

Identifying information

Markus Stocker



Introduction

- Data are uninterpreted symbols, e.g. measurement values
- They are interpreted in scientific investigations
- Result of interpretation typically called “data product”
- Such products are data that convey information, e.g. a map
- Information is implicit in data products



Introduction

- To identify information we need to
 - Individuate information
 - Represent information explicitly (“managed by a database”)
 - Assign PID to information
 - Resolve PID to “landing page” for information

timePeriod	d316e1	d355e1	d398e1	d447e1	d501e1	d562e1	d631e1	d708e1	d794e1	d891e1	d100e2	d112e2
2011-03-26T00:09:00	0	0	0	0	0	63.4929	173.851	510.069	919.079	1447.96	1998.16	2551.9
2011-03-26T00:19:00	0	0	207.099	380.553	115.113	161.997	449.151	979.113	1297.79	1208.7	1487.36	1926.33
2011-03-26T00:29:00	42.443	151.358	153.498	140.06	196.444	373.129	641.935	634.971	835.571	1439.63	1509.69	1571.03
2011-03-26T00:39:00	0	0	0	11.8355	79.573	206.173	361.177	519.083	868.437	1570.33	1840.22	2056.43
2011-03-26T00:49:00	0	0	0	25.1983	10.141	276.094	352.176	807.726	1181.28	1374.37	1806.76	2315.87
2011-03-26T00:59:00	0	0	0	11.298	77.1657	170.074	283.788	306.944	490.77	977.329	1702.81	2483.44
2011-03-26T01:09:00	0	0	0	53.672	362.411	411.892	262.845	796.944	1148.42	1110.6	1666.49	2363.92
2011-03-26T01:19:00	0	0	62.4193	140.462	208.665	284.023	364.863	489.538	688.202	1019.61	1552.69	2227.24

...

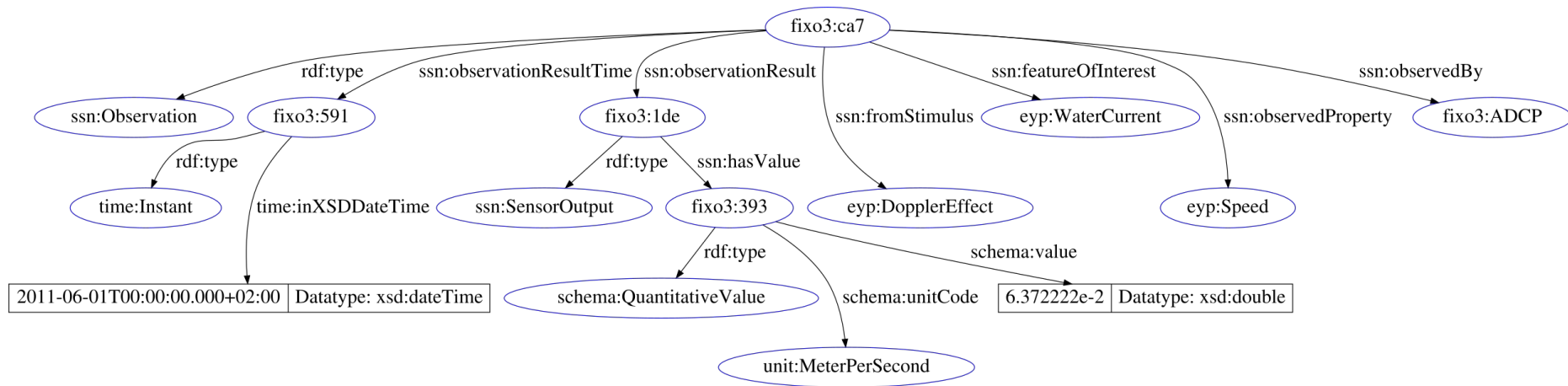


Information

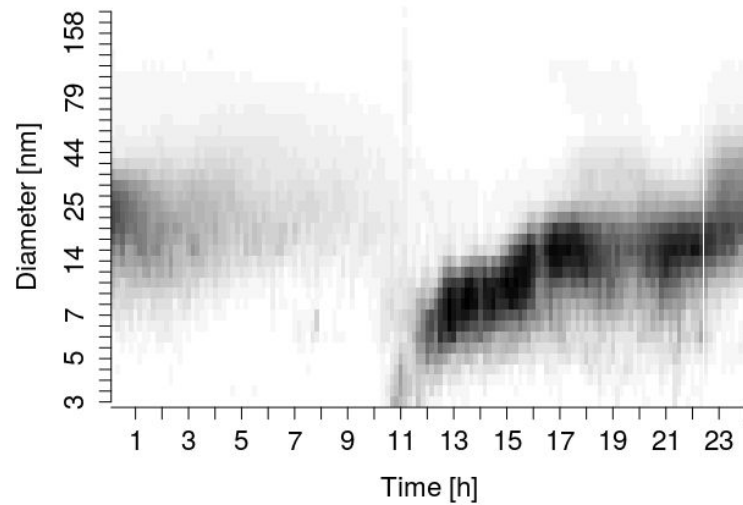
- Consists of *data*
- Data must be *well-formed*
- The well-formed data must be *meaningful*
- Meaningful well-formed data must be *truthful*

