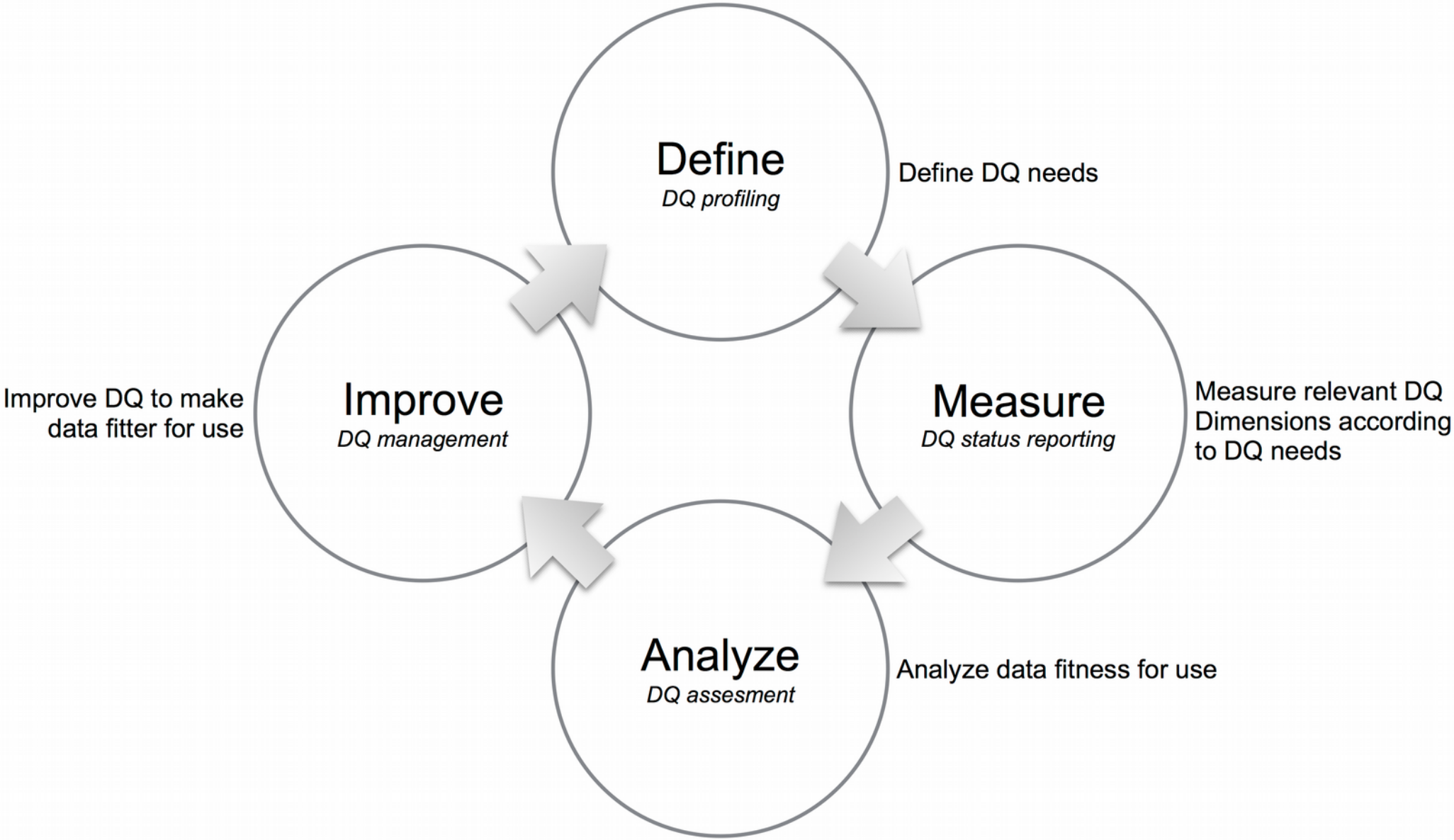
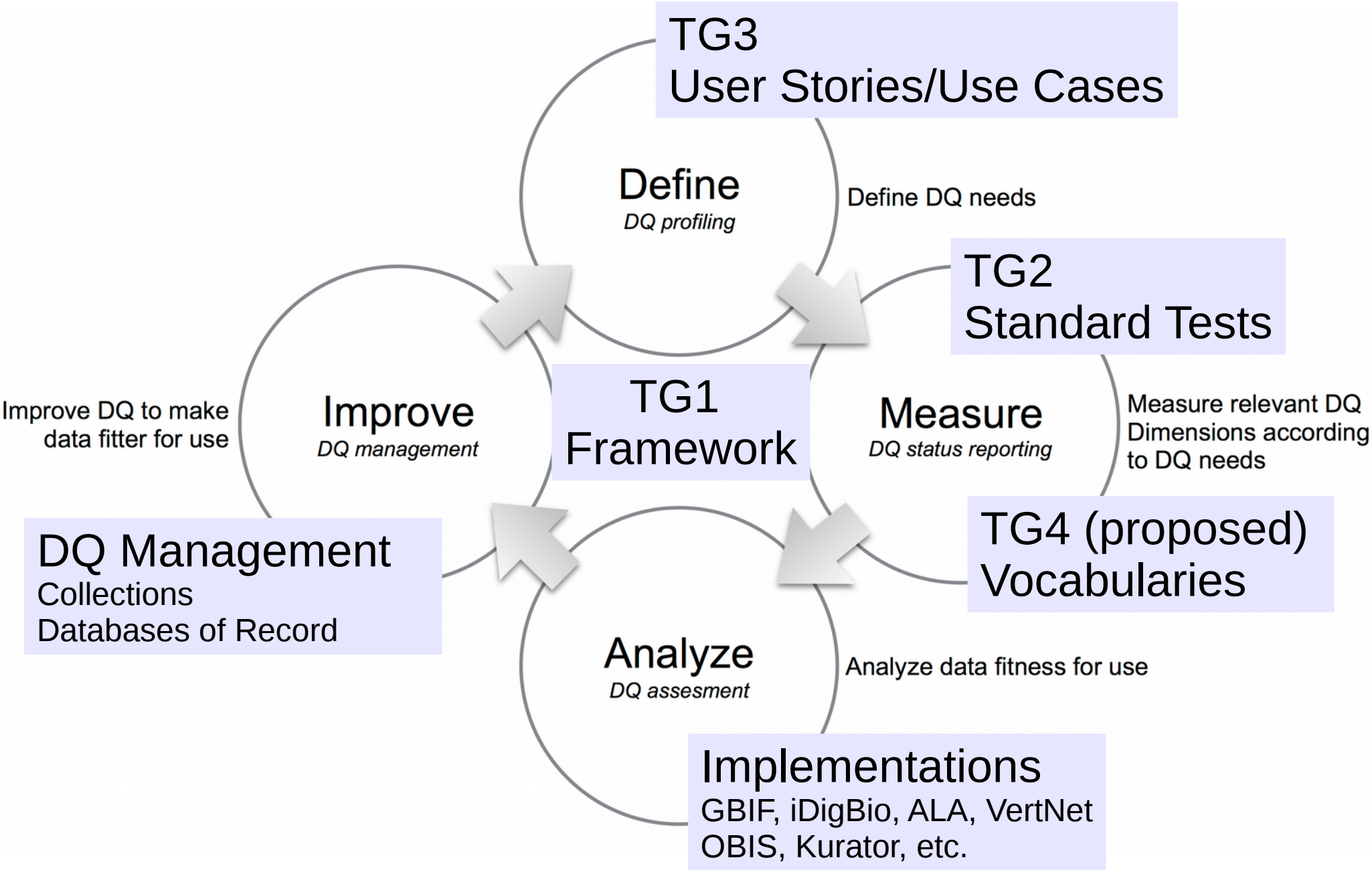
TDWG Data Quality IG

Convener: Arthur Chapman

- TG1 – BDQ Framework
  - Convener: Allan Koch Veiga
- TG2 – Tools, Services and Workflows
  - **Standard Set of Tests**
  - Convener: Lee Belbin
- TG3 – User Stories/Use Cases
  - Convener Miles Nicholls
- Proposed TG4 – Vocabularies


Define
DQ profiling
Define DQ needs
Measure
DQ status reporting
Measure relevant DQ Dimensions according to DQ needs
Analyze
DQ assesment
Analyze data fitness for use
Improve
DQ management
Improve DQ to make data fitter for use


TG3
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TG1
Framework
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Measure relevant DQ Dimensions according to DQ needs
TG4 (proposed)
Vocabularies
DQ Management
Collections
Databases of Record
Analyze
DQ assesment
Analyze data fitness for use
Implementations
GBIF, iDigBio, ALA, VertNet
OBIS, Kurator, etc.

