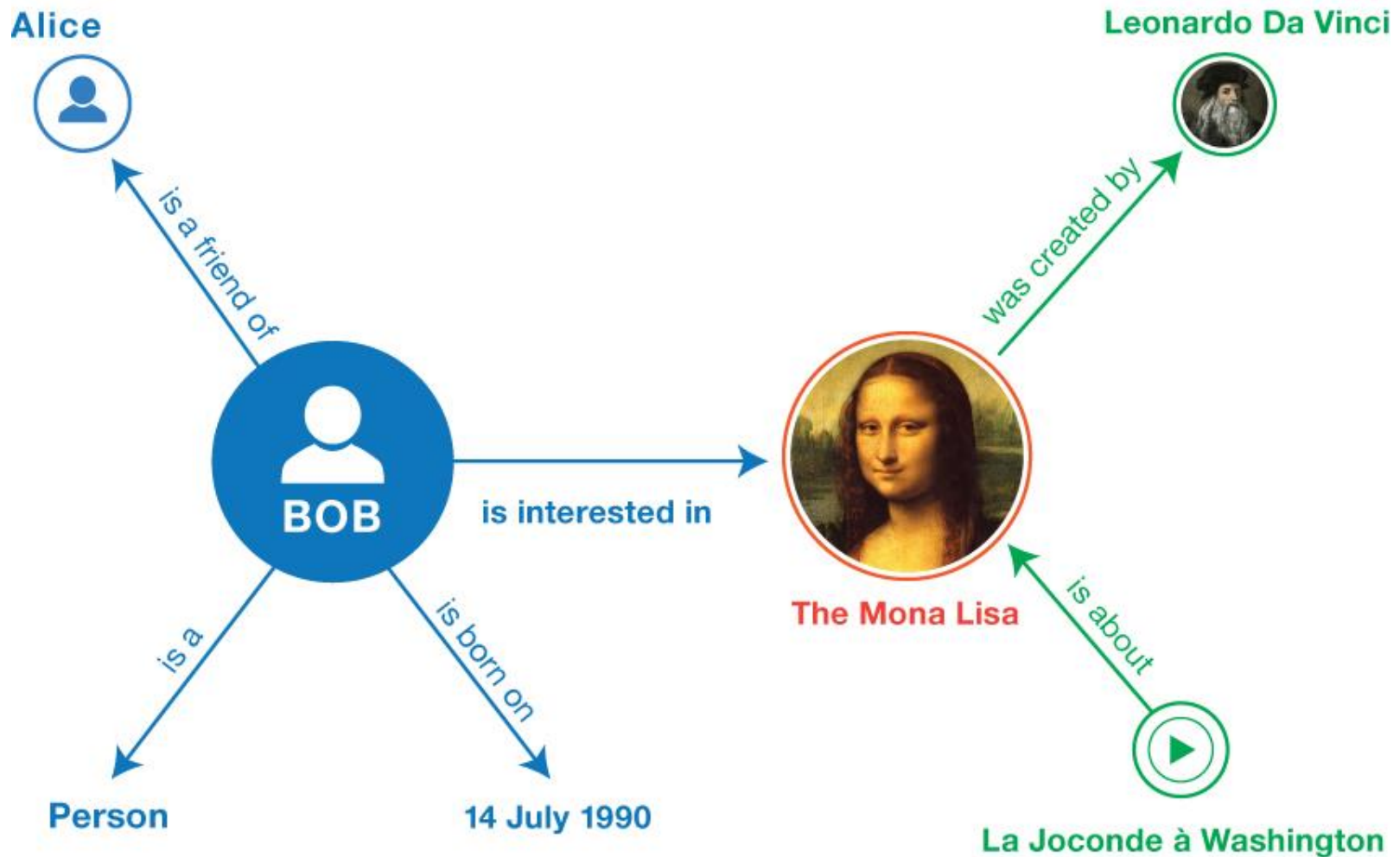


cdt:ucum: describe measurements with The Unified Code for Units of Measure.