Floridi, L. (2011). The Philosophy of Information. Oxford University Press.

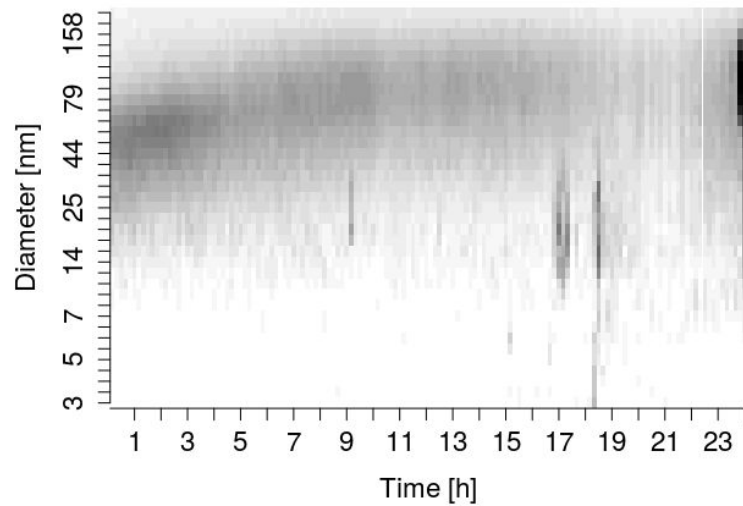
schema:unitCode unit:MeterPerSecond ;
ssn:observationResultTime fixo3:393 fixo3:1de fixo3:591 ;
fixo3:591fixo3:393 . ssn:observationResult fixo3:1de ; a ssn:Observation ;
fixo3:ca7 ssn:observationResultTime fixo3:591 ; ssn:observationResult fixo3:1de ;
ssn:fromStimulus schema:QuantitativeValue ; schema:unitCode eyp:DopplerEffect ;
ssn:featureOfInterest 6.372222e-2 . schema:value eyp:WaterCurrent ;
ssn:observedProperty eyp:Speed ; ssn:observedBy fixo3:ADCP . a
ssn:featureOfInterest time:Instant ; time:inXSDDateTime a
2011-06-01T00:00:00.000+02:00 xsd:dateTime . a
ssn:SensorOutput ; fixo3:1de ssn:hasValue
fixo3:393 unit:MeterPerSecond ;
a eyp:WaterCurrent ;