Data Quality & Fitness for Use

- **Use**: What is the purpose or use for which data must have quality?
- **Data**: What kind of data are relevant and must have quality in the context of the Use?
- **Fitness**: What constitutes “fitness” for the relevant **Data** in the context of the **Use**?

Fitness : Data and Use

- occurrenceId: urn:uuid:a3……..
- eventDate: **1970**

- Use: Phenology
  - eventDate must have a precision of a day or better.
  - Not fit for this use.

- Use: Change in range over 100 year timescale
  - eventDate must have a precision of a year or better.
  - Fit for this use.

DATA PROBLEM PARADIGM *VS* DATA QUALITY PARADIGM

What IS NOT quality?	What IS quality?
Record is duplicated (duplication)	Record is unique (uniqueness)
Coordinates is missing (incomplete)	Coordinates is supplied (complete)
Latitude is out of range (unconformity)	Latitude is in the range (conformity)
Coordinates fall outside of country (inconsistency)	Coordinates fall inside of country (consisntency)

Unfitness for Use
(Data Problem Status)

Is NOT in the Framework scope YET

Fitness for Use
(Data Quality Status)

Is in the Framework scope

Data Quality Management

- Data Quality Control
  - Identify elements of data records that lack quality
  - Propose Amendments to improve quality.
  - Change processes to improve quality in the future.
- Data Quality Assurance
  - Filter a set of records to just those that have quality for the use.
  - Assess if the filtered data set is fit for the use (do enough records remain)

DQ PROFILE

1. Use Case

What is the data use context?

2. Valuable IEs

Which information elements are valuable for the Use Case?

3. DQ Measurement Policy

How to measure the quality in the Use Case context?

4. DQ Validation Policy

How the status of quality should be in the Use Case context?

5. DQ Improvement Policy

How to improve the quality of data in the Use Case context?

DQ SOLUTIONS

DQ Methods and Mechanisms

DQ REPORT

FOR

DQ ASSESSMENT AND MANAGEMENT

Data Resource

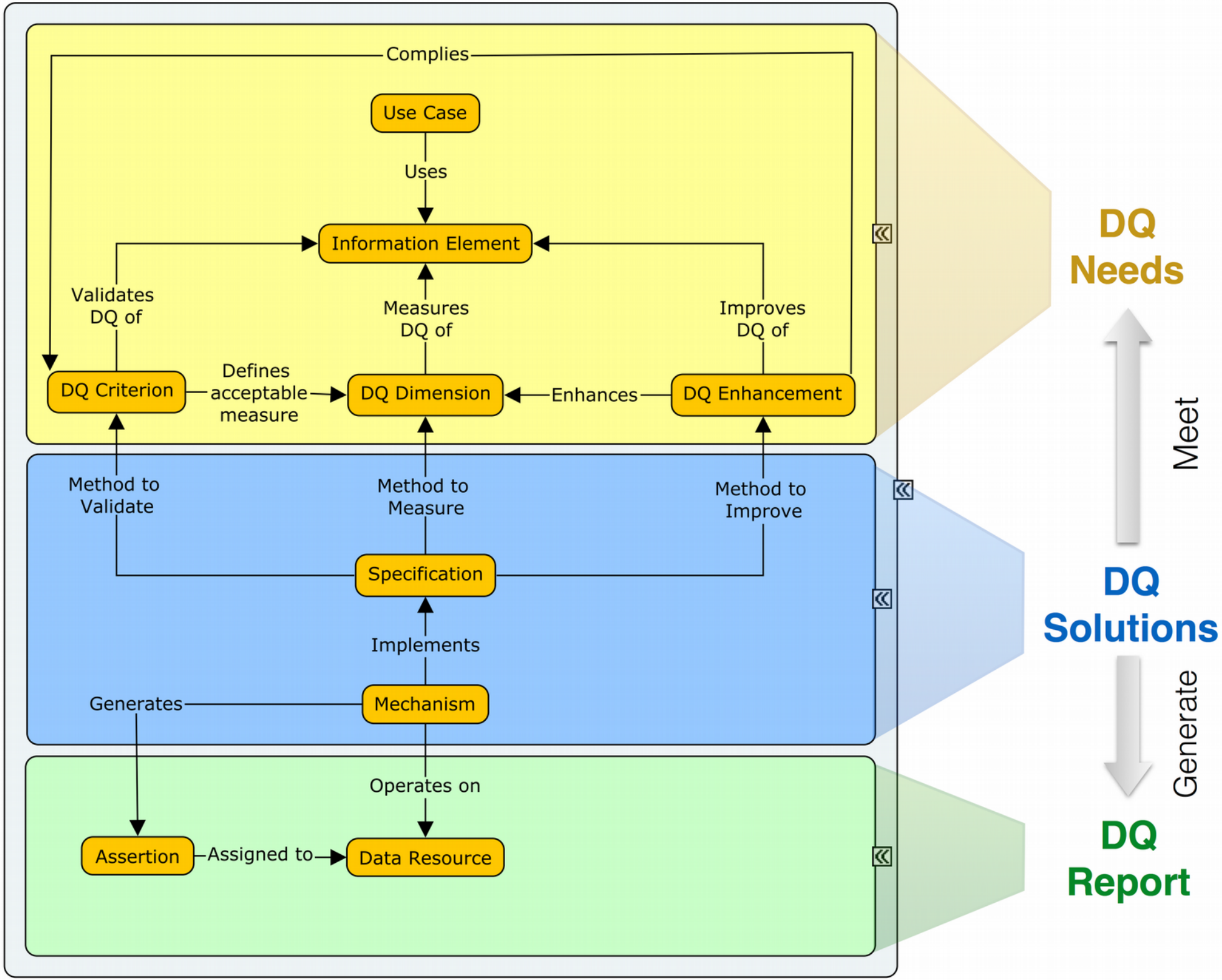
Record / Dataset

DQ Measures

DQ Validations

DQ Improvements

~~IN~~CORRECT


Complies
Use Case
Uses
Information Element
Validates DQ of
Measures DQ of
Improves DQ of
DQ Criterion
Defines acceptable measure
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DQ Enhancement
Method to Validate
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Method to Improve
Specification
Implements
Generates
Mechanism
Operates on
Assertion
Assigned to
Data Resource
DQ Needs
Meet
DQ Solutions
Generate
DQ Report

Describing Data Quality Needs

- **Measure**
  - Multi Record: What portion of records have a non-empty event date with a precision of one year or less?
  - Single Record: What is the duration in seconds represented by the value of eventDate
- **Validation**
  - Compliant: Event date has a precision of one year or less.
  - Not Compliant: Event date has a precision of > one year.
- **Enhancement**
  - Propose a value for event date by interpreting verbatim event date.

Data Quality Needs

- Use Case (Phenology)
  - Valuable Information Elements
    - Scientific name, date collected/recorded, coordinates, phenology
  - Set of Measures
    - MultiRecord: Number of records where scientificName, eventDate, phenology, and coordinates have valid values
  - Set of Validations
    - eventDate resolution to one day or better
  - Set of Enhancements
    - fill in eventDate from verbatimEventDate

Information Element

- Abstract
  - Coordinate
- Concrete
  - dwc:decimalLatitude
  - dwc:decimalLongitude
  - dwc:geodeticDatum
  - dwc:coordinateUncertaintyInMeters
  - dwc:coordinatePrecision

Information Element Concrete Definition is Important

- Abstract
  - Date collected/recorded
- Concrete (1)
  - dwc:eventDate (in flat Darwin Core)
- Concrete (2)
  - dwc:eventDate (in flat Darwin Core)
  - dwc:day
  - dwc:month
  - dwc:year
  - dwc:startDayOfYear
  - dwc:endDayOfYear
  - dwc:eventTime

INTERPRETATION ISSUES

GBIF found issues interpreting the verbatim content of this record:

