The IVOA Parameter Description Language (PDL)

C.M. Zwölf, P. Harrison, J. Garrido,
J.E. Ruiz, F Le Petit

Interoperability ? Yes Please!

- Interoperability is a loaded term, it has been used and abused.

Interoperability:

The ability of systems, components to provide services to and accept services from other systems, components and to use the services so exchanged to enable them to operate effectively together

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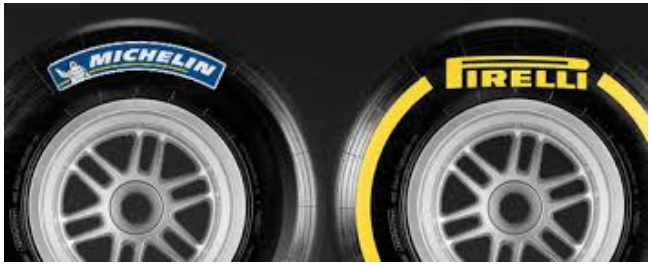

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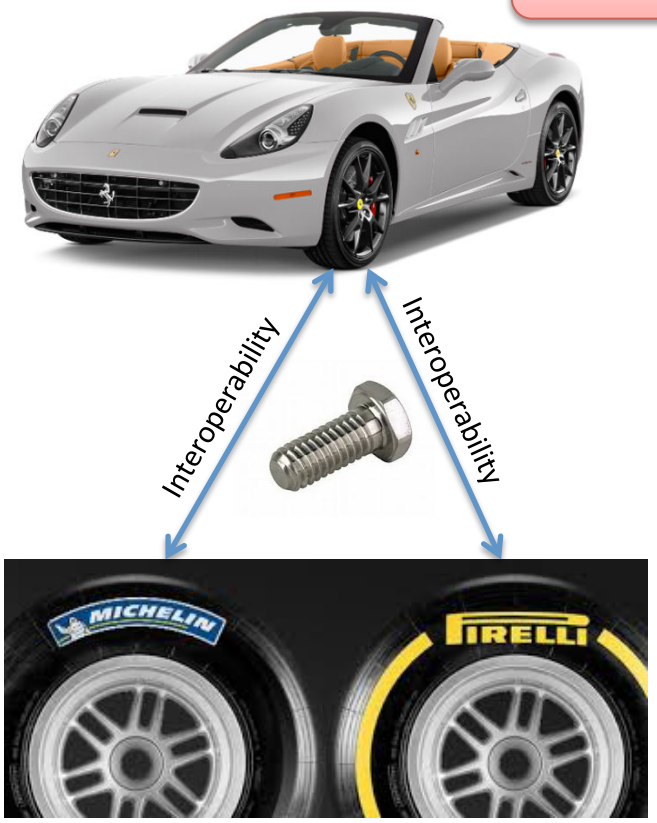

