PROV-Templates

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Special guest: Alessandro Spinuso KNMI

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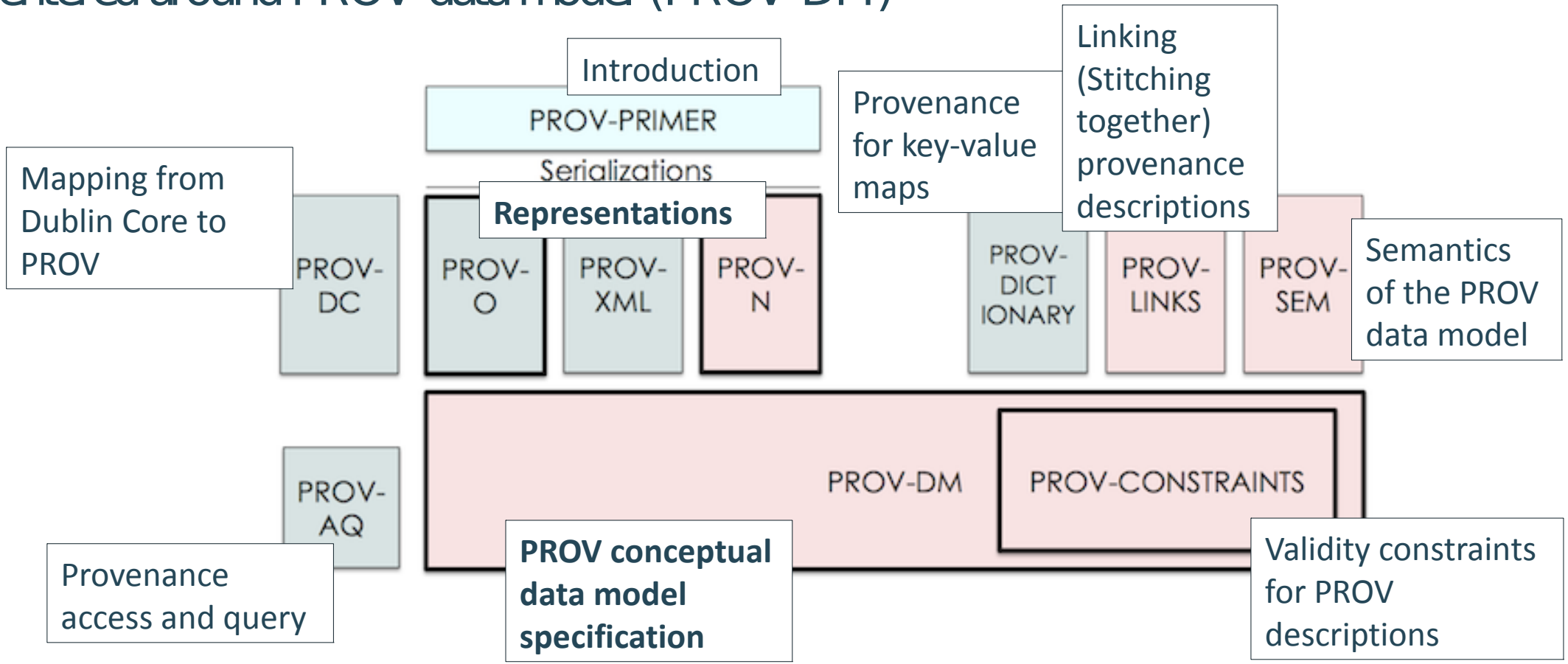
W3C PROV

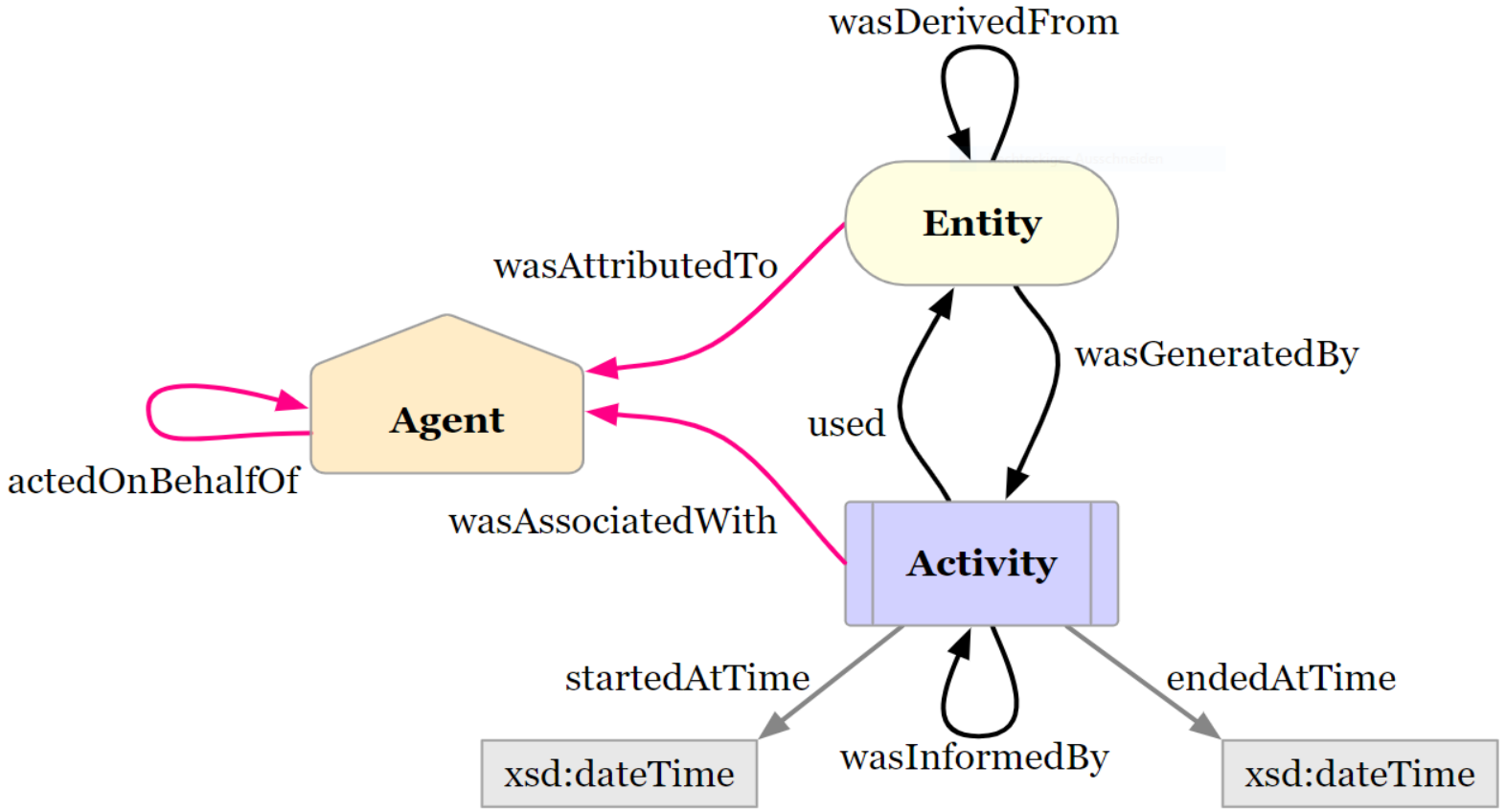
https://www.w3.org/TR/prov-overview/

- Dedicated "ecosystem" of specifications centered around PROV data model (PROV-DM)