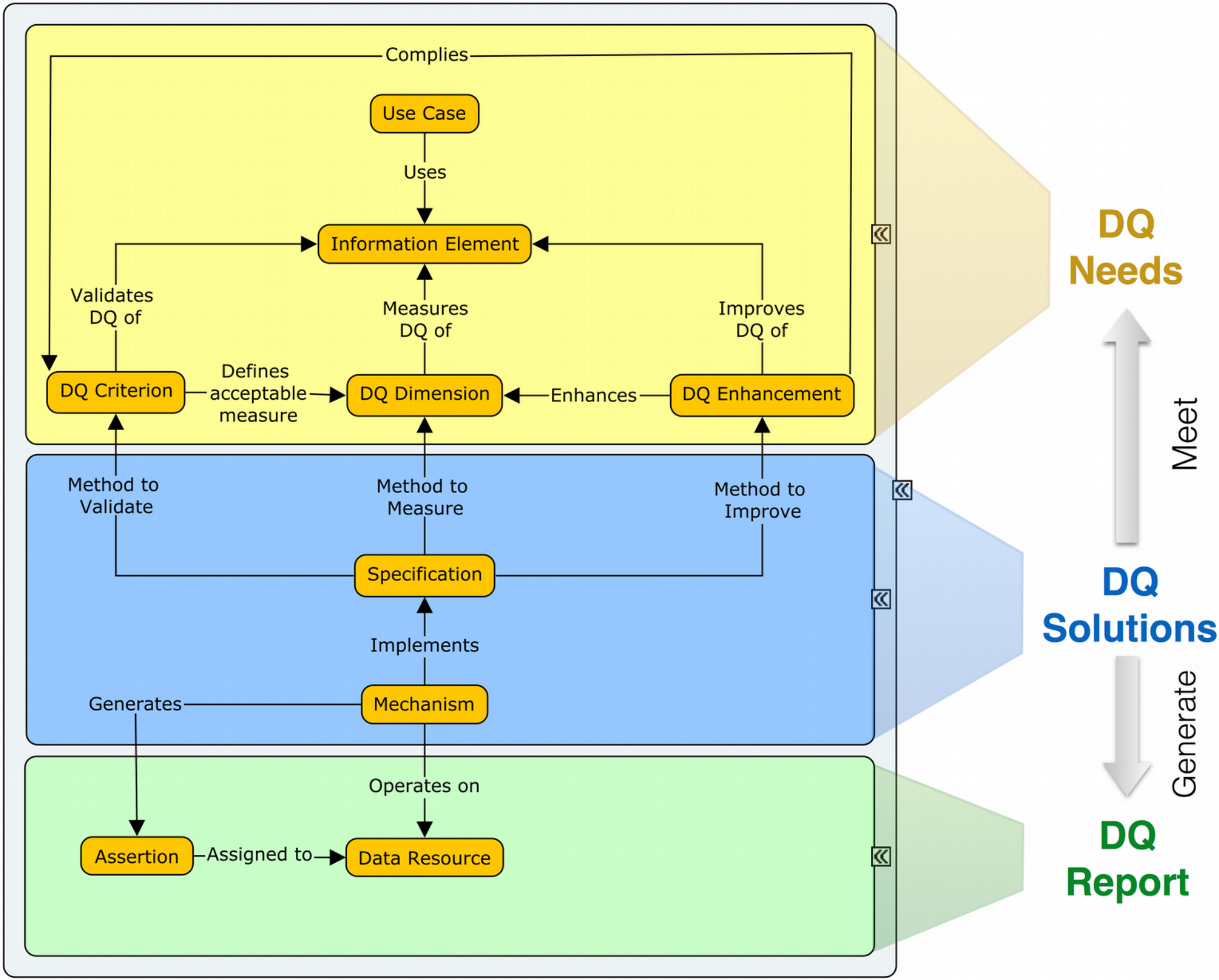
- Recorded date invalid

Event

EVENTDATE	1965-04-01/1965-04-30
STARTDAYOFYEAR	0
VERBATIMEVENTDATE	0/4/1965-0/4/1965

1965-04-01/1965-04-30
is a valid ISO date value.

Inference: To GBIF “Recorded date” means dwc:eventDate and additional dwc:Event terms.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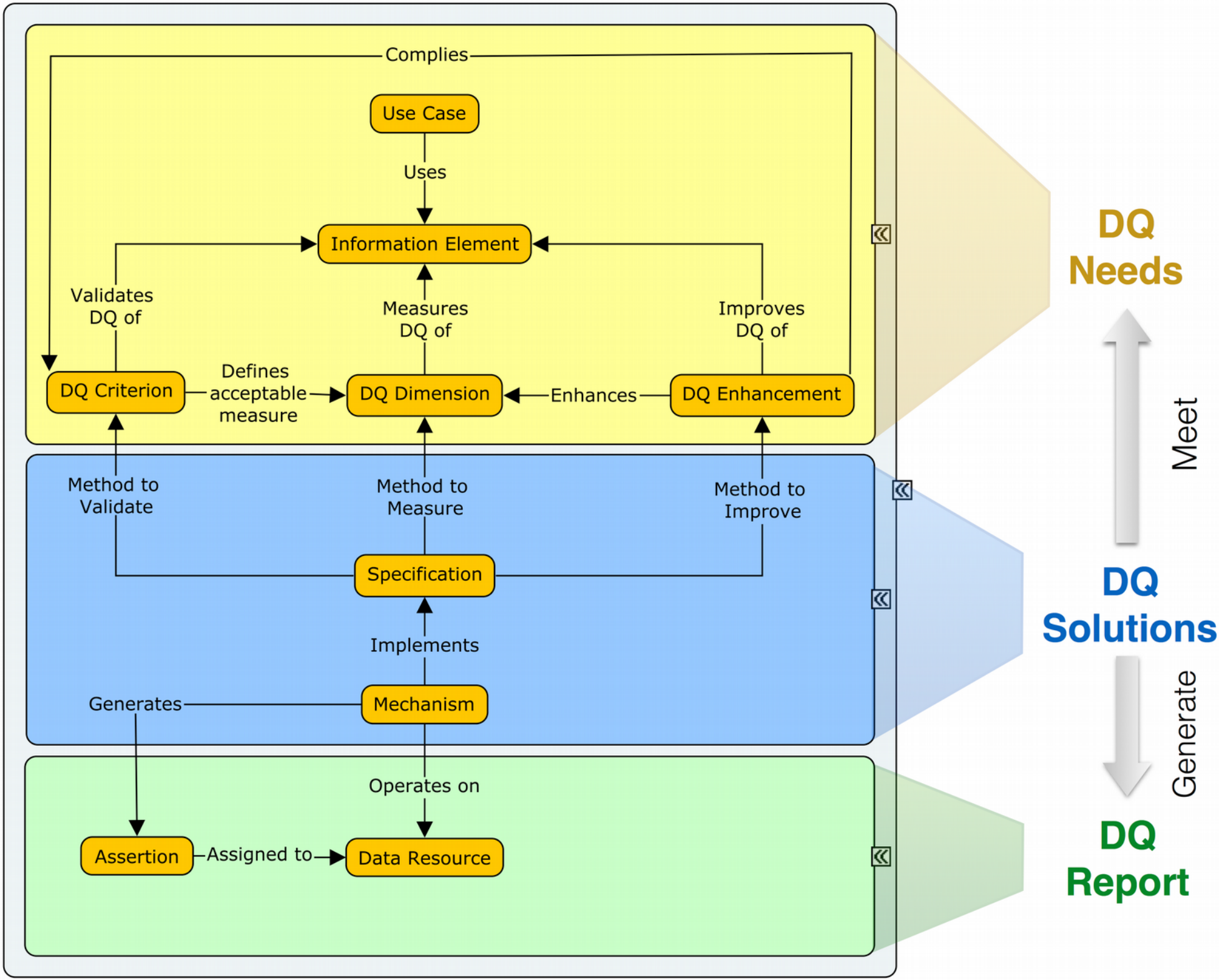
Describing Data Quality Needs

- Data Quality Validation
  - Criterion: Date recorded/collected must be in ISO format.
    - Information element: eventDate
    - **Dimension: Conformance**
    - Resource Type: Single Record
  - Criterion: Date recorded/collected must be to a precision of one year or better.
    - Information element: eventDate
    - **Dimension: Resolution**
    - Resource Type: Single Record
- To measure, framework needs to describe what is being measured.