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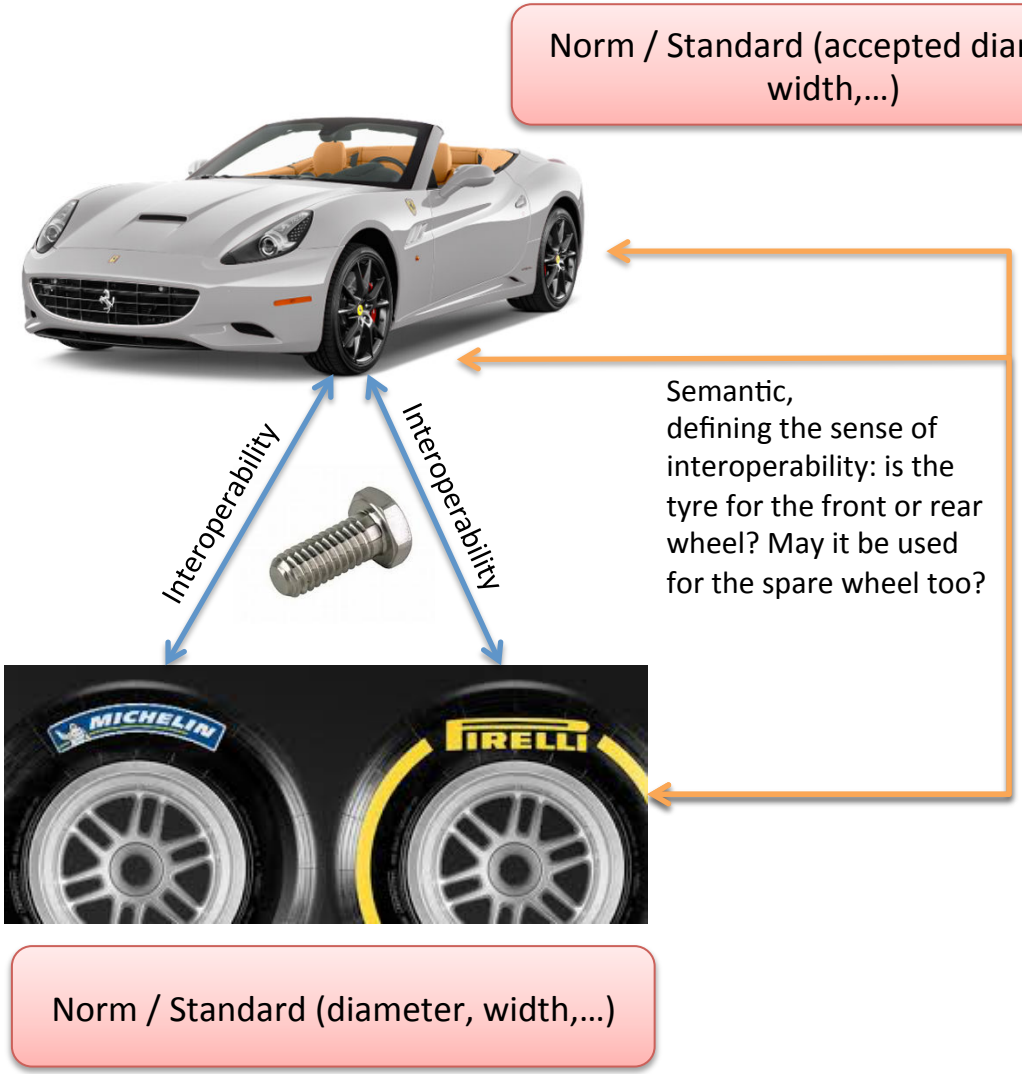

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Technical Interoperability:
Bits and bytes are exchanged in an unambiguous manner via a set of standards/communication protocols

Syntactic Interoperability:
A common data format is defined for the unambiguous sharing of information.

Semantic Interoperability:
The meaning of data is exchanged through a common information model an the meaning of information is unambiguously defined and shared

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The IVOA ***Parameter description language*** fits into this category

Needs for a sematic interoperability

- Data are discovered, extracted, handled through online services
  - The first step for the semantic interoperability of data is the sematic interoperability of the scientific web services.

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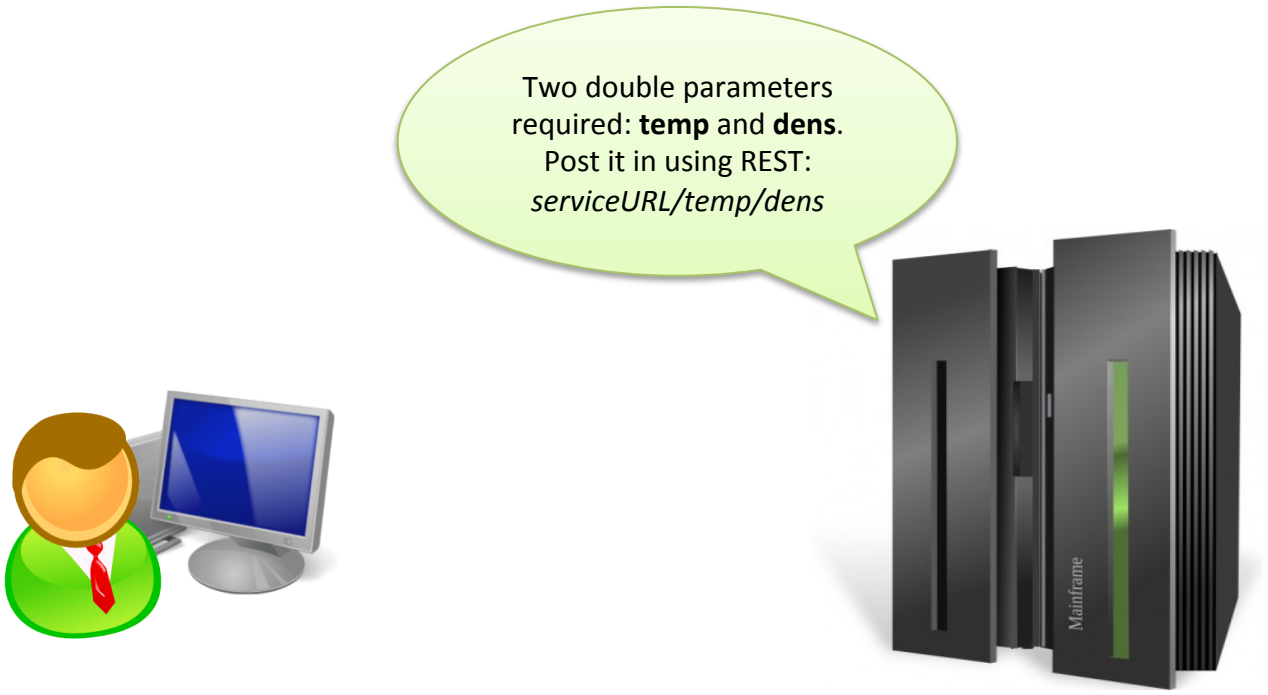