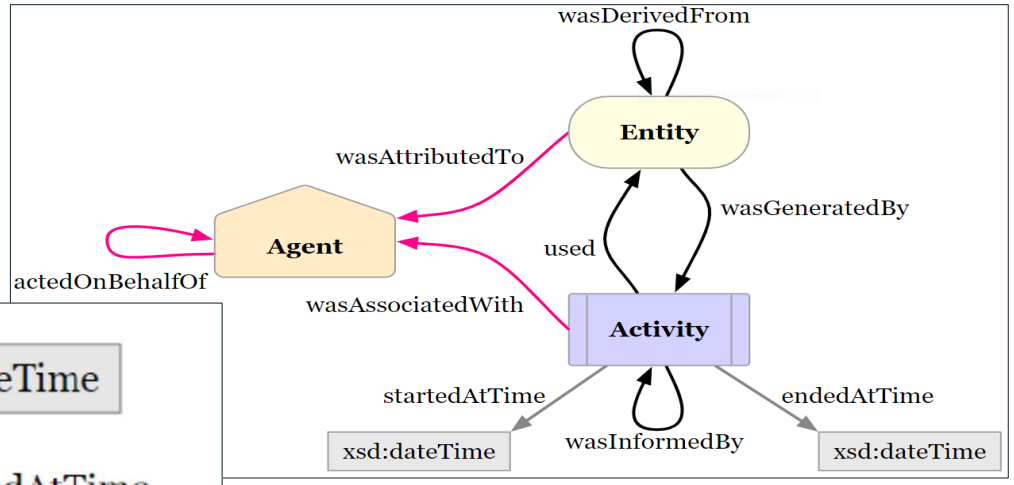


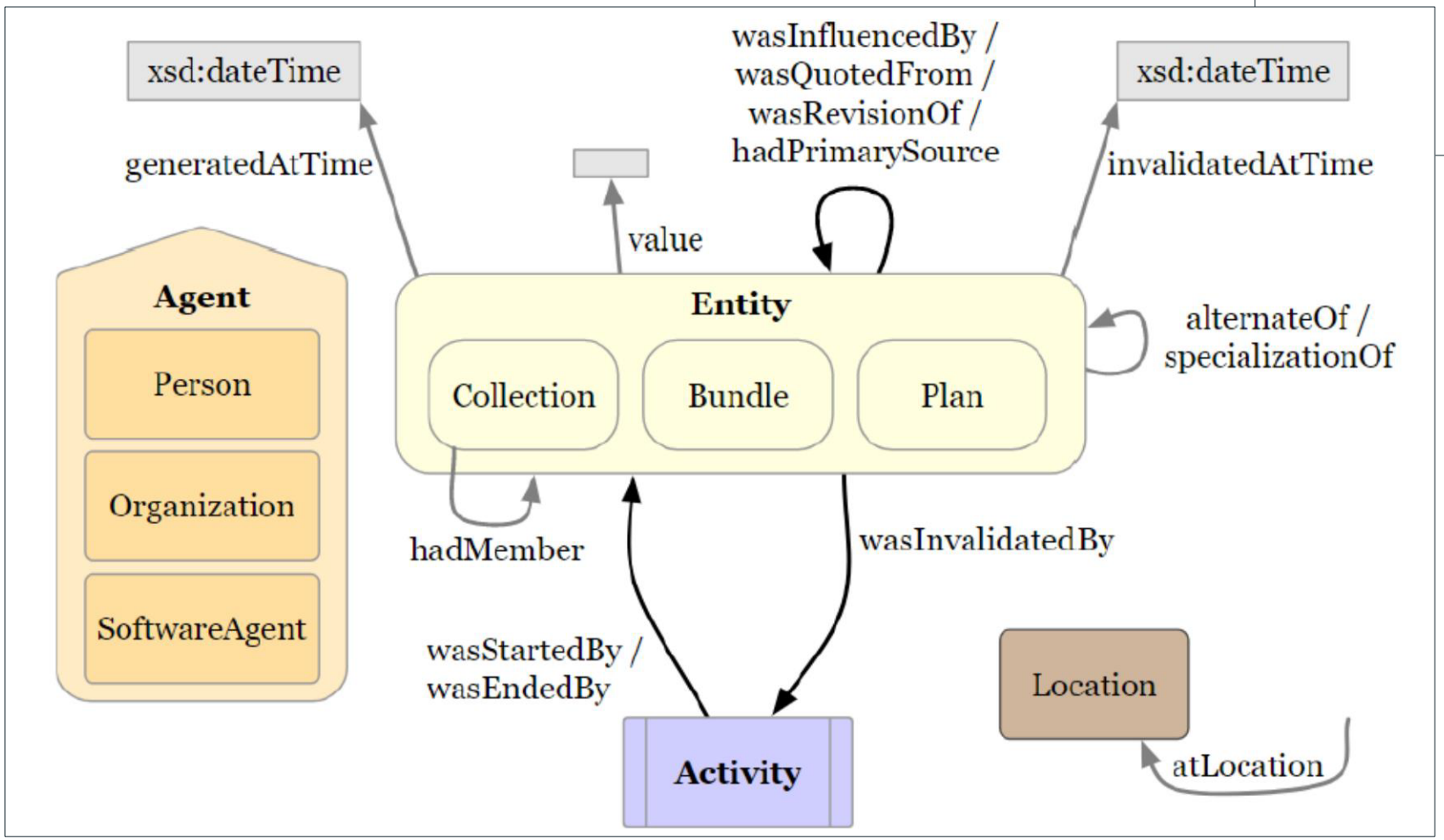
PROV-DM

http://www.w3.org/TR/prov-dm/

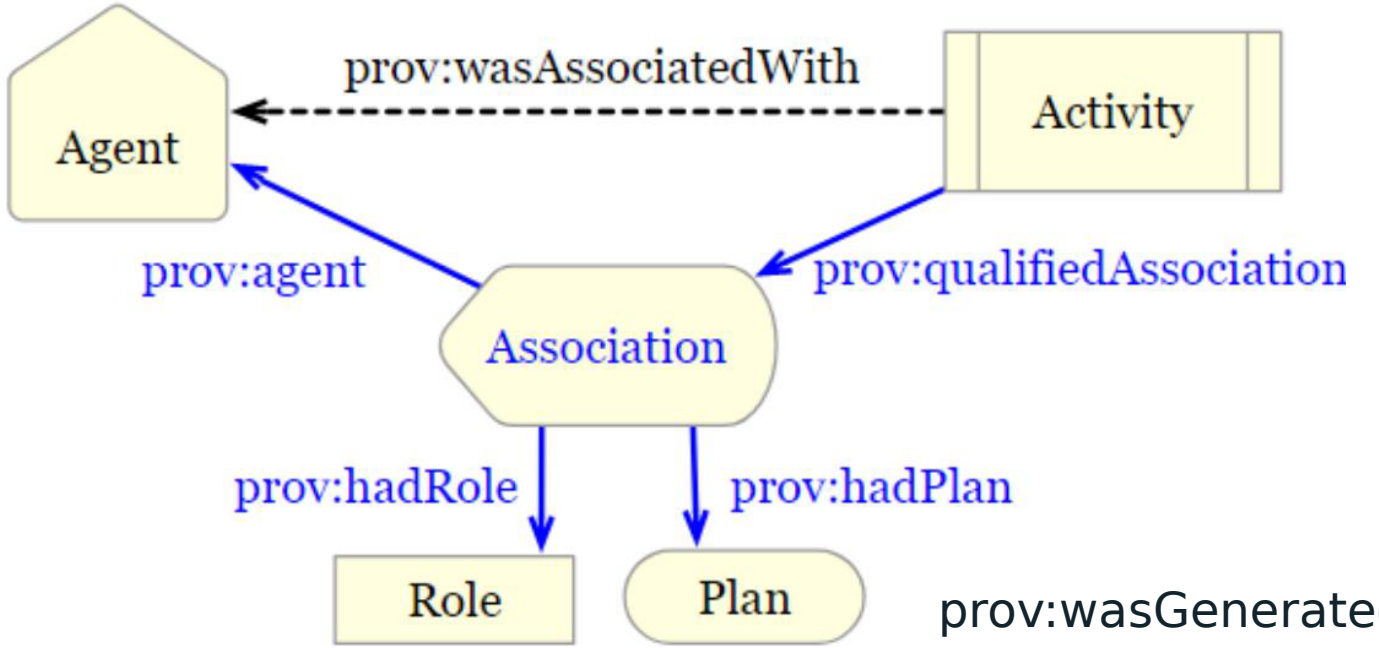


Expanded Terms





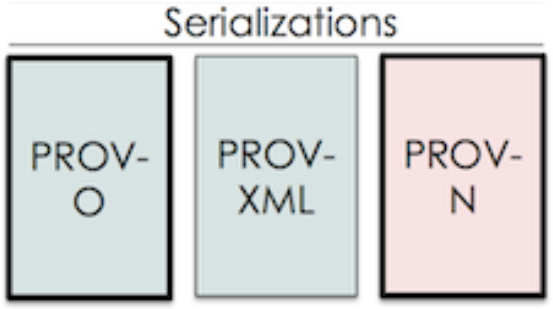
Qualified Terms

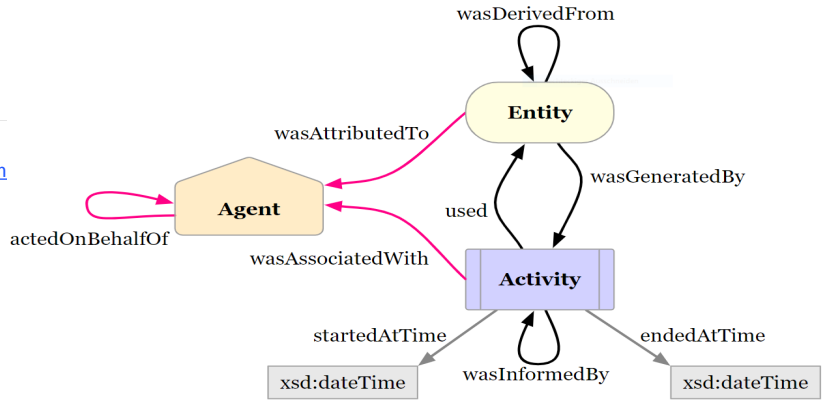


prov:wasGeneratedBy	→ prov:Generation
prov:wasDerivedBy	→ prov:Derivation
prov:wasAttributedTo	→ prov:Attribution
prov:wasInformedBy	→ prov:Communication
prov:actedOnBehalfOf	→ prov:Delegation
prov:wasDerivedBy	→ prov:Derivation
prov:used	→ prov:Usage

PROV-DM

http://www.w3.org/TR/prov-dm/






```
PREFIX prov: <http://www.w3.org/ns/prov#>
PREFIX ex:   <http://example.org#>

ex:entity1
   a prov:Entity;
   prov:wasDerivedFrom ex:entity1;
   prov:wasGeneratedBy ex:activity1;
   prov:wasAttributedTo ex:agent1;

ex:agent1
   a prov:Agent;
   prov:actedOnBehalfOf ex:agent1;

ex:activity1
   a prov:Activity;
   prov:used ex:entity1;
   prov:wasAssociatedWith ex:agent1;
   prov:wasInformedBy ex:activity1;
   prov:startedAtTime „2011-07-14T01:01:01Z“^^xsd:dateTime;
   prov:endedAtTime „2011-08-14T01:01:01Z“^^xsd:dateTime;
```