Maxime Lefrançois
<http://maxime-lefrancois.info/>

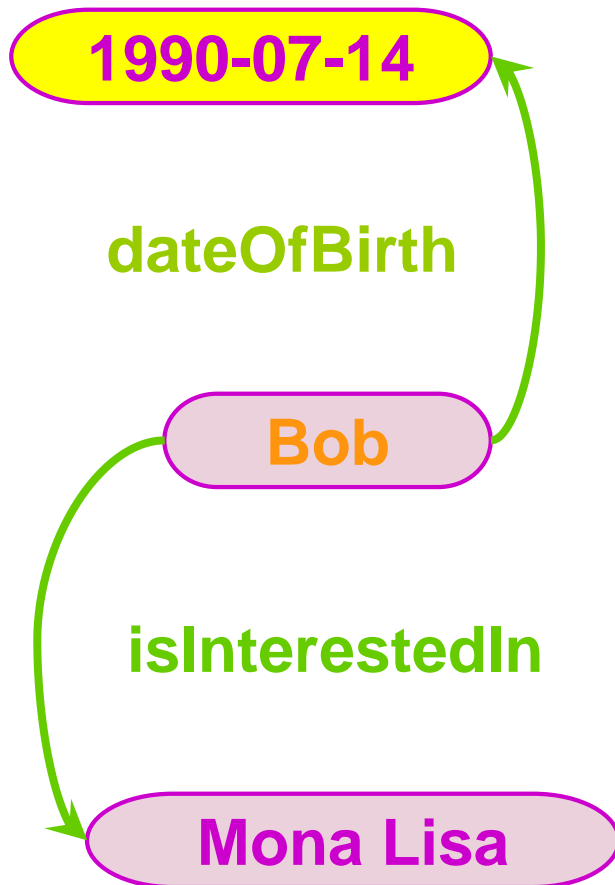
MINES Saint-Étienne – Institut Henri Fayol
Laboratoire Hubert Curien UMR CNRS 5516

An RDF graph



An RDF graph = A set of triples

(Subject , Predicate , Object)



+URIs



nodes and arcs
uniquely identified

Resources: URIs, Literals, (+Blank nodes)

Subject:	URI or Blank node
Predicate:	URI
Object:	URI or Blank node or Literal

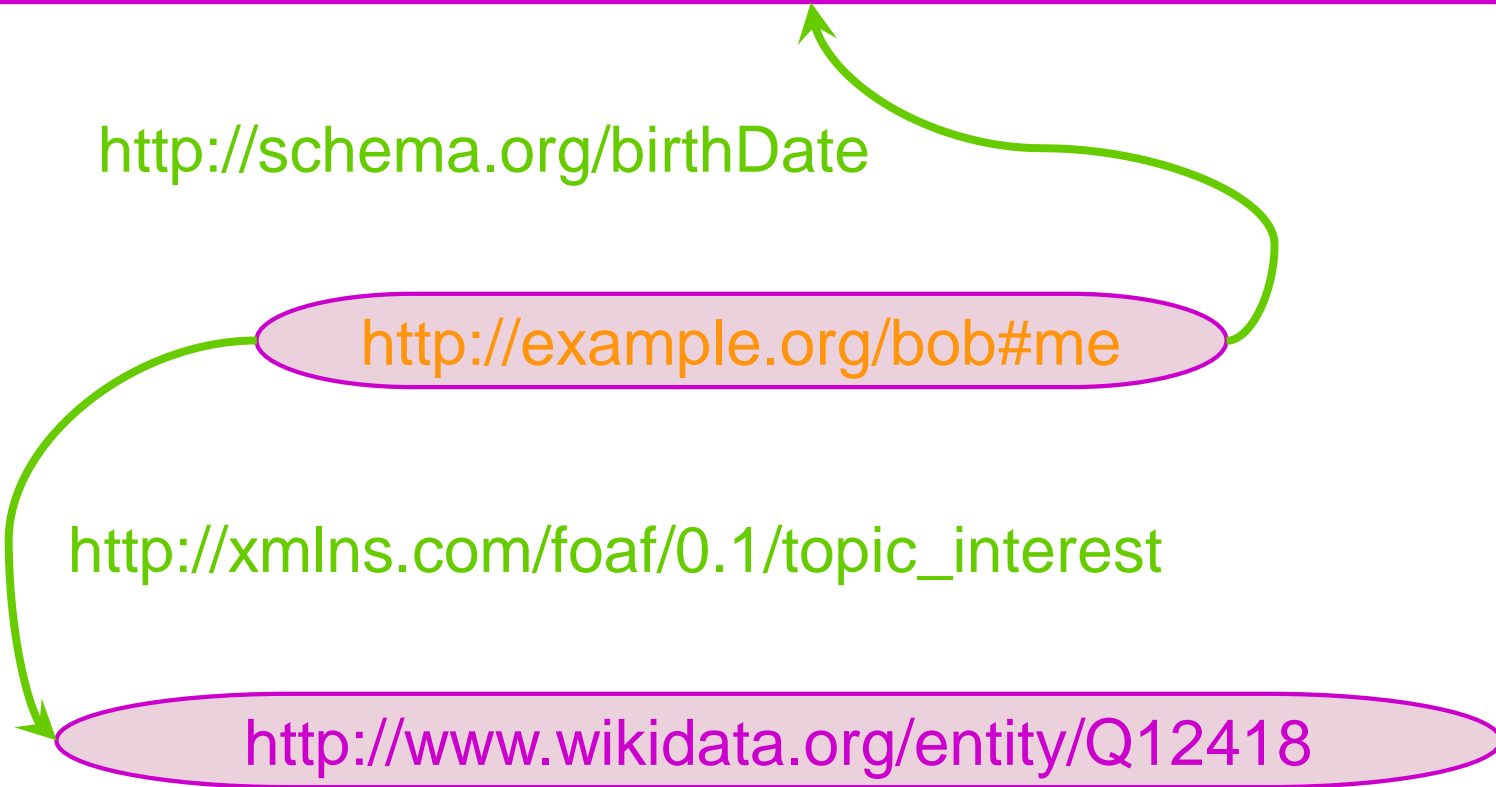
"1990-07-04"^^<http://www.w3.org/2001/XMLSchema#date>