Data Quality Dimension Vocabulary

- Completeness
  - Meaningful and necessary data are present
- Conformance
  - Data conform to syntax, type, **vocabulary**. (TG4)
- Consistency
  - Agreement amongst data elements
- Accuracy
  - Agreement between data values and some source for truth
- Resolution
  - Data have sufficient granularity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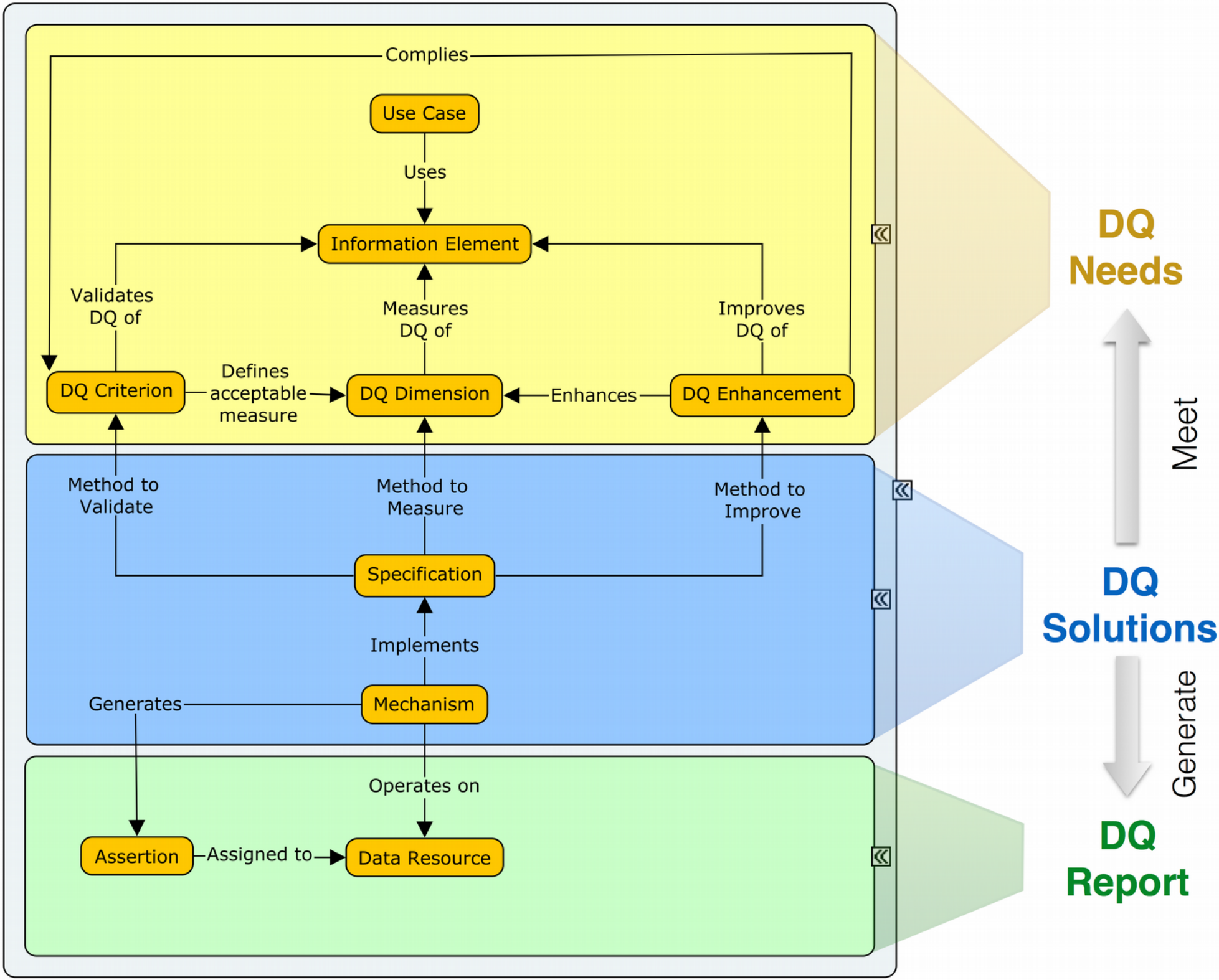
Data Quality Solutions

- For the Criterion in context: Date recorded/collected for single records must be to a precision of one year or better
- **Specification**: dwc:eventDate must contain an ISO date that {multiple possibilities} [Validation]
  - falls within a single year
  - has a duration in seconds less than one julian year (365.25 days)
  - has a duration in days of less than or equal to 365, or 366 if a leap day falls inside the duration.
- **Mechanism**
  - event_date_qc library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Reporting on Data Quality

- Data Quality Validation Report
  - Needs: Criterion: Date recorded must be in ISO format.
    - Information element: eventDate
    - Dimension: Conformance
    - Resource Type: Single Record
  - Solutions
    - Specification: dwc:eventDate parses as an ISO Date
    - Mechanism event_date_qc
  - **Report**
    - **Result Compliant**
    - **Status: Asserted**
    - **Detail: “1884-10” is a valid ISO date.**

Data Quality Report: Validation

- Result
  - Compliant
  - Not Compliant
- Status
  - Asserted
  - Data Ambiguous
  - Data Prerequisites Not Met
  - External Prerequisites Not Met

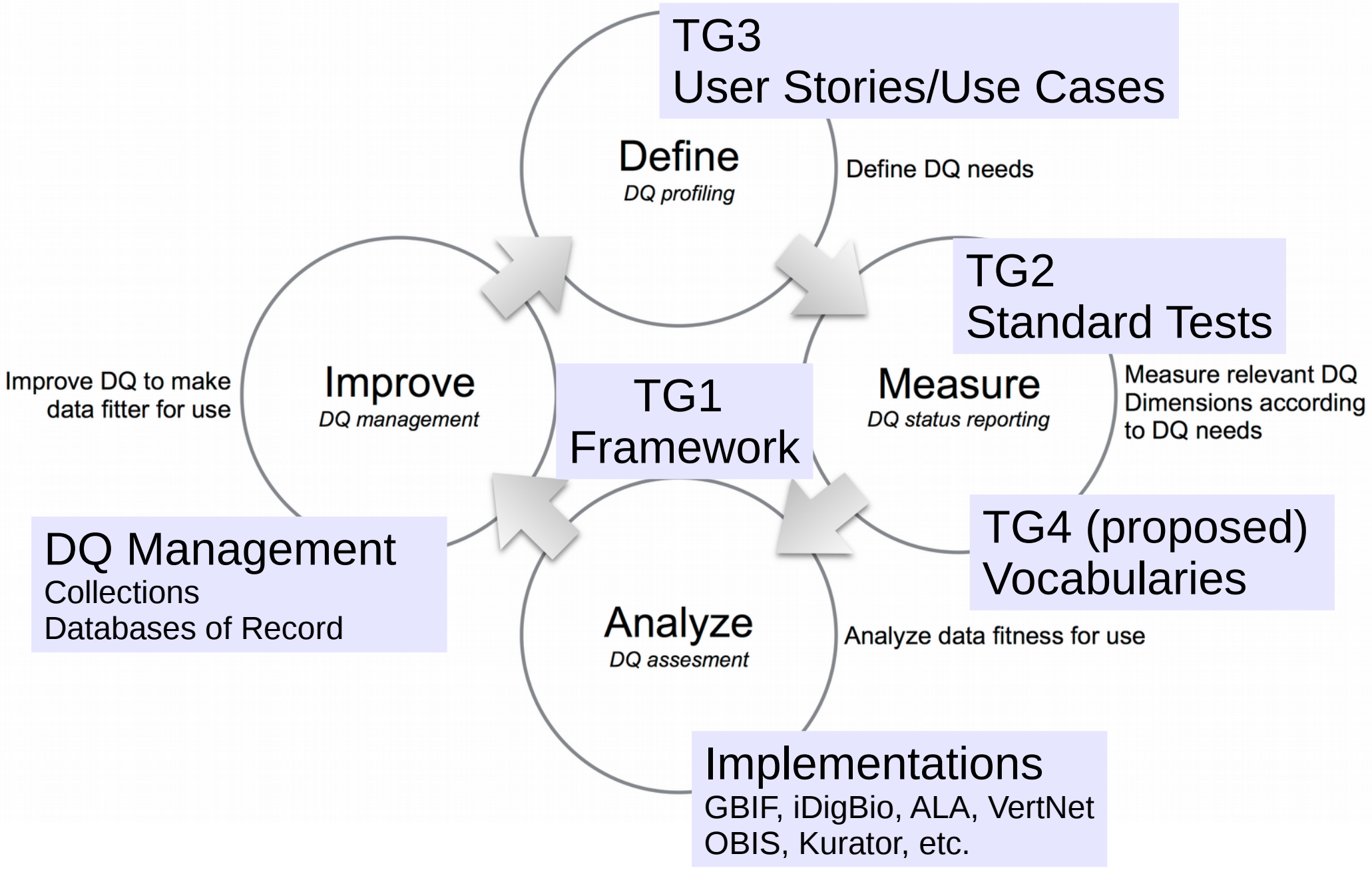
Data Quality Report: Measure

- Result
  - Complete
  - Not Complete
  - {numeric value}

    (e.g. eventDate duration in seconds; proportion of single records in multi record that are complete)
- Status
  - Asserted
  - Data Ambiguous
  - Data Prerequisites Not Met
  - External Prerequisites Not Met

Data Quality Report: Amendment (Proposed Change to Data)

- Result
  - {proposed value}
  - {proposed change to process}
- Status
  - Value Asserted
  - Data Ambiguous
  - Data Prerequisites Not Met
  - External Prerequisites Not Met
  - Process Change Asserted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GBIF, iDigBio, ALA, VertNet
OBIS, Kurator, etc.