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<prov:document       xmlns:prov="http://www.w3.org/ns/prov#" xmlns:xsi=http://www.w3.org/2001/XMLSchem
            xmlns:xsd="http://www.w3.org/2001/XMLSchema" xmlns:ex="http://example.org#">
<prov:activity prov:id="ex:activity1">
            <prov:startTime>2011-07-14T01:01:01Z</prov:startTime>
            <prov:endTime>2011-08-14T01:01:01Z</prov:endTime>
</prov:activity>
<prov:agent prov:id="ex:agent1"/>
<prov:entity prov:id="ex:entity1"/>
<prov:wasDerivedFrom>
            <prov:generatedEntity prov:ref="ex:entity1"/>
            <prov:usedEntity prov:ref="ex:entity1"/>
</prov:wasDerivedFrom>
<prov:wasGeneratedBy>
            <prov:entity prov:ref="ex:entity1"/>
            <prov:activity prov:ref="ex:activity1"/>
</prov:wasGeneratedBy>
<prov:wasAttributedTo>
            <prov:entity prov:ref="ex:entity1"/>
            <prov:agent prov:ref="ex:agent1"/>
</prov:wasAttributedTo>
<prov:used>
            <prov:activity prov:ref="ex:activity1"/>
            <prov:entity prov:ref="ex:entity1"/>
</prov:used>
<prov:wasAssociatedWith>
            <prov:activity prov:ref="ex:activity1"/>
            <prov:agent prov:ref="ex:agent1"/>
</prov:wasAssociatedWith>
<prov:wasInformedBy>
            <prov:informed prov:ref="ex:activity1"/>
            <prov:informant prov:ref="ex:activity1"/>
</prov:wasInformedBy>
<prov:actedOnBehalfOf>
            <prov:delegate prov:ref="ex:agent1"/>
            <prov:responsible prov:ref="ex:agent1"/>
</prov:actedOnBehalfOf>
</prov:document>
```

```
document
            prefix bnode <http://openprovenance.org/provtoolbox/bnode/>
            prefix ex <http://example.org#>
            prefix rdf <http://www.w3.org/1999/02/22-rdf-syntax-ns#>