http://schema.org/birthDate

http://example.org/bob#me

http://xmlns.com/foaf/0.1/topic_interest

http://www.wikidata.org/entity/Q12418



URI Prefixes

@Prefix xsd:	<http://www.w3.org/2001/XMLSchema#>.
@Prefix schema:	<http://schema.org/>.
@Prefix foaf:	<http://xmlns.com/foaf/0.1/>.
@Prefix wikidata:	<http://www.wikidata.org/entity/>.

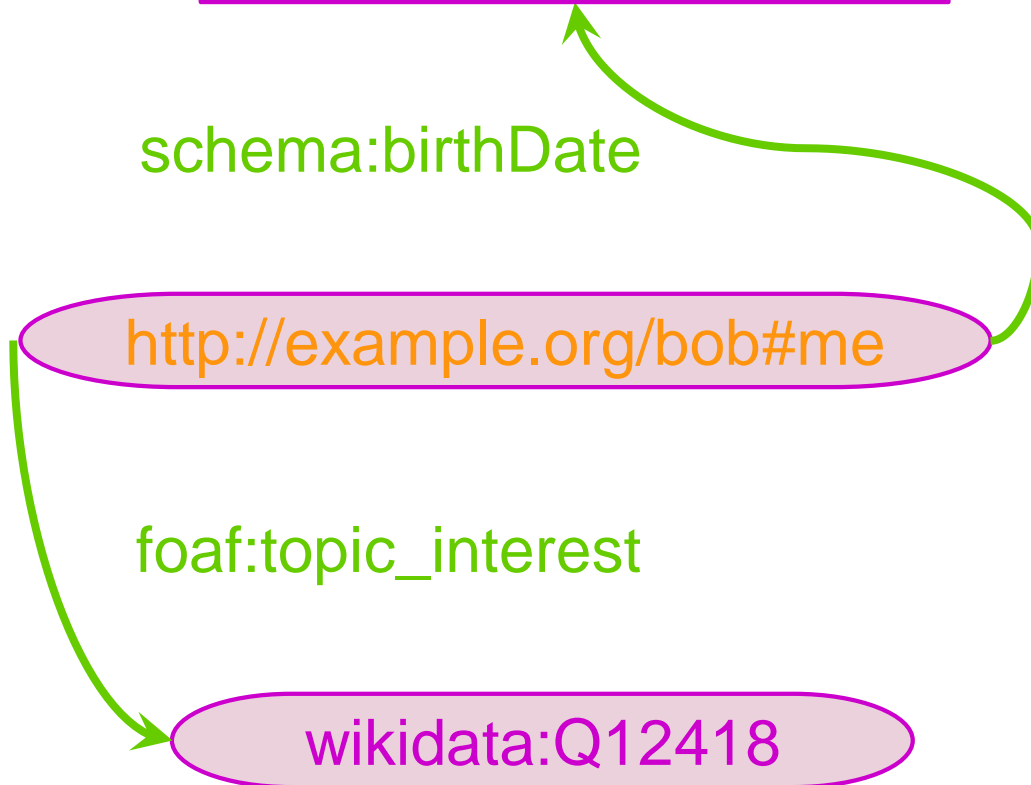
"1990-07-04"^^xsd:date

schema:birthDate

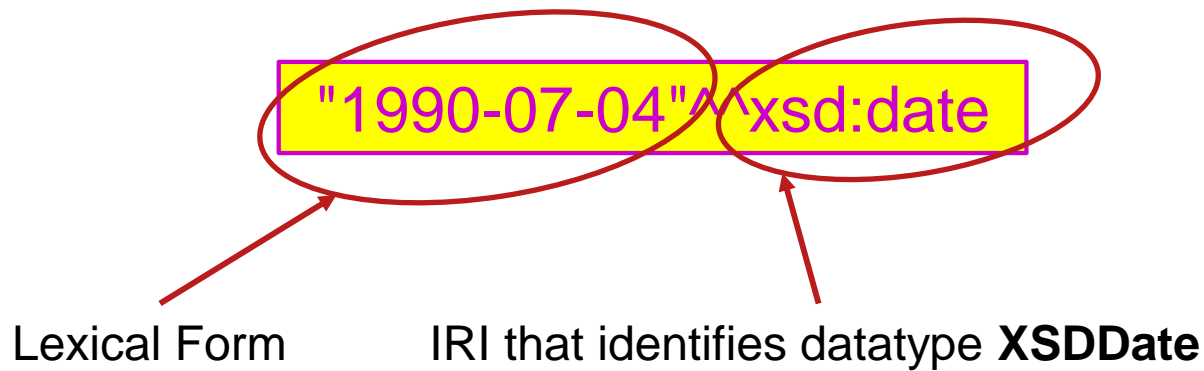
http://example.org/bob#me

foaf:topic_interest

wikidata:Q12418



Literals and Datatypes



A Datatype D :

- a set $L(D)$ of Unicode strings called the *Lexical Space*;
- a set $V(D)$ called the *Value Space*;
- a mapping $L2V(D) : L(V) \rightarrow V(D)$, called the Lexical-to-value mapping, maps all Strings in $L(D)$ to a value in $V(D)$

Heavily used datatypes

XSD datatypes (**W3C XSD 1.1 Part 2: Datatypes**)

3 [Built-in Datatypes and Their Definitions](#)