Tools can have differing opinions

State/Province	Locality	Decimal Latitude	Decimal Longitude
Sabah	8 km S Sapulut	4.62851	116.47158
Galápagos	Galápagos Islands	-0.76951	-85.91155
Galápagos	Galápagos Islands	-0.76969	-85.91183
Galápagos	Galápagos Islands	-0.76965	-85.91153
	Approx. 105 mi. N. of Cabo, Orange	WAS: -5.475; CHANGED TO: 5.475	-51.35833
	Approx. 105 mi. N. of Cabo, Orange	WAS: -5.475; CHANGED TO: 5.475	-51.35833
Ogooué-Maritime	Moukalaba-Doudou National Park Buffer Zone	-3.08247	10.43732
	about 30 miles SSE of Joao Pessoa	-7.15833	-34.425
	Approx. 105 mi. N. of Cabo, Orange	WAS: -5.475; CHANGED TO: 5.475	-51.35833
	Approx. 105 mi. N. of Cabo, Orange	WAS: -5.475; CHANGED TO: 5.475	-51.35833
Galápagos	Galápagos Islands	-0.76951	-85.91155
	Approx. 105 mi. N. of Cabo, Orange	WAS: -5.475; CHANGED TO: 5.475	-51.35833
	Approx. 105 mi. N. of Cabo, Orange	WAS: -5.475; CHANGED TO: 5.475	-51.35833
Cochabama	Cocapata	-16.95	-66.71667
Mazaruni-Potaro	Potaro River at Tukeit Fall	WAS: 5.21667; CHANGED TO: -5.21667	-59.41667
Nord-Kivu	Forest, Lulenga -River Road	WAS: 2.41306; CHANGED TO: -2.41306	29.37306
	Approx. 105 mi. N. of Cabo, Orange	WAS: -5.475; CHANGED TO: 5.475	-51.35833
O			10.43587
P			-83.23333
G			-85.91155
			122.25141
		; CHANGED TO: 5.475	-51.35833
Li			-77.15
P			-49.8
G			-85.91183
		; CHANGED TO: 5.475	-51.35833
Yu			117.66667
			122.25141
Napo	Rio Pucuno	-0.8	-77
Sabah	Batu Punggul, 16 km ESE Sapulut	4.64045	116

MCZ data in GBIF
Flagged as: Latitude inverted
FP-Akka disagrees.
Interoperability problem.

cc BY SA

TG2: Set of 112 Tests

(Amendments, Validations, Measures)

DQ Tests-Assertions - Post workshop.xlsx

File Edit View Insert Format Data Tools Add-ons Help All changes saved in Drive

Comments

Calibri 11

e.g. Count the number of tests that resulted in "TRUE" (i.e., where a test has failed)

#	GUID	IDs	Variable	Specification (Technical Description)	Record Resolution	Term Resolution
1	453844ae-9df4		TESTS_FLAGGED_REPORT	e.g. Count the number of tests that resulted in "TRUE" (i.e., where a test has failed)	SingleRecord	MultiTerm
1a	b2ed42aa-be7b		TESTS_TOTAL_REPORT	The total number of tests run against each record	SingleRecord	MultiTerm
2	28a42e6e-1a79		RECORD_COMPLETENESS_REPORT	e.g. Count the number of non-NULL or empty (disregarding spaces) values of the record.	SingleRecord	MultiTerm
6	62a9c256-43e		MODIFIED_DATE_INVALID	dcterms:modifiedDate cannot to parsed to an explicit date/time	SingleRecord	SingleTerm
6a	367bf43f-9cb6		MODIFIED_DATE_AMENDED	dcterms:modifiedDate was able to be transformed to ISO standard	SingleRecord	SingleTerm
12a	48aa7d66-36d		DAY_INVALID	day is < 1 or > 31	SingleRecord	SingleTerm
12c	7e8ecf5a-8134		DAY_IMPOSSIBLE	day/=calendar	SingleRecord	MultiTerm
12b	01c6dafa-088		MONTH_INVALID	month is <1 or >12	SingleRecord	SingleTerm
12	f98a54eb-59e7-44c7-b96f-200e6af1c895	30009	DAY_MONTH_TRANSPOSED	month>12 and day<12	SingleRecord	MultiTerm
5a	31d463b4-2a1		EVENT_DATE_YEAR_INCOMPLETE	eventDate resolution to year only	SingleRecord	SingleTerm
5b	1d48e078-0e01-4035-98f0-532697b293a7	30010	EVENT_DATE_MONTH_INCOMPLETE	eventDate resolution to month only	SingleRecord	SingleTerm

A Test: is dwc:day in range 1-31?

#	12a
GUID	48aa7d66-36d1-4662-a503-df170f11b03f
IDs	
Variable	DAY_INVALID
Description (warning/error)	The value given for event day is less than 1 or greater than 31
Description (test - PASS)	The value given for event day is between 1 and 31
Specification (Technical)	day is < 1 or > 31
Record Resolution	**SingleRecord**
Term Resolution	**SingleTerm**
Data Dependency	Internal
Output Type	**Validation**
Example	day=32
Darwin Core Class	Event
Darwin Core Terms	day
DQ Dimension	**Conformance**
Severity	Warning
Source	ALA

occurrence_demoset.xls - LibreOffice Calc

File Edit View Insert Format Tools Data Window Help

Arial 10

A1 This spreadsheet represents the output of data quality control software run on a copy of harvested occurrence record data. The software runs a workflow composed

	A
1	This spreadsheet represents the output of data quality control software run on a copy of harvested occurrence record data. The software runs a workflow composed of a set of "actors" each of which examines a facet of the data (one for checking scientific names, one for checking georeferences, and one for checking date collected). These actors can assert that problems exist in the data (which in some cases are real problems, and in other cases are not), and can as
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	Total r

	G	H	I	J	K	L
1	Date Collected	Determiner	Scientific Name	Scientific Name Authorship	Taxon Id	Family
2	1950-05-27	[no agent data]	Placopecten magellanicus	(Gmelin, 1791)		Pectinidae
3	1920-11-02	Catalog	Hemidactylium scutatum	(Temminck & Schlegel)		Plethodontidae
4	1959-04-26	Catalog	Ambystoma maculatum	(Shaw, 1802)		Ambystomatidae
5	1965-06-27	systematic card, Catalog	Lithobates clamitans melanota	(Rafines.)		Ranidae
6	1904-08-16	Catalog	Plethodon cinereus	(Green, 1818)	http://api.gbif.org/v1/species/2431491	Plethodontidae
7	1987-03-01	Catalog	Plethodon glutinosus complex			Plethodontidae
8	1964-01-01	[no agent data]	Gammaridea			
9	1873-01-01/1924-08-16	Catalog	Plethodon cinereus	(Green, 1818)	http://api.gbif.org/v1/species/2431491	Plethodontidae
10	19					
11	19					
12	19					
13	18					
14	19					

	AC	AD	AE
1	ScientificNameValidator	DateValidator	GeoRefValidator
2	don't know	no change needed; looks good to us	don't know
3	don't know	no change needed; looks good to us	no change needed; looks good to us
4	don't know	no change needed; looks good to us	no change needed; looks good to us
5	there seems to be a problem, but we don't know how to solve it	no change needed; looks good to us	no change needed; looks good to us
6	no change needed; looks good to us	no change needed; looks good to us	no change needed; looks good to us
7	there seems to be a problem, but we don't know how to solve it	there seems to be a problem, but we don't know how to solve it	don't know
8	don't know	there seems to be a problem, but we don't know how to solve it	don't know
9	no change needed; looks good to us	we have proposed this change	no change needed; looks good to us
10	n		
11	d		
12	n		
13	d		
14	d		

	AB	AC	
1	Date Collected	Actor Result	Comment
2	1950-05-27	no change needed; looks good to us	can't construct eventD
3	1920-11-02	no change needed; looks good to us	can't construct eventD
4	1959-04-26	no change needed; looks good to us	can't construct eventD
5	1965-06-27	no change needed; looks good to us	can't construct eventD
6	1904-08-16	no change needed; looks good to us	can't construct eventD
7	1987-03-01	there seems to be a problem, but we don't know how to solve it	can't construct eventD
8	1964-01-01	there seems to be a problem, but we don't know how to solve it	can't construct eventD
9	WAS: 1804-08-16/1924-08-16; CHANGED TO: 1873-01-01/1924-08-16	we have proposed this change	Event date (1804-08-1
10	1904-08-16/1924-08-16	no change needed; looks good to us	Event date (1904-08-1
11	1920-11-02	no change needed; looks good to us	can't construct eventD
12	1904-08-16/1924-08-16	no change needed; looks good to us	Event date (1904-08-1
13	1880-01-01/1880-12-31	no change needed; looks good to us	Event date (1880-01-0
14	1966-07-16	no change needed; looks good to us	can't construct eventD

Description / Analysis Results / ScientificNameValidator / DateValidator / GeoRefValidator / BasisOfRecordValida

Find Find All Match Case

Sheet 1 / 6 PageStyle_Description Sum=0

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An example data record

- occurrenceID: urn:uuid:205f3f79-512a-44a8-be35-76eef7b89c5d
- verbatimEventDate: 0/10/1973
- **day: 0**
- month:10
- year:1973
- eventDate: 1973-10