            activity(ex:activity1,2011-07-14T01:01:01Z,2011-08-14T01:01:01Z)
            agent(ex:agent1)
            entity(ex:entity1)
            wasDerivedFrom(ex:entity1, ex:entity1)
            wasGeneratedBy(ex:entity1,ex:activity1,-)
            wasAttributedTo(ex:entity1, ex:agent1)
            used(ex:activity1,ex:entity1,-)
            wasAssociatedWith(ex:activity1,ex:agent1,-)
            wasInformedBy(ex:activity1,ex:activity1)
            actedOnBehalfOf(ex:agent1,ex:agent1,-)
endDocument
```

Generating Provenance Data

Supported by existing workflow management systems

e.g. Taverna plugin

Dedicated libraries to annotate scripting environments

e.g. “YesWorkflow”

Direct implementation in own software

Extraction from existing log output

PROV-TEMPLATE

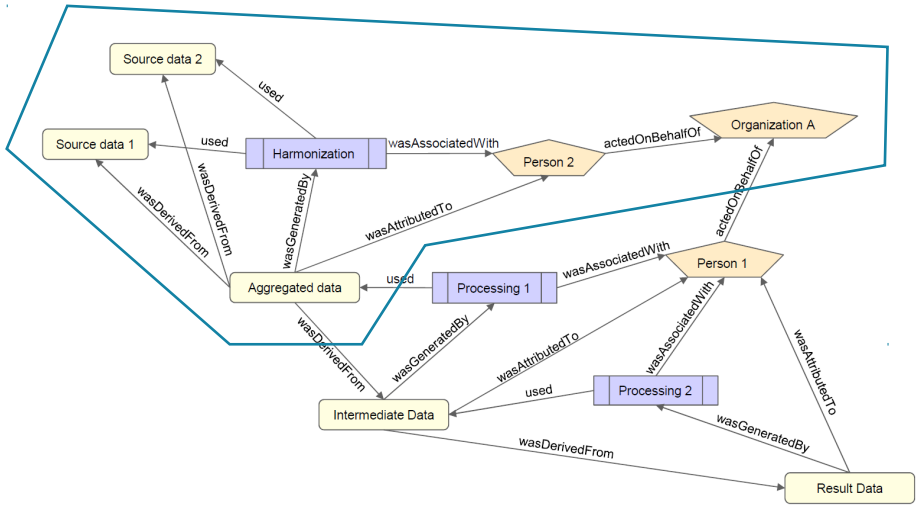
Decoupling of generation of PROV-DM descriptions from application source code

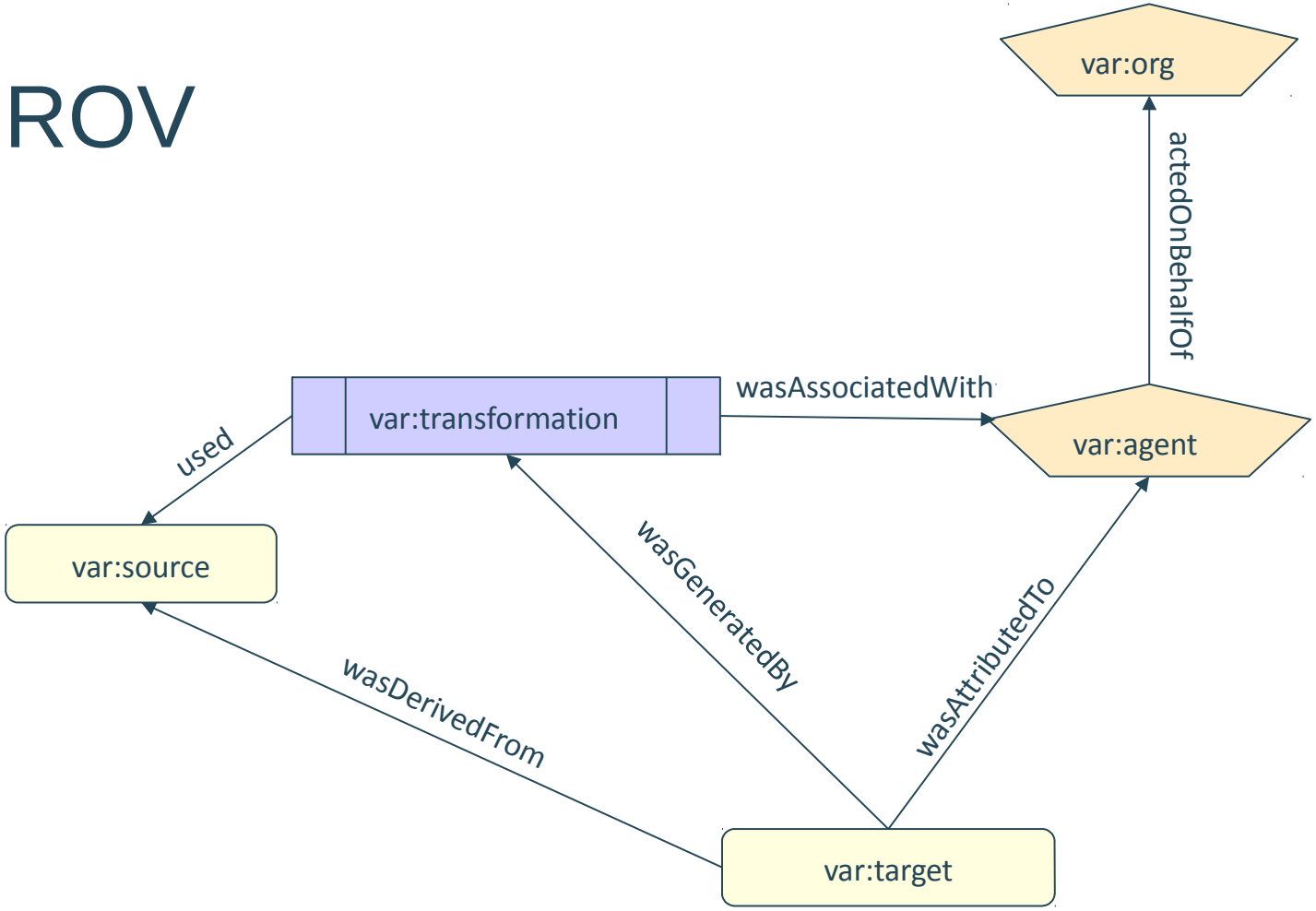
- Re-use existing log data
- Adapt provenance represenation without changing source code

Reference

PROV-TEMPLATE

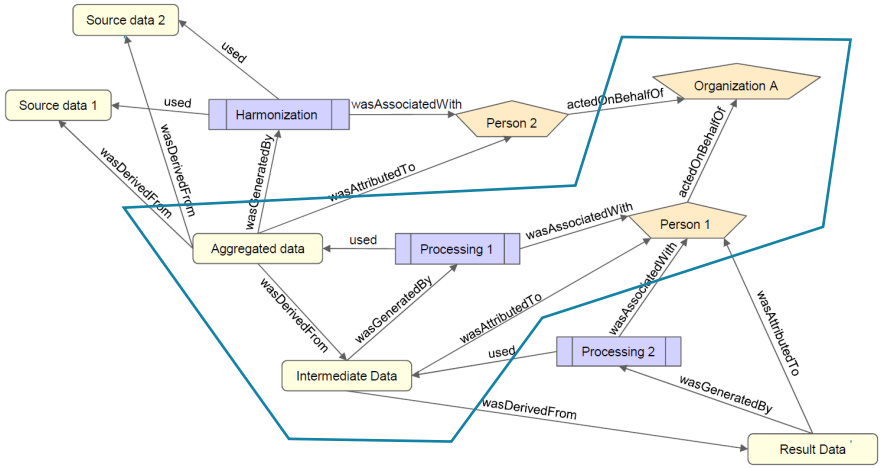
Templating system for PROV

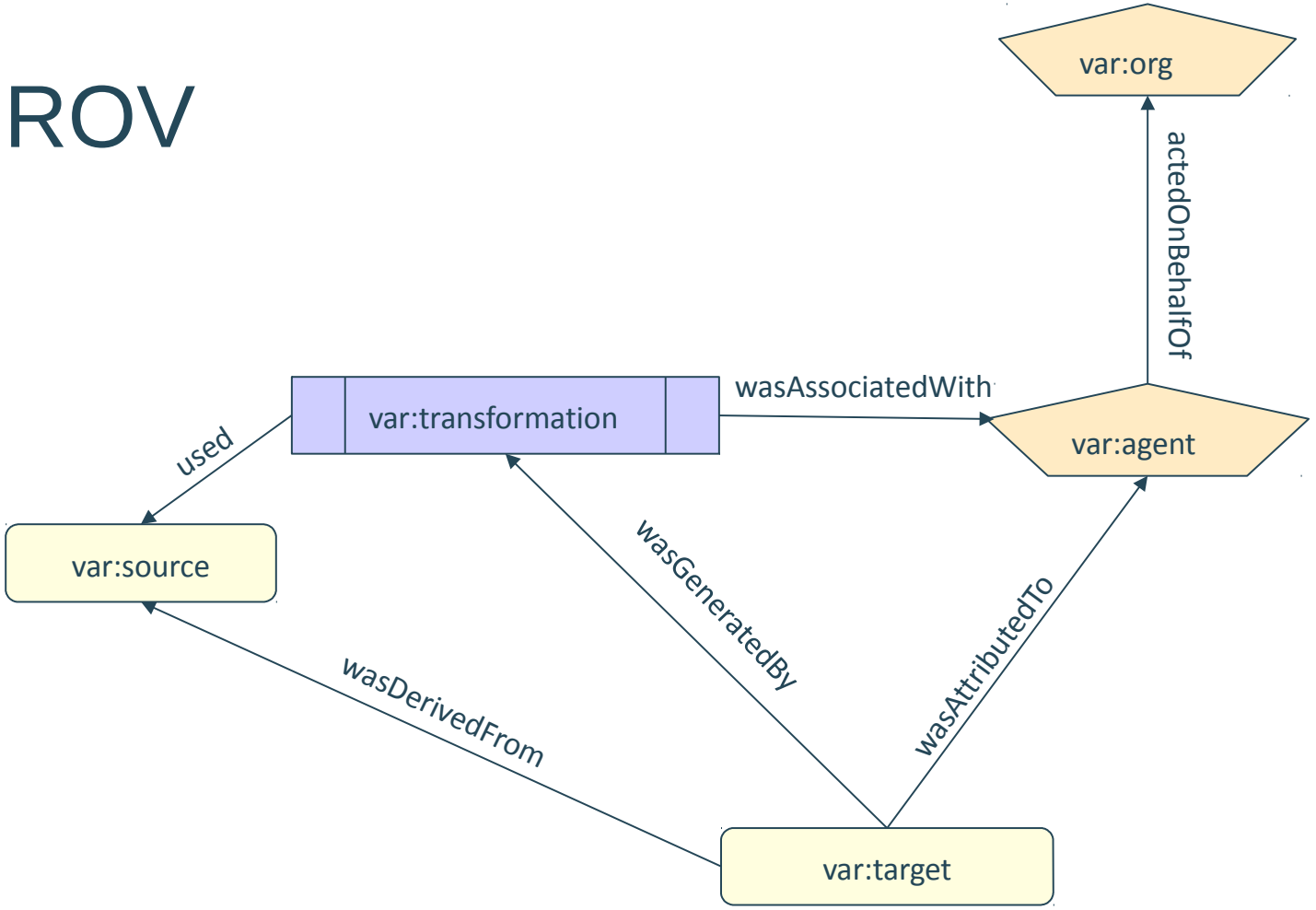




PROV-TEMPLATE

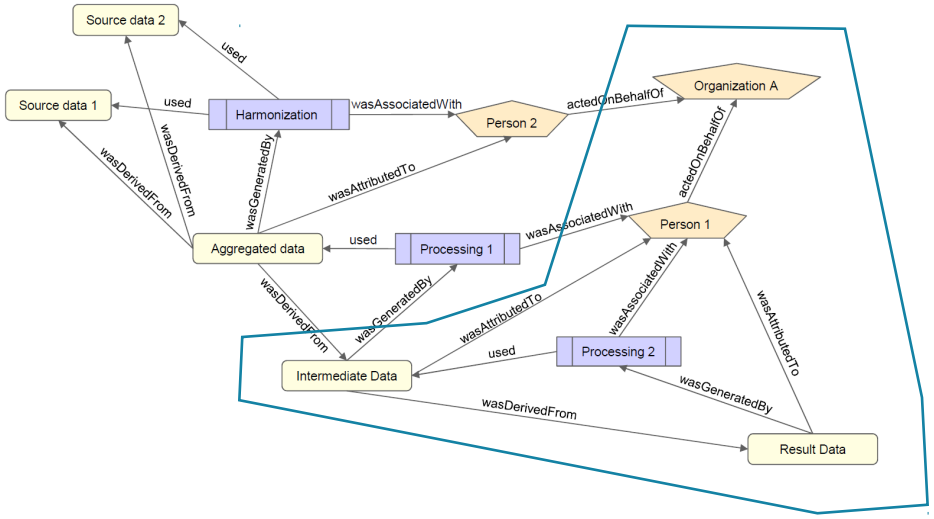
Templating system for PROV

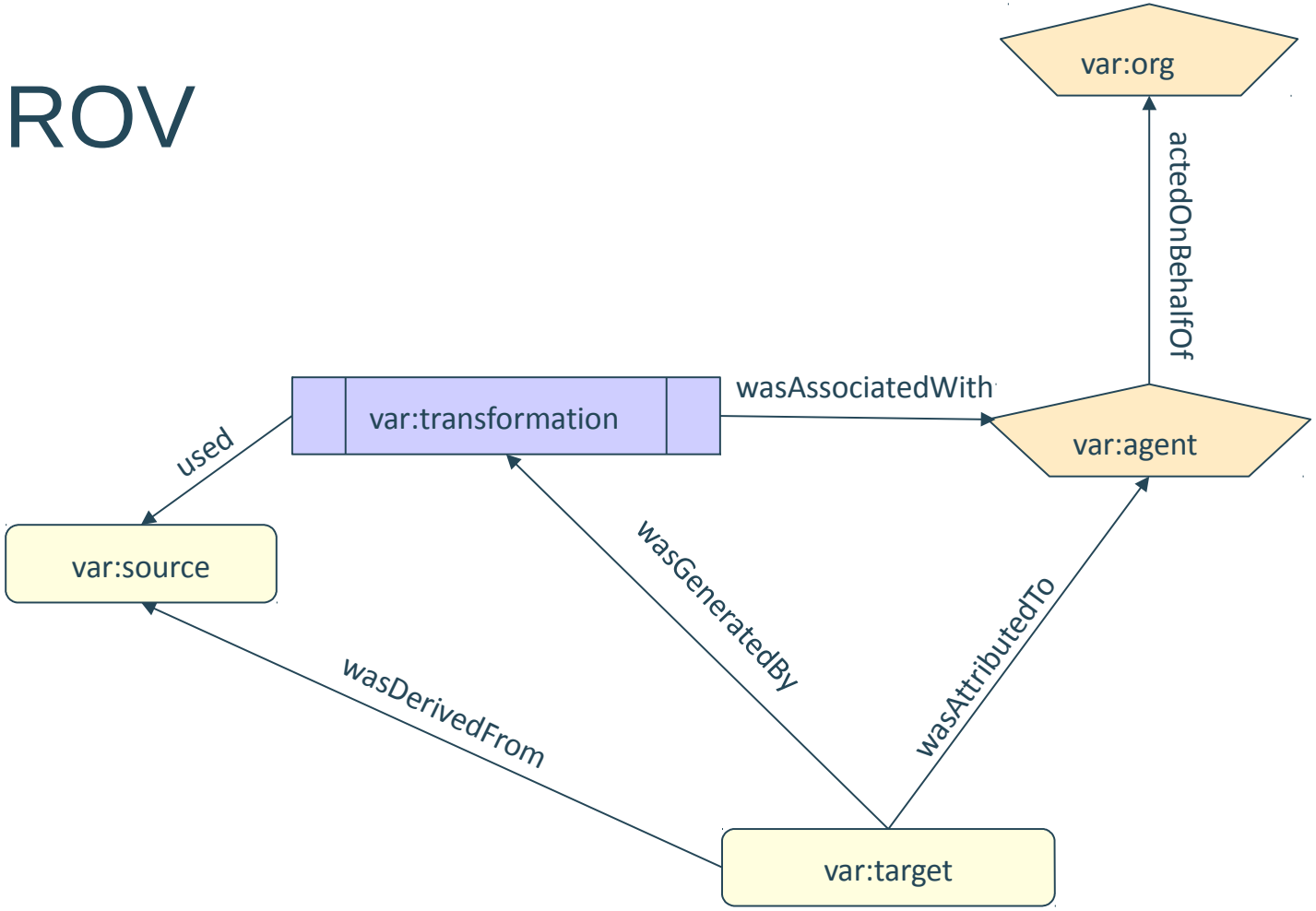




PROV-TEMPLATE

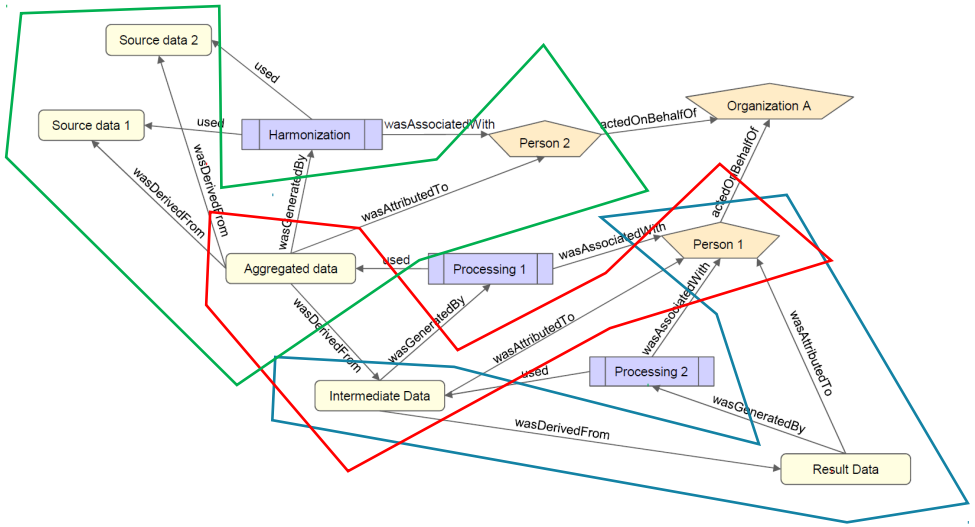
Templating system for PROV

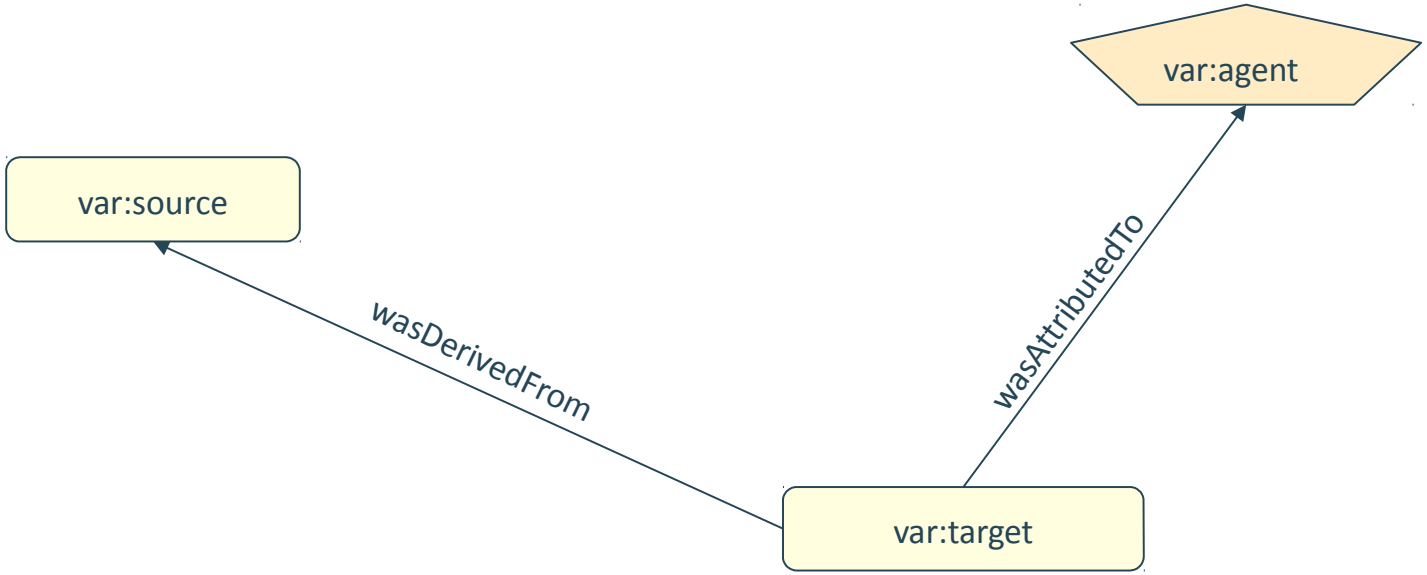




PROV-TEMPLATE

Templating system for PROV

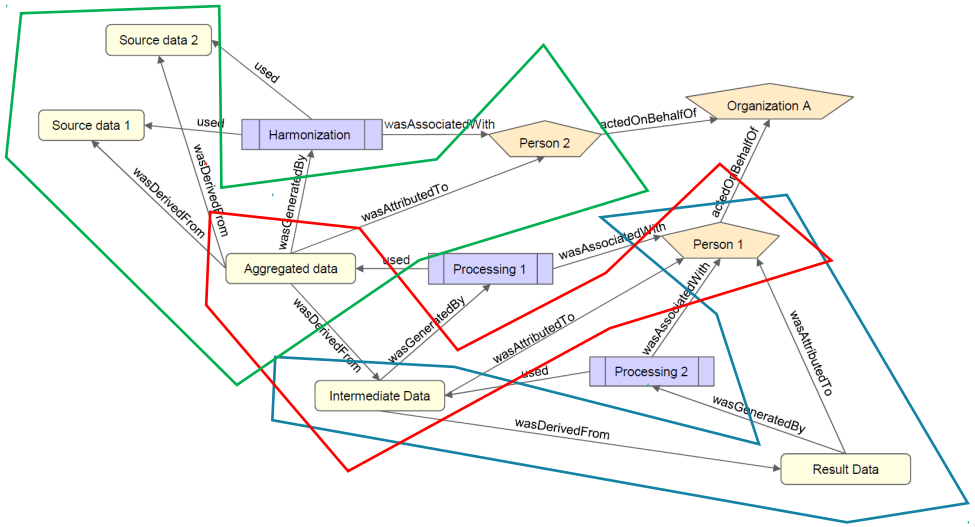


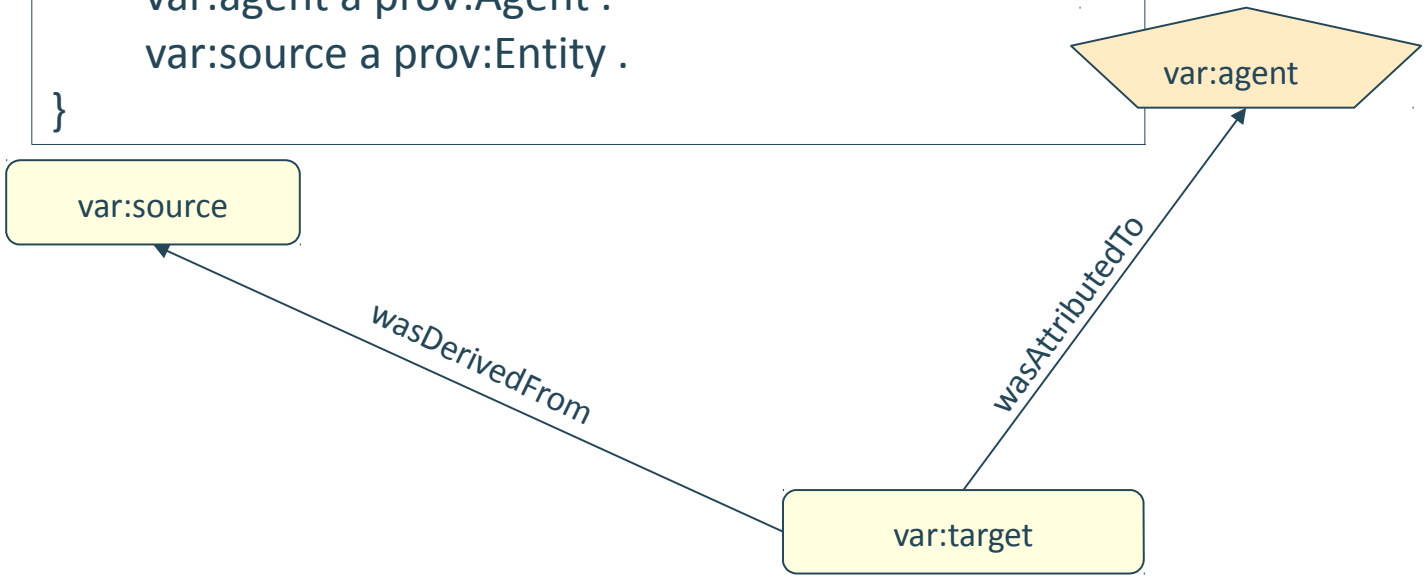


PROV-TEMPLATE

Templating system for PR