3.1 [Namespace considerations](#)

3.2 [Special Built-in Datatypes](#)

[anySimpleType](#) · [anyAtomicType](#)

3.3 [Primitive Datatypes](#)

[string](#) · [boolean](#) · [decimal](#) · [float](#) · [double](#) · [duration](#) · [dateTime](#) · [time](#) · [date](#) · [gYearMonth](#) · [gYear](#) · [gMonthDay](#) · [gDay](#) · [gMonth](#) · [hexBinary](#) · [base64Binary](#) · [anyURI](#) · [QName](#) · [NOTATION](#)

3.4 [Other Built-in Datatypes](#)

[normalizedString](#) · [token](#) · [language](#) · [NMTOKEN](#) · [NMTOKENS](#) · [Name](#) · [NCName](#) · [ID](#) · [IDREF](#) · [IDREFS](#) · [ENTITY](#) · [ENTITIES](#) · [integer](#) · [nonPositiveInteger](#) · [negativeInteger](#) · [long](#) · [int](#) · [short](#) · [byte](#) · [nonNegativeInteger](#) · [unsignedLong](#) · [unsignedInt](#) · [unsignedShort](#) · [unsignedByte](#) · [positiveInteger](#) · [yearMonthDuration](#) · [dayTimeDuration](#) · [dateTimeStamp](#)

