



NRC - CMRC

From Discovery to Innovation...

CVO Constraint System

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Overview



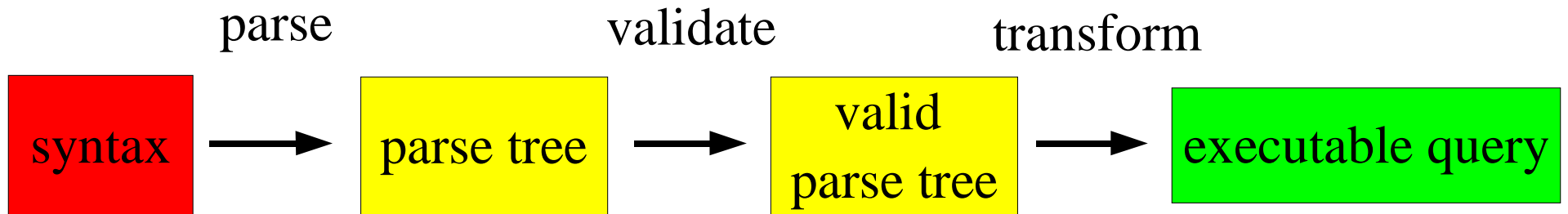
- CVO query specification: constraint-based system
- context where constraints are applicable
- components of a constraint system
- usage examples

Constraints



- constraint
 - statement that can be true or false
- constraint ~ filter
 - apply a constraint to a set ~ filter based on a condition
- constraints have semantic meaning
 - capture the concept of a condition
 - useful at the semantic level (no functionality)

Context



- serialization format

- e.g. XML

- software representation

- e.g. object model

- service implementation details

- e.g. SQL

constraints

Components

- Expression: base class for all *arguments*

Expression

```
Constant( <serializable value object> )
```

```
Property( <name of a property> )
```

```
VirtualProperty( Property, <alias|domain value> )
```

Operator

```
MathOp( Expression, <math op>, Expression )
```

```
MethodOp( Property|MethodOp, <method name> )
```

Components

- Constraint: base class for all Constraint types

Constraint

Known(ex)

Unknown(ex)

Eq(lhs, rhs)

Leq(lhs, rhs)

Geq(lhs, rhs)

Between(lb, value, ub)

Contains(extent, value)

Intersect(geom, geom)

Top(ex, n)

Bottom ex, n)

Statement:

ex is known

ex is not known

lhs == rhs

lhs <= rhs

lhs >= rhs

lb <= value <= ub

value is in extent

geom \cap geom

ex is in top n-list

ex is in bottom n-list

Usage

- statement: $foo > 5$

```
Geq( Property("foo"), Constant(5) )
```

Usage

- statement: $foo > 5$

```
Geq( Property("foo"), Constant(5) )
```

- statement: position is in a circle w/ center, radius

- aka Cone Search in a source catalog

```
Intersect( Property("position"),  
          Constant( Circle2D(center, radius) ) )
```


Usage

- statement: $foo > 5$

```
Geq( Property("foo"), Constant(5) )
```

- statement: position is in a circle w/ center, radius

- aka Cone Search in a source catalog

```
Intersect( Property("position"),  
           Constant( Circle2D(center, radius) ) )
```

- statement: the area covered > 1 sq. degree

- spatial_bounds is a Polygon2D, which has an area() method

```
Geq(MethodOp( Property("spatial_bounds"), "area" ),  
     Constant(1) )
```

More Usage

- statement: flux at wavelength W is known

```
Contains( MethodOp(Property("flux"), "domain"),  
          Constant(W) )
```

More Usage

- **statement: flux at wavelength W is known**

```
Contains( MethodOp(Property("flux"), "domain"),  
          Constant(W) )
```

➤ **or**

```
Known( VirtualProperty(Property("flux"),  
                        Constant(W) )
```

More Usage

- **statement: flux at wavelength W is known**

```
Contains( MethodOp(Property("flux"), "domain"),  
          Constant(W) )
```

‣ or

```
Known( VirtualProperty(Property("flux"),  
                        Constant(W) )
```

- **statement: ellipticity was produced by process P**

- P is an EntryLink from a process catalog
- all properties have a provenance() method

```
Eq( P,  
    MethodOp(Property("ellipticity"), "provenance")  
    )
```

Summary



- Constraint
 - statement
 - implicit AND with multiple constraints
- Expression
 - Property: named property in a catalog
 - Operator:
 - › specify computed values
 - › access substructure of properties (methods)
 - Constant: simpler wrapper around values (Quantity?)
- serialization to XML: trivial
- abstraction: freedom for queryable service implementors