```
@prefix prov: <http://www.w3.org/ns/prov#> .
@prefix var: <http://openprovenance.org/var#> .

{
    var:target a prov:Entity ;
        prov:wasAttributedTo var:agent ;
        prov:wasDerivedFrom var:source .

    var:agent a prov:Agent .
    var:source a prov:Entity .
}
```

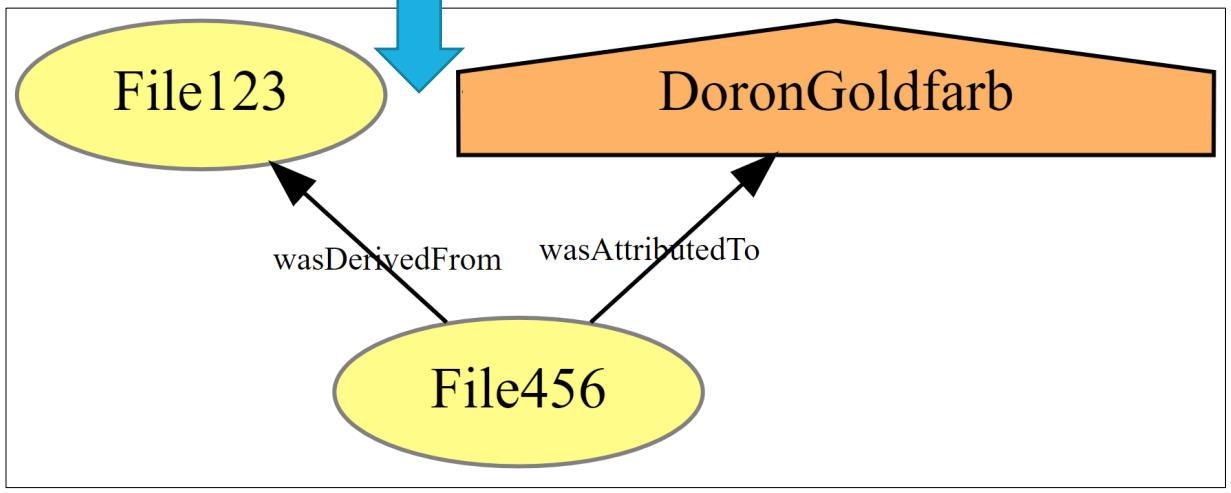


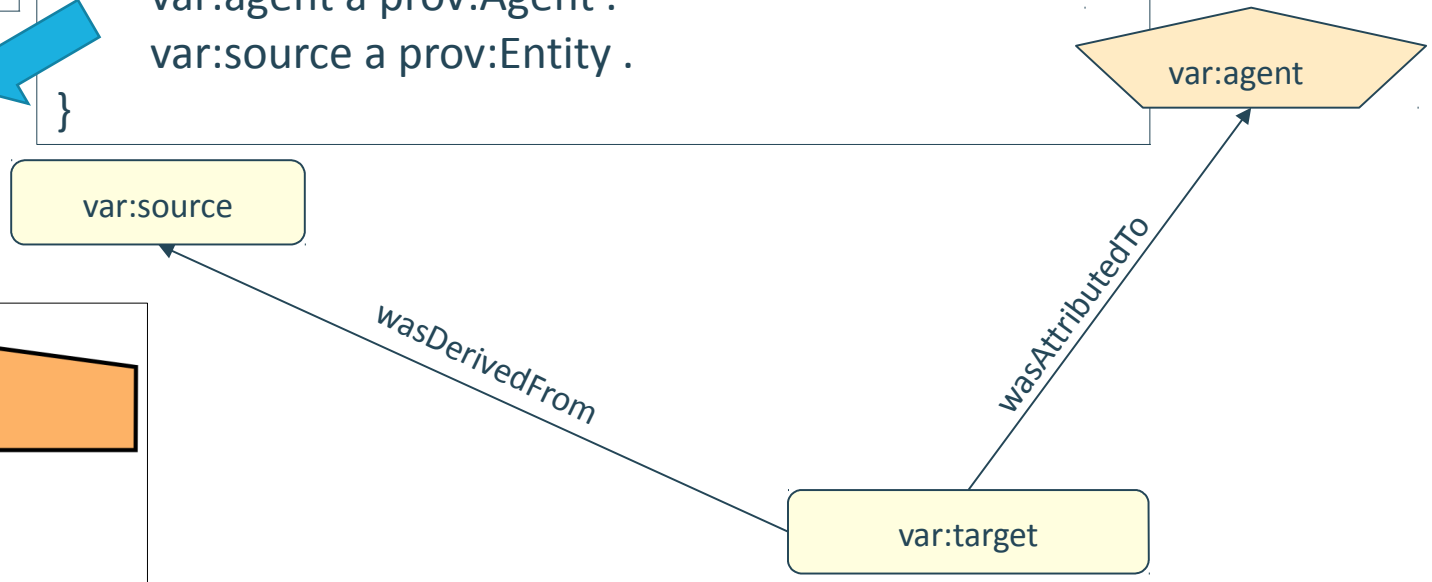


```
{
    "var": {
        "agent": [{"@id": "envri:DoronGoldfarb"}],
        "source": [{"@id": "envri:File123" }],
        "target": [{"@id": "envri:File456"}]
    },
    "context": {
        "envri": "http://envri.eu/"
    }
}
```

```
@prefix prov: <http://www.w3.org/ns/prov#> .
@prefix var: <http://openprovenance.org/var#> .

{
    var:target a prov:Entity ;
        prov:wasAttributedTo var:agent ;
        prov:wasDerivedFrom var:source .

    var:agent a prov:Agent .
    var:source a prov:Entity .
}
```

EXPANSION

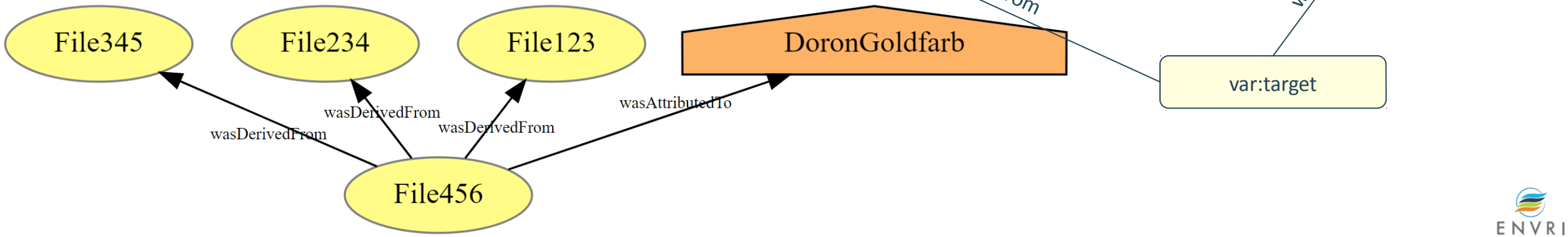




```
{
    "var": {
        "agent": [{"@id": "envri:DoronGoldfarb"}],
        "source": [{"@id": "envri:File123" },
         {"@id": "envri:File234" },
         {"@id": "envri:File245" }],
        "target": [{"@id": "envri:File456"}]
    },
    "context": {
        "envri": "http://envri.eu/"
    }
}
```

```
@prefix prov: <http://www.w3.org/ns/prov#> .
@prefix var: <http://openprovenance.org/var#> .

{
    var:target a prov:Entity ;
        prov:wasAttributedTo var:agent ;
        prov:wasDerivedFrom var:source .

    var:agent a prov:Agent .
    var:source a prov:Entity .
}
```

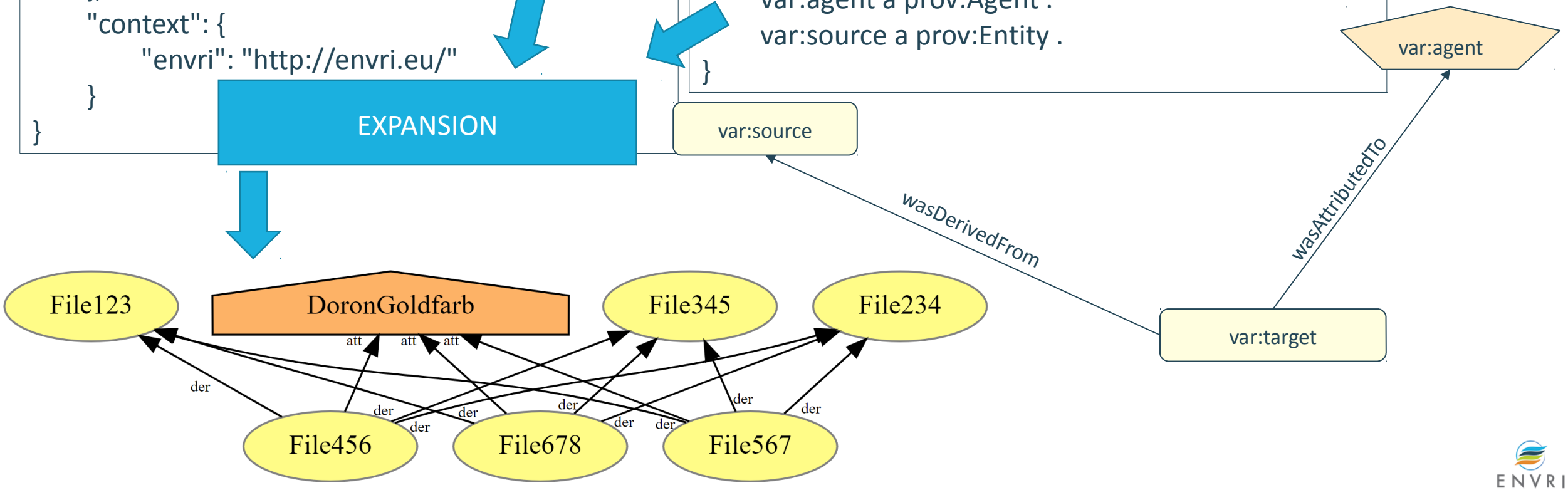
EXPANSION