Some tests

- **Day In Range=NOT_COMPLIANT**
- Month In Range=COMPLIANT
- EventDate Correctly Formatted=COMPLIANT
- EventDate precision calendar year or better =COMPLIANT
- Day Consistent With Month/Year =DATA_PREREQUISITES_NOT_MET

More Details

- Criterion in Context: Day In Range, Single Record
- Information Element: dwc:day=0
- Result: NOT_COMPLIANT
- DataResource: Single Record: urn:uuid:205f3f79-512a-44a8-be35-76eef7b89c5d
- Specification: Provided value for day '0' is not an integer in the range 1 to 31.
- Mechanism: Kurator: Date Validator - DwCEventDQ

More Detail

- Month In Range COMPLIANT Provided value for month '10' is an integer in the range 1 to 12.
- EventDate precision Julian year or better. COMPLIANT Provided value for eventDate '1973-10-01' has a duration less than or equal to one Julian year of 365.25 days.
- EventDate precision calendar year or better. COMPLIANT Provided value for eventDate '1973-10-01' does not contain a leap day and has a duration less than or equal to one calendar year of 365 days. 1973-10-01

Placopecten magellanicus Gmelin, 1791

FP-Akka

(Gmelin, 1791)

Placopecten magellanicus WAS: Gmelin, 1791; CHANGED TO: (Gmelin, 1791)

Found accepted name Placopecten magellanicus
Source: Catalog of Life.
Authorship: Differs only in Parentheses
Authorship Similarity: 0.833

Data?

Process?

Dataset?

DB Software?

Goals?

Defect

Source?

DQ Software?

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Kurator Visualization

Month In Range	COMPLIANT	Provided value for month '10' is an integer in the range 1 to 12.	10		
EventDate precision Julian year or better.	COMPLIANT	Provided value for eventDate '1973-10-01' has a duration less th	1973-10-01		
EventDate precision calendar year or better.	COMPLIANT	Provided value for eventDate '1973-10-01' does not contain a lea	1973-10-01		
Day Consistent With Month/Year	DATA_PREREQUISITES_NOT_MET	Provided value for day 0 is outside the range 1-31.	0	1973	10
Day In Range	NOT_COMPLIANT	Provided value for day '0' is not an integer in the range 1 to 31.	0		

Month In Range	COMPLIANT	Provided value for month '10' is an integer in the range 1 to 12.
EventDate precision Julian year or better.	COMPLIANT	Provided value for eventDate '1973-10-01' has a duration less than or equal to one Julian year of 365.25 days.
EventDate precision calendar year or better.	COMPLIANT	Provided value for eventDate '1973-10-01' does not contain a leap day and has a duration less than or equal to one calendar year of 365 days.
Day Consistent With Month/Year	DATA_PREREQUISITES_NOT_MET	Provided value for day 0 is outside the range 1-31.
Day In Range	NOT_COMPLIANT	Provided value for day '0' is not an integer in the range 1 to 31.

GBIF Flag (different record)

INTERPRETATION ISSUES

GBIF found issues interpreting the verbatim content of this record:

- Recorded date invalid

Following the verbatim content link:

Event

EVENTDATE	1965-04-01/1965-04-30
STARTDAYOFYEAR	0
VERBATIMEVENTDATE	0/4/1965-0/4/1965

DarwinCore: MeasurementOrFact

- MeasurementOrFact
  - Definition: “A measurement of or fact about an rdfs:Resource”
- Terms
  - measurementID
  - measurementType
  - measurementValue
  - measurementAccuracy
  - measurementUnit
  - measurementDeterminedBy
  - measurementDeterminedDate
  - measurementMethod
  - measurementRemarks

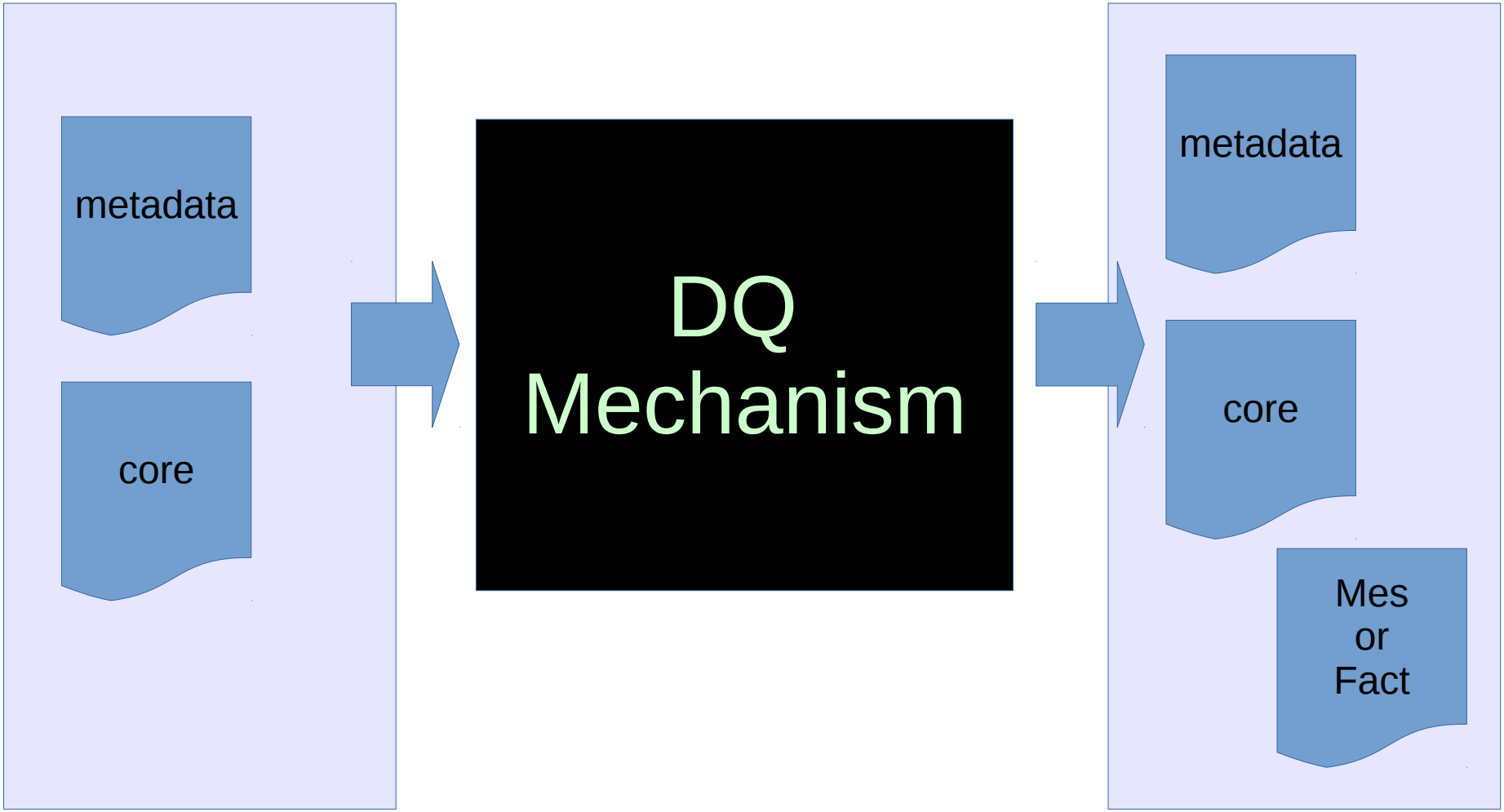
DarwinCore: MeasurementOrFact

- measurementID
- measurementType
  - Data quality Validation (Validation|Measure|Amendment)
- measurementValue
  - COMPLIANT (COMPLIANT|NOT_COMPLIANT)
- measurementAccuracy
- measurementUnit
- measurementDeterminedBy
  - DQFramework: Mechanism: “event_date_qc v1.0.3 DwCEventQC”
- measurementDeterminedDate
- measurementMethod
  - DAY_IN_RANGE: 48aa7d66-36d1-4662-a503-df170f11b03f
- measurementRemarks
  - Provided value for dwc:day of “10” is in the range 1-31.