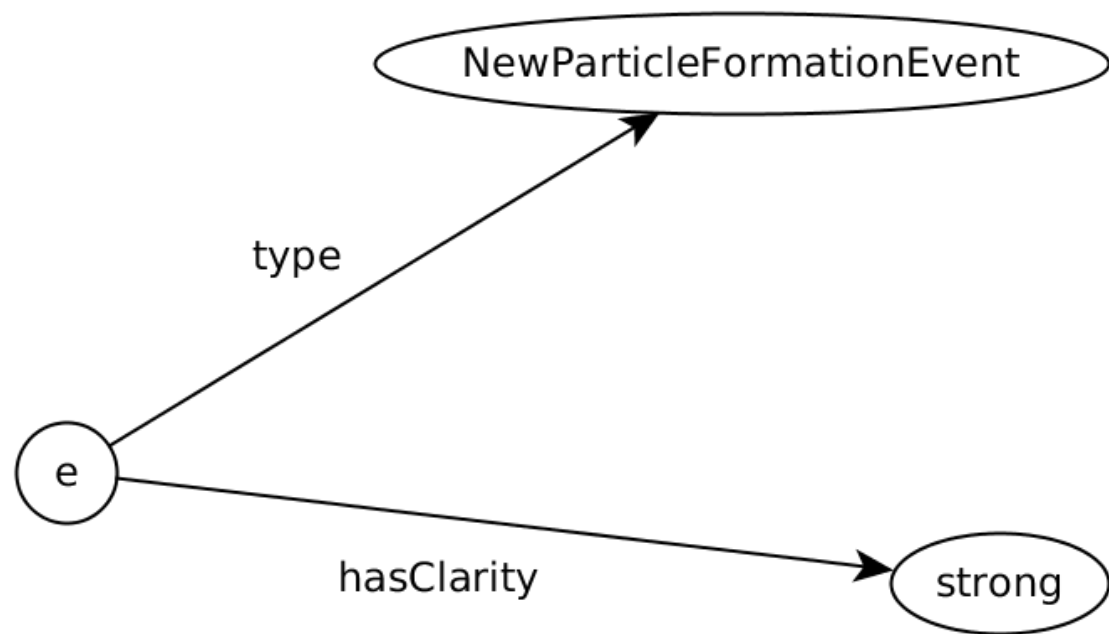


Information **about reality**,
acquired by interpreting
(processed) observations



Data Product



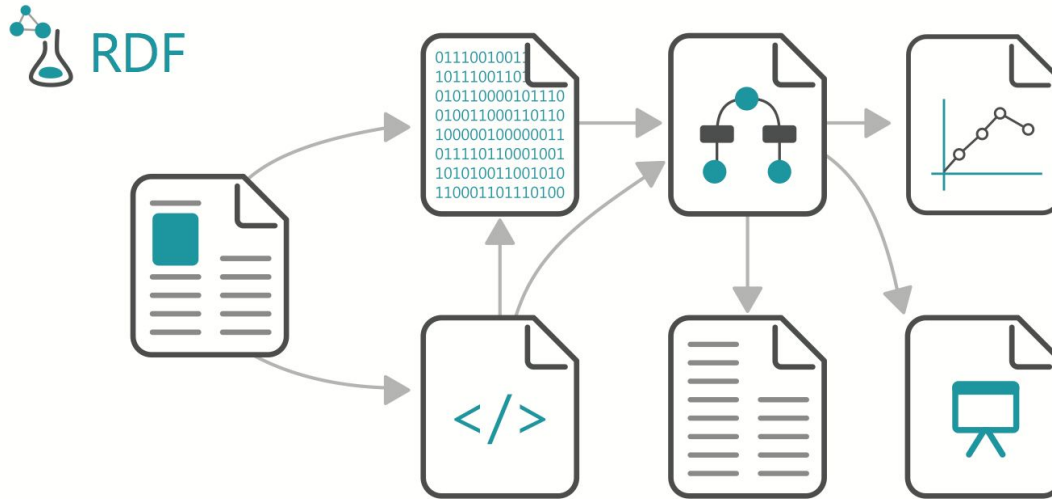


```
ex:e a ex:NewParticleFormationEvent ;  
    ex:hasClarity ex:strong .
```



Research object

- “Semantically rich aggregations of resources that bring together data, methods and people in scientific investigations” (Bechhofer et al., 2013)



```
# -----
# Author: Markus Stocker
# ORCID: 0000-0001-5492-3212
# Date: 2016-08-11
# License: CC-BY
# -----
library(Rcurl)
library("github.com/egonw/rrdf")
# Requires rJava, see:
# http://stackoverflow.com/a/2593282
library(rrdf)
library(uuid)

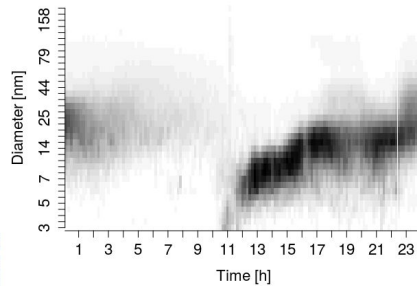
# ---- CONFIGURATION ----
Sys.setlocale("LC_TIME", "en_US.UTF-8")

host <- "http://avaa.tdata.fi"
table <- "HYV_DNPS"
from <- "2011-03-26 00:00:00.000"
to <- "2011-03-27 00:00:00.000"
quality <- "ANY"
averaging <- "NONE"
type <- "NONE"
variables <- c("d316e1", "d355e1", "d398e1", "d447e1", "d501e1", "d562e1",
"d631e1", "d708e1", "d794e1", "d891e1", "d100e2", "d112e2",
"d126e2", "d141e2", "d158e2", "d178e2", "d200e2", "d224e2",