```
{
    "var": {
        "agent": [{"@id": "envri:DoronGoldfarb"}],
        "source": [{"@id": "envri:File123" },
         {"@id": "envri:File234" },
         {"@id": "envri:File245" }],
        "target":  [{"@id": "envri:File456"},
         {"@id": "envri:File567"},
         {"@id": "envri:File678"}]
    },
    "context": {
        "envri": "http://envri.eu/"
    }
}
```

EXPANSION

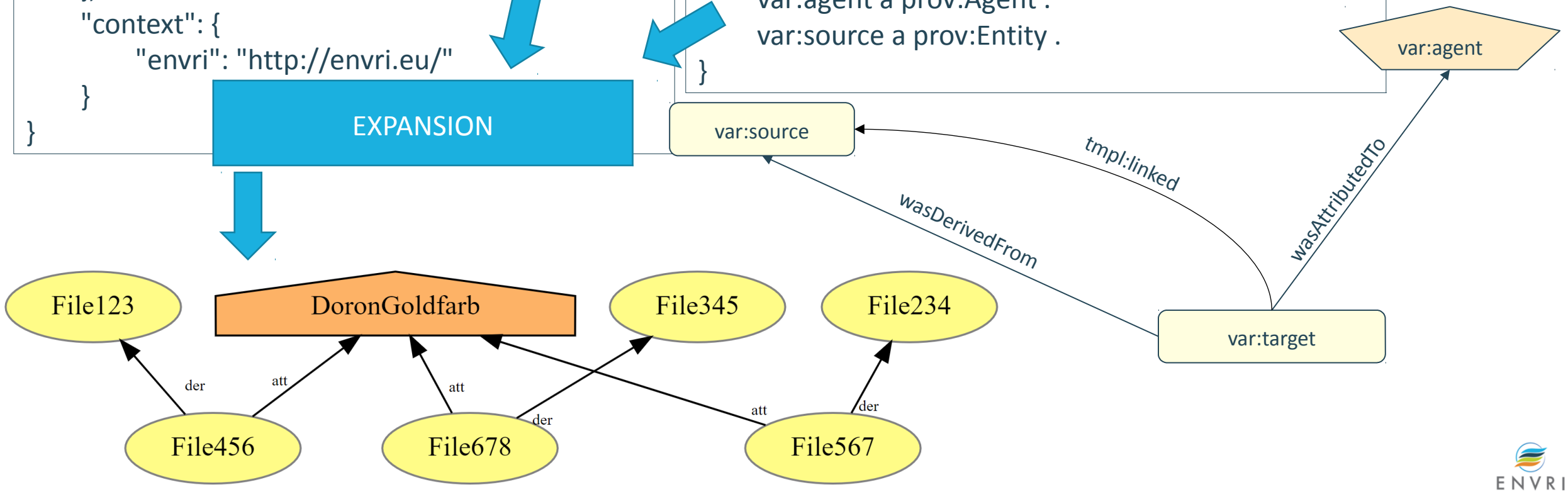
```
@prefix prov: <http://www.w3.org/ns/prov#> .
@prefix var: <http://openprovenance.org/var#> .

{
    var:target a prov:Entity ;
        prov:wasAttributedTo var:agent ;
        prov:wasDerivedFrom var:source .

    var:agent a prov:Agent .
    var:source a prov:Entity .
}
```



```
{
    "var": {
        "agent": [{"@id": "envri:DoronGoldfarb"}],
        "source": [{"@id": "envri:File123" },
         {"@id": "envri:File234" },
         {"@id": "envri:File245" }],
        "target":  [{"@id": "envri:File456"},
         {"@id": "envri:File567"},
         {"@id": "envri:File678"}]
    },
    "context": {
        "envri": "http://envri.eu/"
    }
}
```

EXPANSION

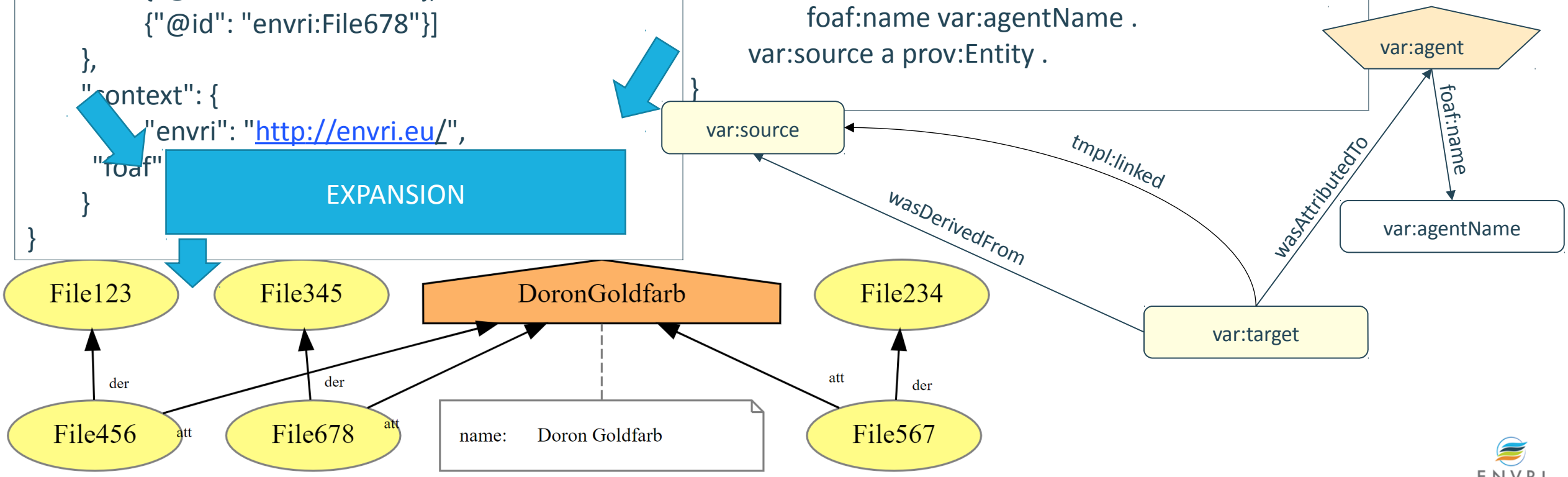
```
@prefix prov: <http://www.w3.org/ns/prov#> .
@prefix var: <http://openprovenance.org/var#> .
@prefix tmpl: <http://openprovenance.org/tmpl#> .
{
    var:target a prov:Entity ;
        prov:wasAttributedTo var:agent ;
        prov:wasDerivedFrom var:source ;
        tmpl:linked var:source .
    var:agent a prov:Agent .
    var:source a prov:Entity .
}
```



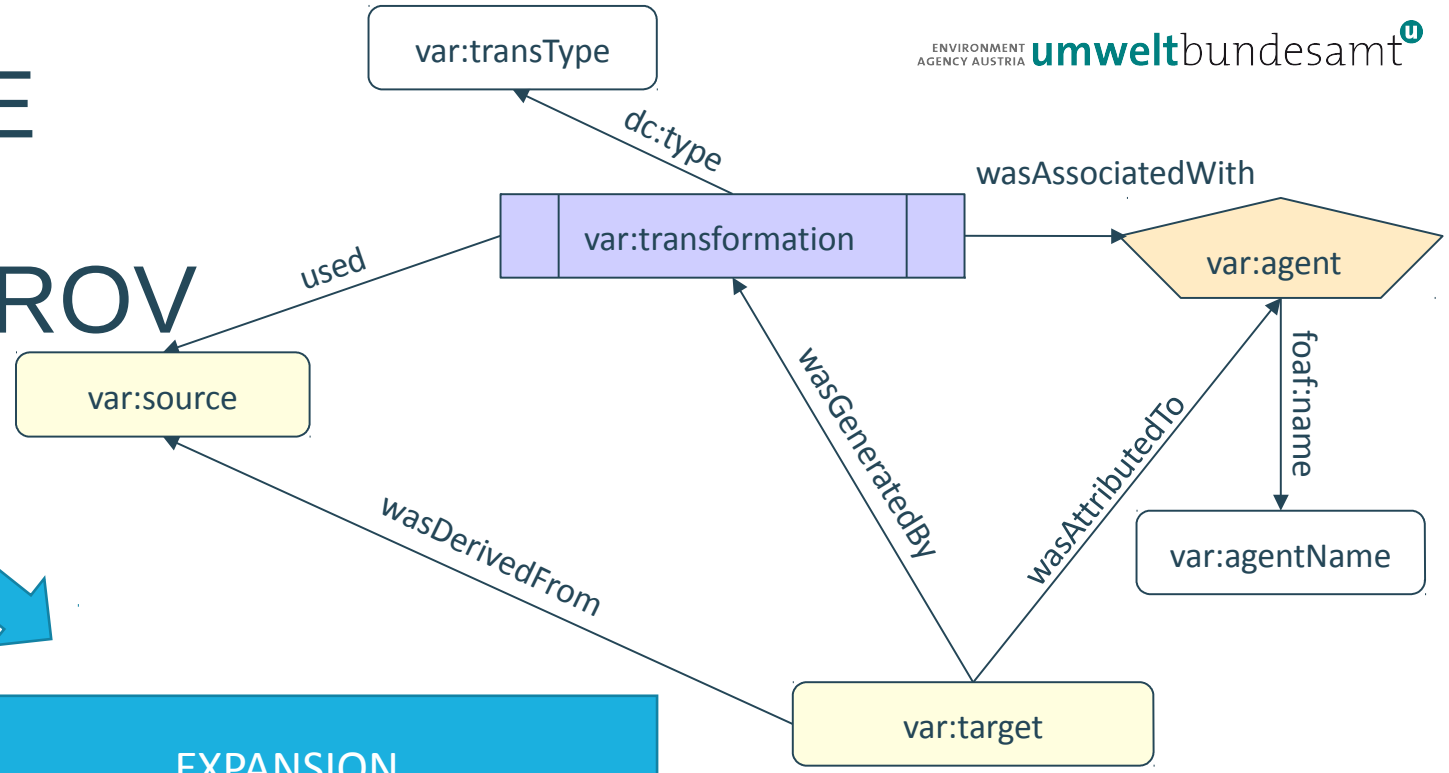
```
{
    "var": {
        "agent": [{"@id": "envri:DoronGoldfarb"}],