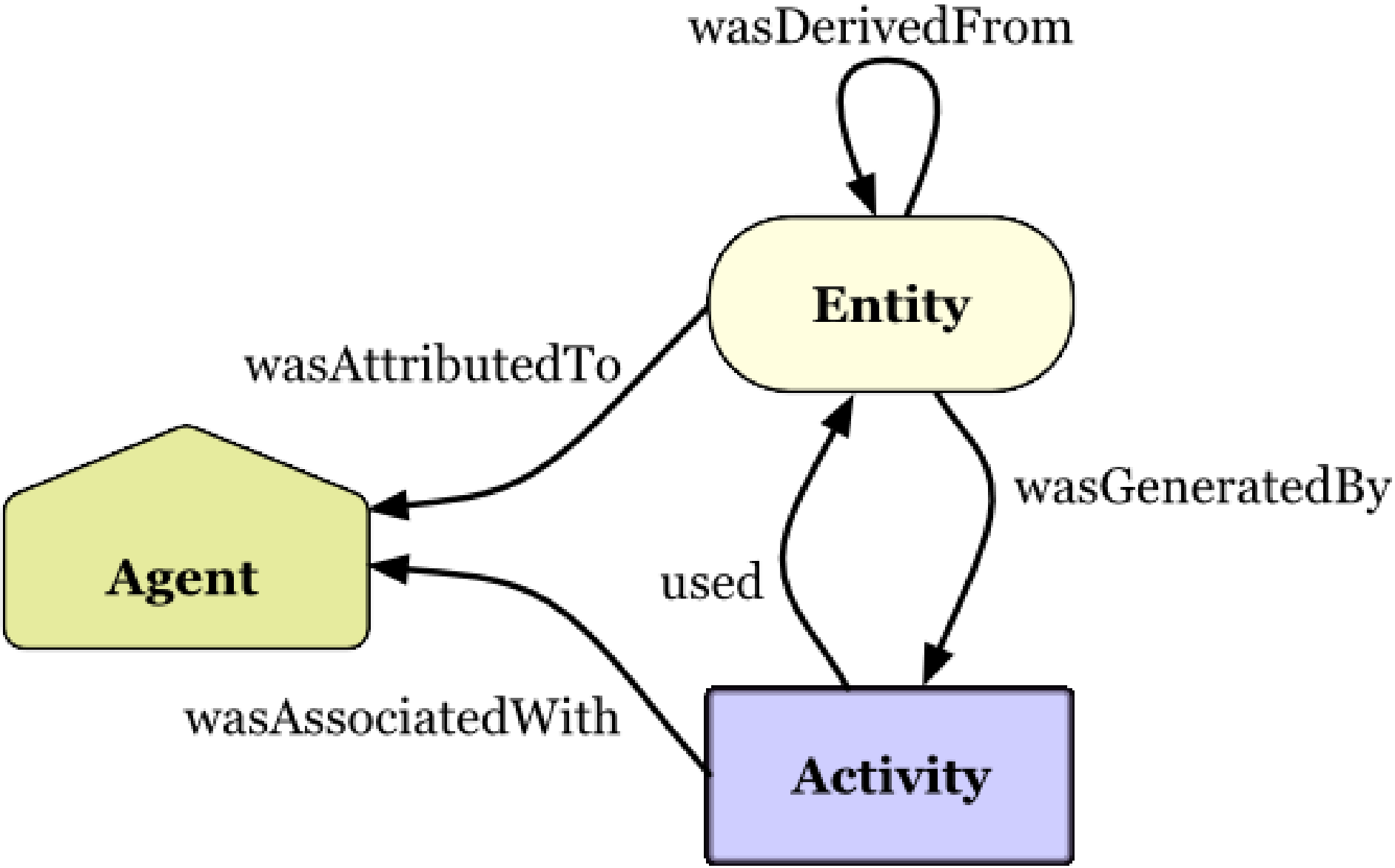
DarwinCore: MeasurementOrFact

- measurementID
- measurementType
  - Data quality Measure
- measurementValue
  - 31536000
- measurementAccuracy
- measurementUnit
  - Seconds
- measurementDeterminedBy
  - DQFramework: Mechanism: “event_date_qc v1.0.3 DwCEventQC”
- measurementDeterminedDate
- measurementMethod
  - EVENT_DATE_DURATION_SECONDS
- measurementRemarks
  - Provided value for dwc:eventDate of “1981” translates to an ISO date with a duration of 31536000 seconds.

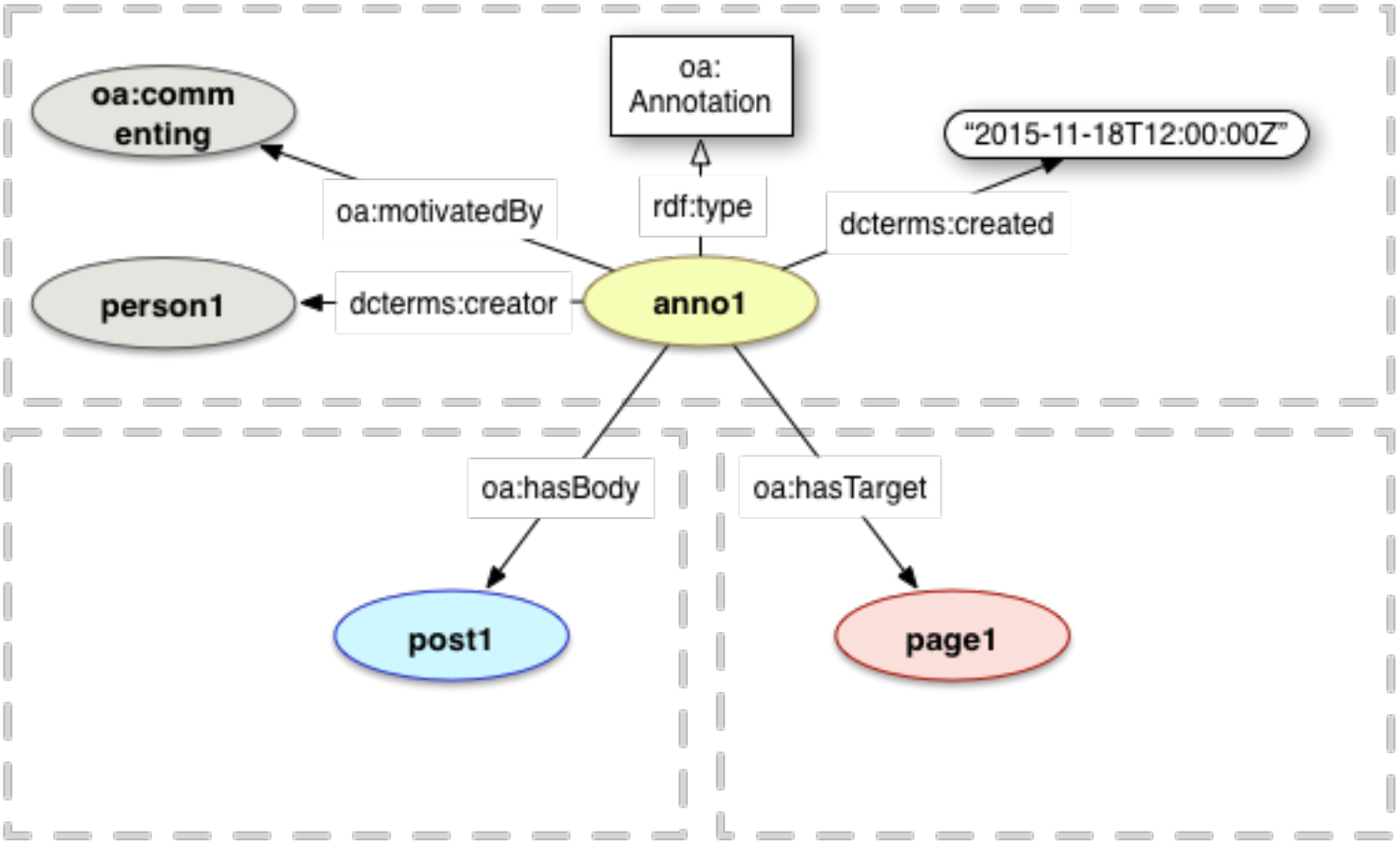
We’ll need a controlled vocabulary


metadata
core
DQ
Mechanism
metadata
core
Mes
or
Fact

W3C: Prov


wasDerivedFrom
Entity
wasAttributedTo
Agent
wasGeneratedBy
used
wasAssociatedWith
Activity