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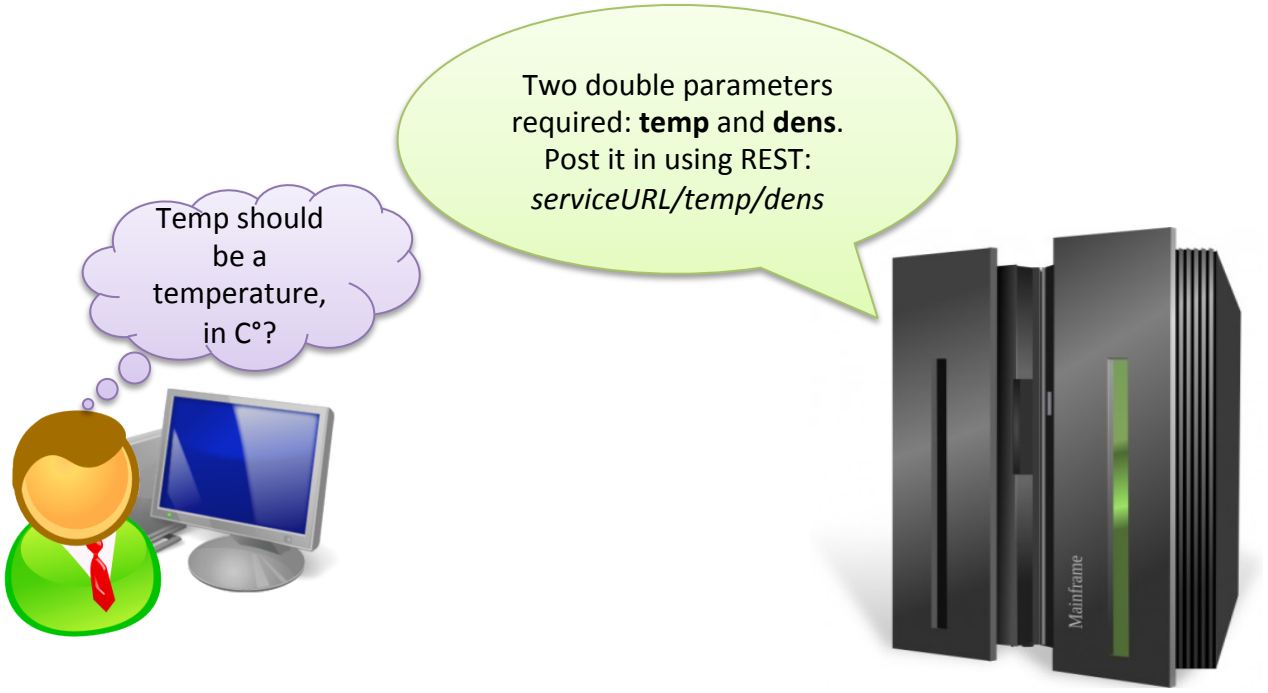