        "agentName": ["Doron Goldfarb"],
        "source": [{"@id": "envri:File123" },
         {"@id": "envri:File234" },
         {"@id": "envri:File245" }],
        "target":  [{"@id": "envri:File456"},
         {"@id": "envri:File567"},
         {"@id": "envri:File678"}]
    },
    "context": {
        "envri": "http://envri.eu/",
        "foaf"
    }
}
```

EXPANSION

```
@prefix prov: <http://www.w3.org/ns/prov#> .
@prefix var: <http://openprovenance.org/var#> .
@prefix tmpl: <http://openprovenance.org/tmpl#> .
@prefix foaf: <http://xmlns.com/foaf/0.1/> .
{
    var:target a prov:Entity ;
        prov:wasAttributedTo var:agent ;
        prov:wasDerivedFrom var:source ;
        tmpl:linked var:source .
    var:agent a prov:Agent ;
        foaf:name var:agentName .
    var:source a prov:Entity .
}
```

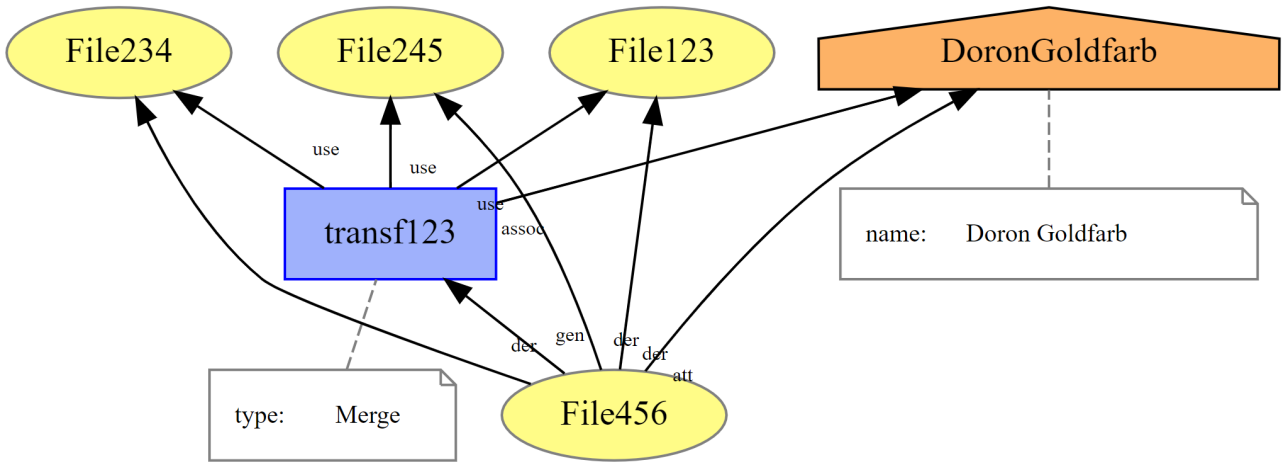


```
@prefix prov: <http://www.w3.org/ns/prov#> .
@prefix var: <http://openprovenance.org/var#> .
@prefix tmpl: <http://openprovenance.org/tmpl#> .
@prefix foaf: <http://xmlns.com/foaf/0.1/> .
@prefix dc: <http://purl.org/dc/terms/> .
{
        var:target a prov:Entity ;
                prov:wasAttributedTo var:agent ;
                prov:wasDerivedFrom var:source ;
                prov:wasGeneratedBy var:transformation .
        var:agent a prov:Agent ;
                foaf:name var:agentName .
        var:transformation a prov:Activity ;
                prov:used var:source ;
                dc:type var:transType ;
                prov:wasAssociatedWith var:agent .
        var:source a prov:Entity .
}
```

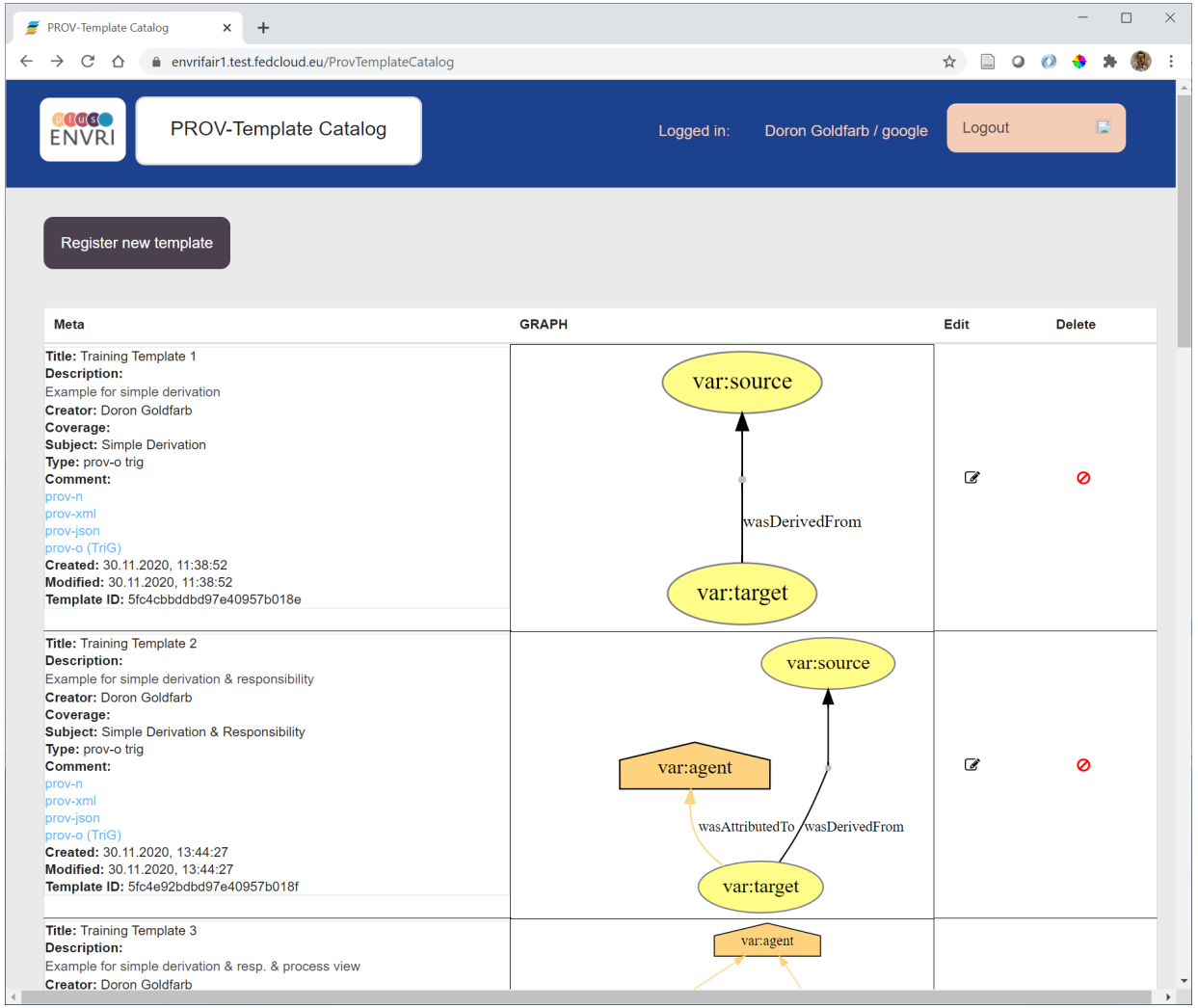


EXPANSION

```
{
    "var": {
        "source": [{"@id": "envri:File123" }, {"@id": "envri:File234" },{"@id": "envri:File245" }],
        "agent": [{"@id": "envri:DoronGoldfarb"}],
        "agentName": ["Doron Goldfarb"],
        "transformation":[{"@id": "envri:transf123"}],
        "transType": ["Merge"],
        "target":  [{"@id": "envri:File456"}]
    },
    "context": {
            "envri": "http://envri.eu/",
       "foaf" : "http://xmlns.com/foaf/0.1/ ",
       "dc"   : "http://purl.org/dc/terms/> "
    }
```



ENVRI PROV-Template Catalog



PROV-Template Tools

Envri Implementation

- https://github.com/EnvriPlus-PROV
  - https://github.com/EnvriPlus-PROV/EnvriProvTemplates (Python Lib)
  - https://github.com/EnvriPlus-PROV/ProvTemplateCatalog (Catalog Frontend & API)

Reference Implementation

- https://openprovenance.org

ProvToolbox Java package

Additional information:

- Luc Moreau Blog (https://lucmoreau.wordpress.com/2017/03/30/prov-template-a-quick-start/)
- Paper: "**A Templating System to Generate Provenance**" (https://ieeexplore.ieee.org/abstract/document/7909036)

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ENVRI

FAIR

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