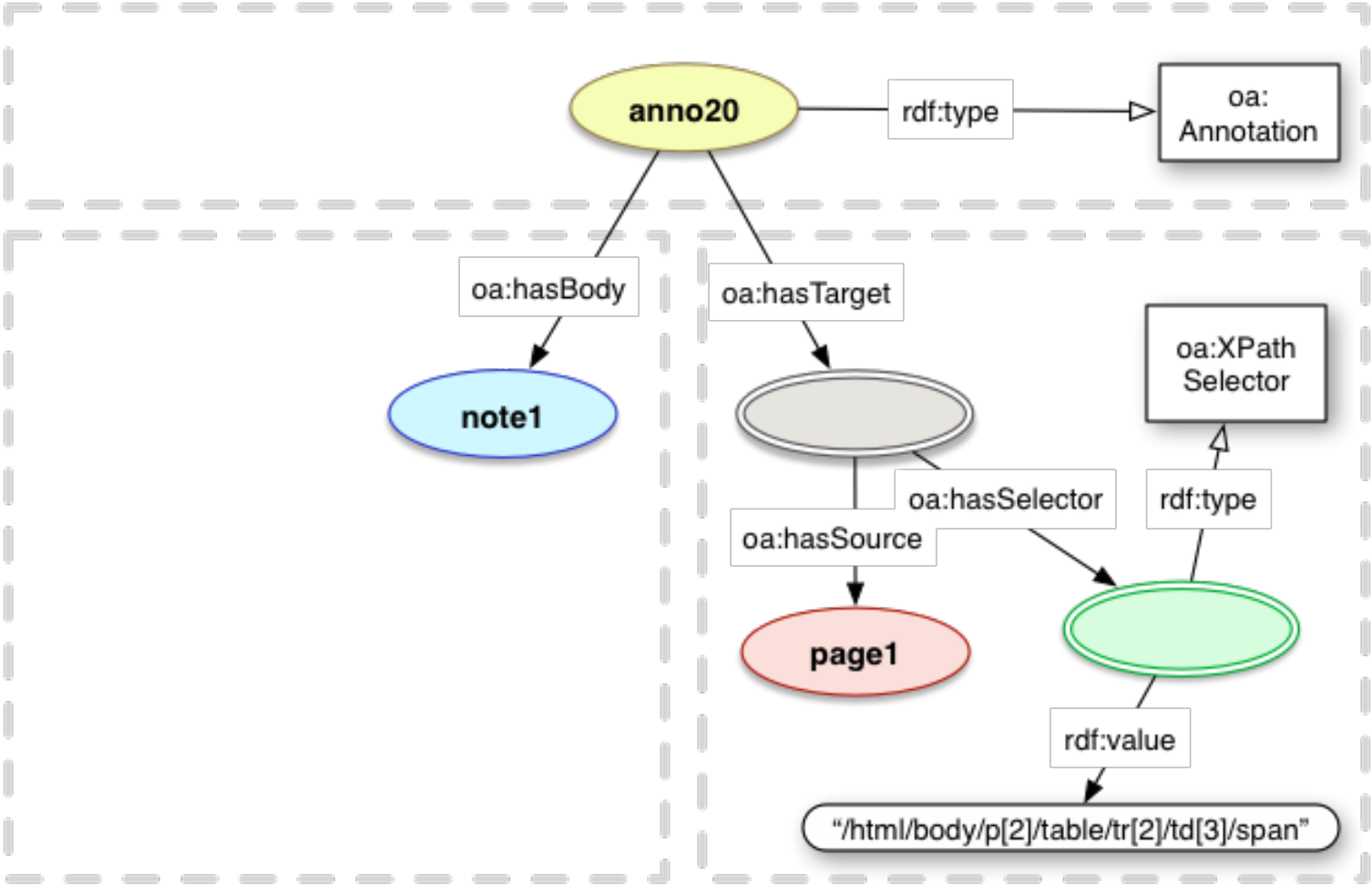
W3C oa:Annotation



Annotation Conversations

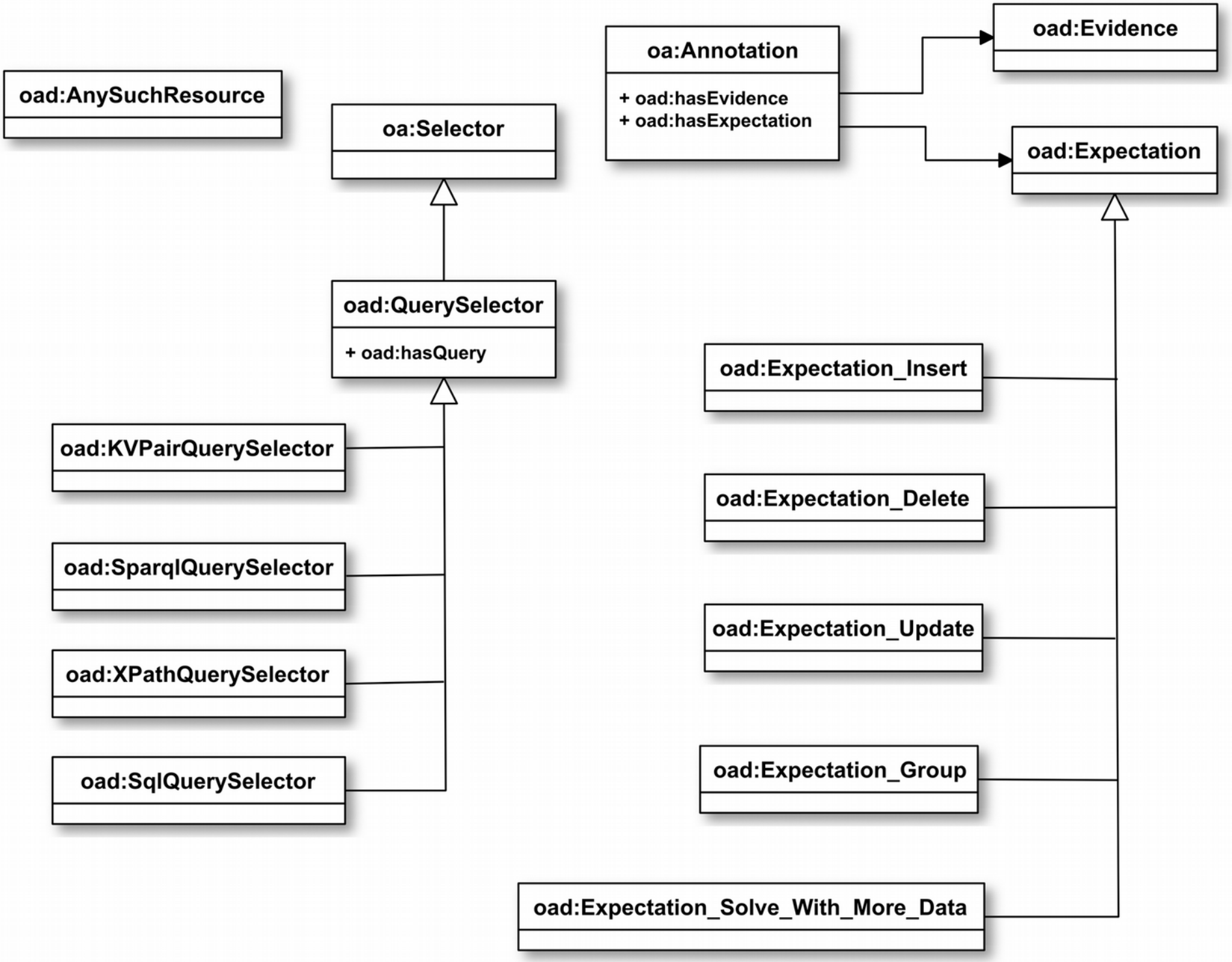
- The Target of one Annotation can be another Annotation.
  - An annotation on a data record can be treated as an issue (in the bug tracking sense)
  - A subsequent annotation can mark the first annotation as resolved (or as won’t fix).

XPathSelector



OAD extensions:

- oad:QuerySelector
- oad:AnySuchResource
- oad:Evidence
- oad:Expectation
  - oad:Expectation_Update
  - oad:Expectation_Solve_With_More_Data


oad:AnySuchResource
oa:Selector
oa:Annotation
+ oad:hasEvidence
+ oad:hasExpectation
oad:Evidence
oad:Expectation
oad:QuerySelector
+ oad:hasQuery
oad:KVPairQuerySelector
oad:SparqlQuerySelector
oad:XPathQuerySelector
oad:SqlQuerySelector
oad:Expectation_Insert
oad:Expectation_Delete
oad:Expectation_Update
oad:Expectation_Group
oad:Expectation_Solve_With_More_Data

{
"name": "48aa7d66-36d1-4662-a503-df170f11b03f",
"description": "Test to see whether a provided day is an integer in the range of values that can
"specification": "Compliant if dwc:day is an integer in the range 1 to 31 inclusive, not compliant
"label": "Day In Range",
"type": "VALIDATION",
"mechanism": "Kurator: Date Validator - DwCEventDQ"
},

"occurrenceID": "MCZ:Herp:R-149699",
“day”: “0”,
"eventDate": "1973-10-01"
{
"stage": "PRE_ENHANCEMENT",
"name": "48aa7d66-36d1-4662-a503-df170f11b03f",
"context": {
"fieldsConsulted": [

],
"fieldsActedUpon": [
"day"
]
},
"comment": "Provided value for day '0' is not an integer in the range 1 to 31.",
"type": "VALIDATION",
"status": "NOT_COMPLIANT"
},