GeoSPARQL wktLiterals (**OGC**)

```
"POLYGON((-77.050125 38.892086, -77.039482 38.892036, -77.039482 38.895393, -77.033669 38.895508, -77.033585 38.892052, -77.031906 38.892086, -77.031883 38.887474, -77.050232 38.887142, -77.050125 38.892086))"^^geo:wktLiteral.
```

Quantity and Quantity values

CIM NGS-LD INFORMATION MODEL

```
[
{"@id": "ParkingA",
"isAdjacentTo": {"hasObject": {"@id": "StreetA"}},
"hasOpening": {"@id": "GateA"}},
"parkingLastMaximumOccupancy": "25 spaces",
"hasDirectPart": {"@id": "ParkingSpaceAH1"},
"hasDirectPart": {"@id": "ElectricChargingSpaceAE1"}},

{"@id": "StreetA",
"hasState": {"hasValue": "30% congested"},
"reliability": "90%"},
"isConnectedTo": {"hasObject": {"@id": "AlleyB"}},
"inDirection": "one way"}},

{"@id": "ParkingSpaceAH1",
"availability": "available",
"applicableForUser": "handicapped"},

{"@id": "ElectricChargingSpaceAE1",
"availability": "available",
"maximumCurrent": "50 Amperes"}]
```

Questions:

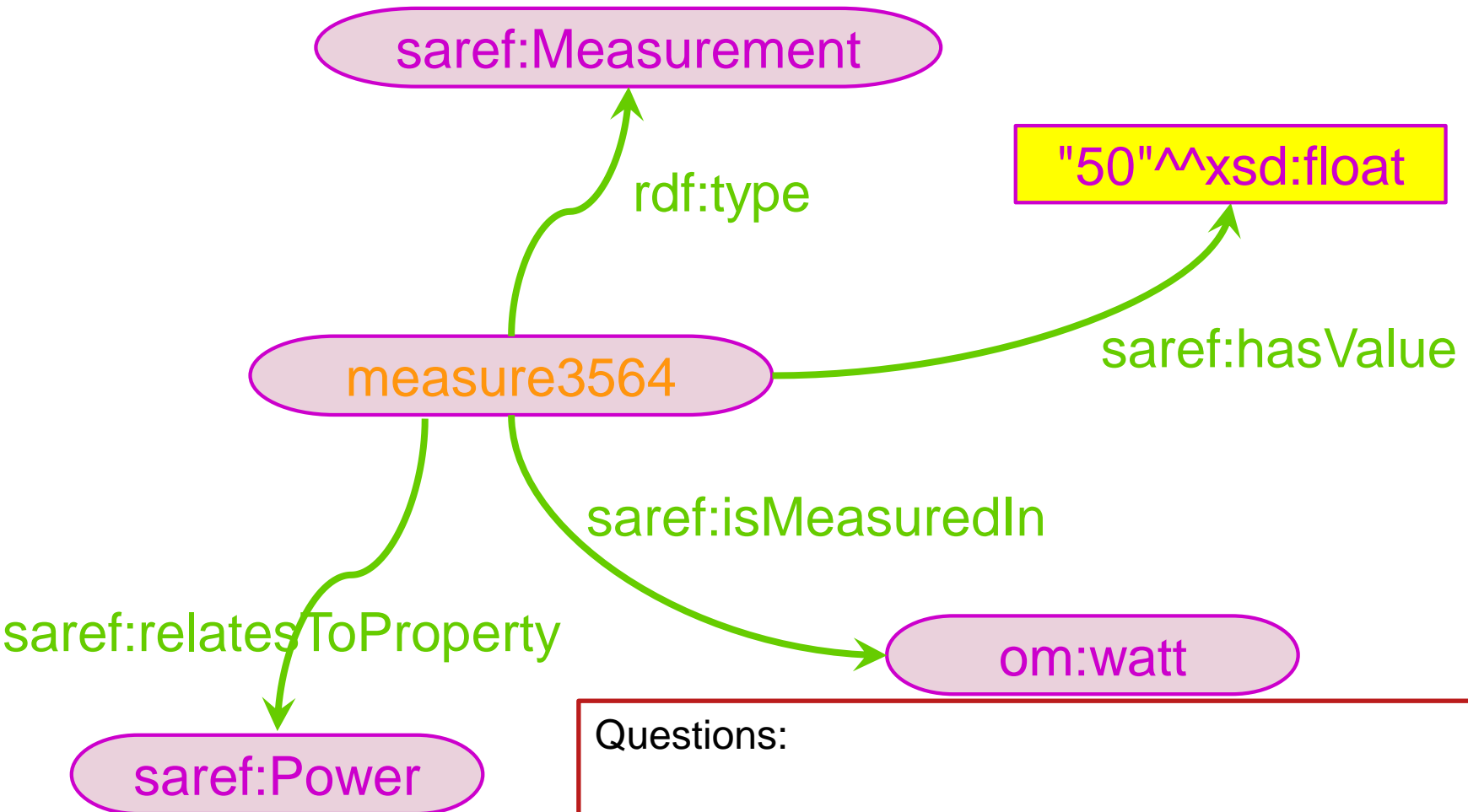
What is the semantics of 50 Amperes?