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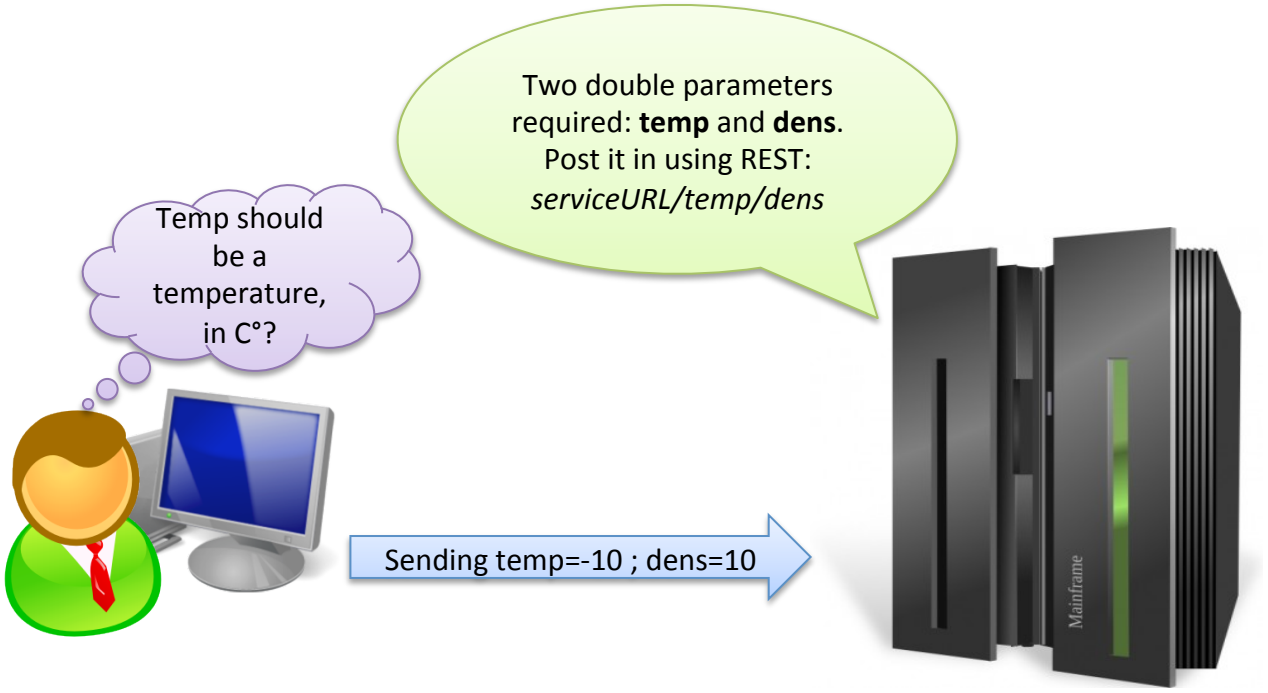

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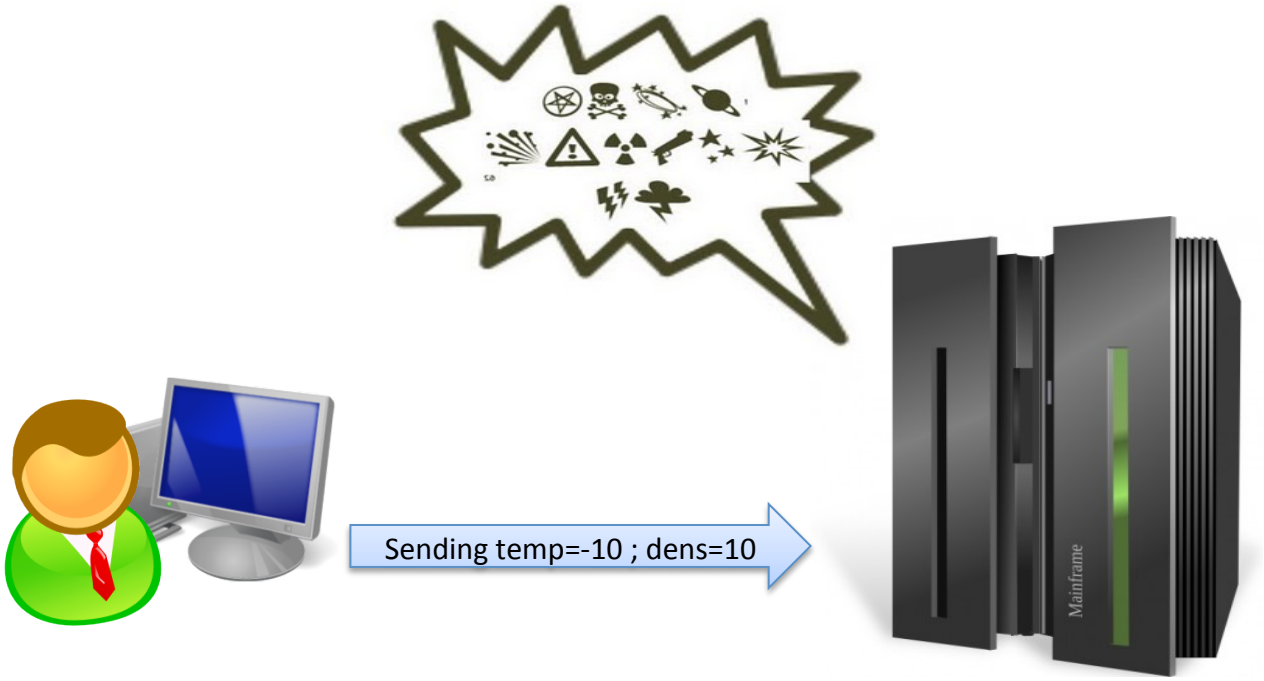