```

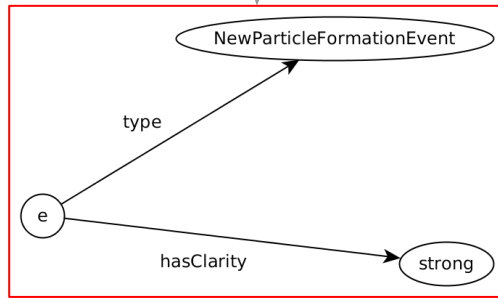
```
#prefix qb: <http://purl.org/linked-data/cube#> .
#prefix ex: <http://example.org#> .
#prefix dimension: <http://purl.org/linked-data/sdmx/2009/dimension#> .

ex:d319b0bf-24b5-449a-8d66-54c8b17afe7
a
qb:Observation ;
ex:d108b2 <"1301.86"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d108b3 <"146.488"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d126e2 <"5765.31"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d1126e1 <"334.462"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d126e2 <"6762.73"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d126e1 <"119.767"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d141e2 <"7563.71"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d141e1 <"101.166"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d158e2 <"8190.98"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d158e1 <"84.262"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d178e2 <"7767.8"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d178e1 <"78.0302"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d200e2 <"6753.22"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d200e1 <"57.6419"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d224e2 <"6467.31"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d224e1 <"3086.22"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d226e2 <"2156.81"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d316e1 <"251.875"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d316e2 <"1707.69"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d355e1 <"168.213"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d355e2 <"1184.19"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d398e1 <"265.944"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d398e2 <"625.340"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d447e1 <"415.541"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d447e2 <"374.991"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d501e1 <"508.331"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d501e2 <"773.747"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d562e1 <"1006.54"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d562e2 <"225.807"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d631e1 <"1663.32"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d631e2 <"173.586"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d708e1 <"2761.95"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d708e2 <"175.845"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d794e1 <"3411.52"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d794e2 <"158.71"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d891e1 <"1207.95"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:d891e2 <"148.043"^^http://www.w3.org/2001/XMLSchema#double> ;
qb:DataSet
dimension:timePeriod
dimension:timePeriod <"2011-03-26T08:29:00"^^http://www.w3.org/2001/XMLSchema#dateTime"> .
ex:d1
```



```
#prefix ex: <http://example.org#> .
#prefix dimension: <http://purl.org/linked-data/sdmx/2009/dimension#> .
#prefix qb: <http://purl.org/linked-data/cube#> .

ex:Sdf2e06e-5288-4cf9-a04e-6e8c204646b1
qb:Observation ;
ex:p01 <"182721.285992693"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p02 <"91342.053033951"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p03 <"42964.823384576"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p04 <"26473.321306087"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p05 <"13416.025044344"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p06 <"9393.90646981048"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p07 <"8465.7579595562"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p08 <"6732.99213687614"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p09 <"5888.09222677874"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p10 <"4851.9029806067"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p11 <"4689.78576752719"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p12 <"3529.9472878159"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p13 <"2800.15913938687"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p14 <"2336.02027821801"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p15 <"1693.5233253359"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p16 <"1426.11874696801"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p17 <"1005.80962345565"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p18 <"727.531591381707"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p19 <"597.0517668255"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p20 <"525.633284620044"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p21 <"290.00227863251"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p22 <"254.090693216949"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p23 <"231.284448747975"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p24 <"182.809535984002"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p25 <"156.975828147814"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p26 <"141.530875977784"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p27 <"129.56393016864"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p28 <"0.10934808948093"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p29 <"0.0936701322005406"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p30 <"0.057418608088215"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p31 <"0.0499170120683776"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p32 <"0.0268110452149435"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p33 <"0.0171719898374185"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p34 <"0.015455325633149"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p35 <"0.0073117555122899"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p36 <"0.001816248353137"^^http://www.w3.org/2001/XMLSchema#double> ;
ex:p37 <"0.00288493748712496"^^http://www.w3.org/2001/XMLSchema#double> ;
qb:DataSet
dimension:timePeriod
ex:d2 <"2011-03-26"^^http://www.w3.org/2001/XMLSchema#date> .
ex:d2 a qb:DataSet ;
<"http://www.w3.org/1999/02/22-rdf-syntax-ns#xsi:type"^^http://www.w3.org/2001/XMLSchema#string> <"https://figshare.com/s/162ee315f878ab56ba8e"> , <"https://doi.org/10.6084/m9.figshare.3571146"> .
```





Take aways

- Data products are artefacts in scientific investigations
- They are meaningful but only to human experts
- They convey information but information is implicit
- Adopt technologies and techniques to represent information explicitly
- Evolve RIs from data systems to information systems
- Identify information objects persistently and cross link with resources
- Cross link research objects to ORCID

```
<> a ro:ResearchObject ;  
  dct:creator [ a foaf:Person; dbo:orcidId "0000-0001-5492-3212" ] .  
...
```