Are these values the same?

"50 A" "50 Ampere" "50 ampères"
"50 Amperes" "50 000 mA"

Quantity and Quantity values

SAREF Ontology



Questions:

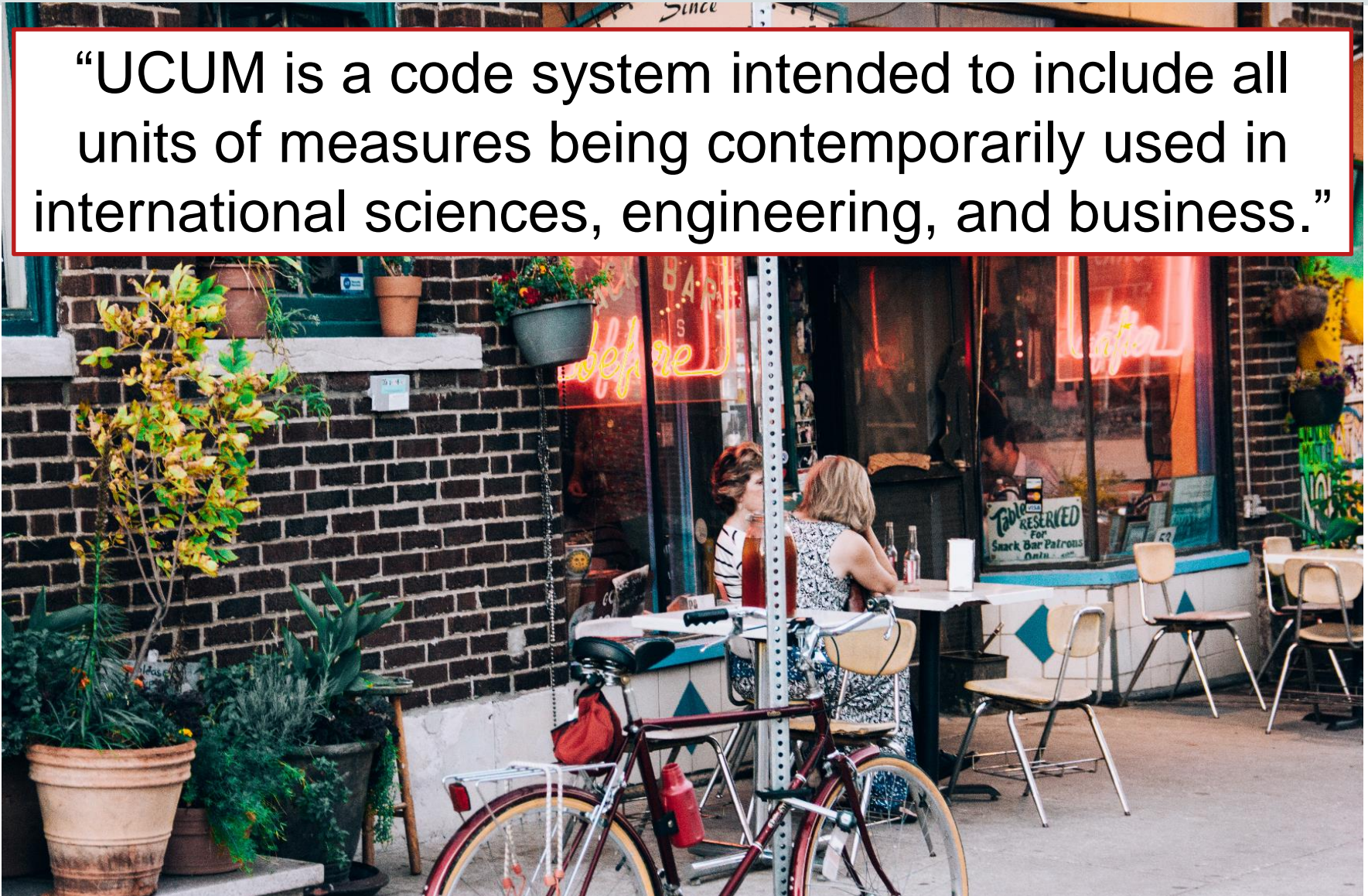
Rely on OM 1.6 ?

How to compare with $5e-3$ of `om:kiloWatt` ?

What is the actual thing whose power is measured?

The cdt:ucum datatype

“UCUM is a code system intended to include all units of measures being contemporarily used in international sciences, engineering, and business.”



@prefix cdt: <http://w3id.org/lindt/custom_datatypes#>.

The cdt:ucum datatype



"20.7 Cel"^^cdt:ucum

"68.4 %"^^cdt:ucum

"27.1 ug.m-3"^^cdt:ucum

"142 [ppm]"^^cdt:ucum

"1013.25 hPa"^^cdt:ucum

"1.01325e5 Pa"^^cdt:ucum

"0.27 W/(m2.K)"^^cdt:ucum

"0 [mi_i]/h"^^cdt:ucum
"0 m.s-1"^^cdt:ucum
"0 km/h"^^cdt:ucum

"450 lm"^^cdt:ucum

"276 W"^^cdt:ucum

"102 m2"^^cdt:ucum

"52 a"^^cdt:ucum

"33 cL"^^cdt:ucum

"0.7 L"^^cdt:ucum

"4.31 bar"^^cdt:ucum

@prefix cdt: <http://w3id.org/lindt/custom_datatypes#>.

The cdt:ucum datatype

Linked Datatypes - Playground ✕ +

← → ↻ 🏠 <https://ci.mines-stetienne.fr/lindt/playground.html> ☆ 🏠 🌐 🔄 📄

Linked Datatypes Overview **Playground** Team Specifications ▾

Linked Datatypes Playground

Check out [The Specification of cdt:ucum and other UCUM datatypes - The Unified Code for Units of Measure code system](#)

You can load and try one of the examples:

SPARQL Query

See the documentation for our predefined [RDF Datatypes](#).

Query

```
1 PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
2 PREFIX cdt: <http://w3id.org/lindt/custom_datatypes#>
3 SELECT ?value1 ?value2 ?result
4 WHERE{
5   VALUES ( ?value1 ?value2 ) {
6     ( "1.0 m/s"^^cdt:speed "2 s"^^cdt:time )
7     ( "1.0 m/s"^^cdt:ucum "2"^^xsd:int )
8     ( "1.0 m/s"^^cdt:ucum "2"^^xsd:double )
9   }
10  BIND( ?value1 * ?value2 AS ?result )
11 }
12
```

Result

value1	value2	result
"1.0 m/s"^^cdt:speed	"2 s"^^cdt:time	"2.0 m"^^cdt:length
"1.0 m/s"^^cdt:ucum	"2"^^xsd:int	"2.0 m/s"^^cdt:speed
"1.0 m/s"^^cdt:ucum	"2"^^xsd:double	"2.0 m/s"^^cdt:speed

Conclusion

Quantity values are very important to represent context information, measurement, device metadata.

Quantity values are best modeled in RDF using well typed literals

The `cdt:ucum` datatype is designed to model quantity values

The `cdt:ucum` datatype uses UCUM (infinite number of units)

UCUM and `cdt:ucum` have open-source implementations