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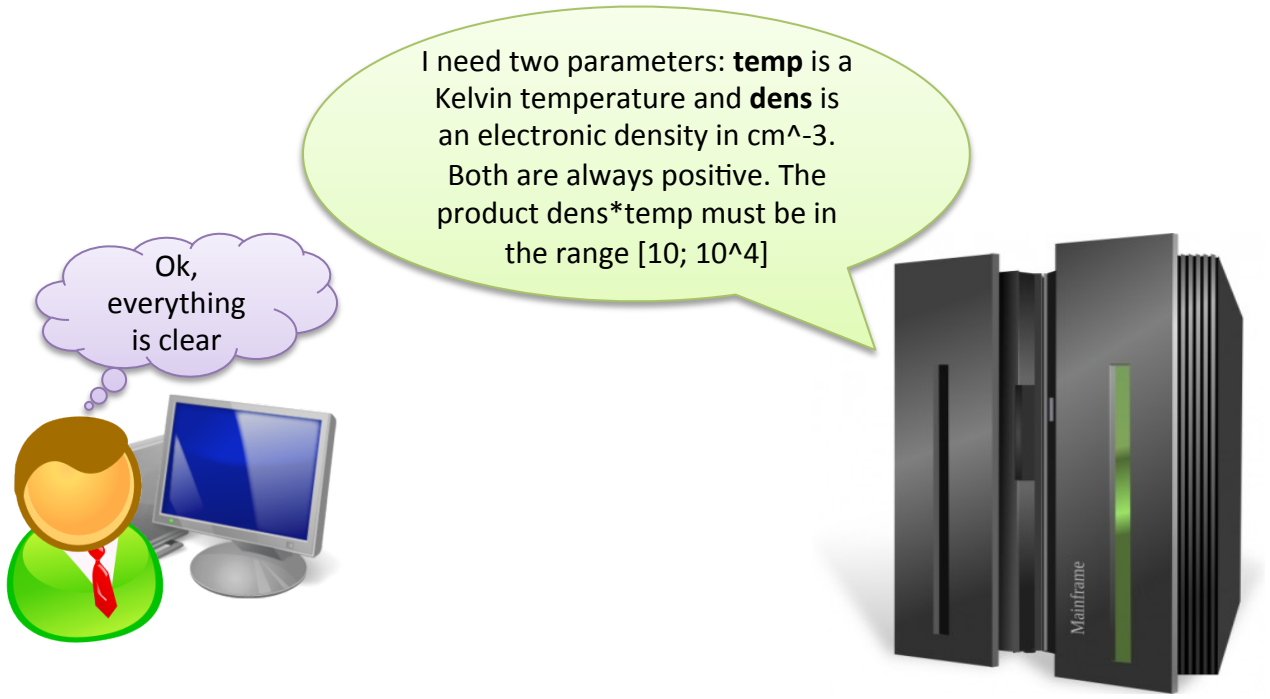
With PDL



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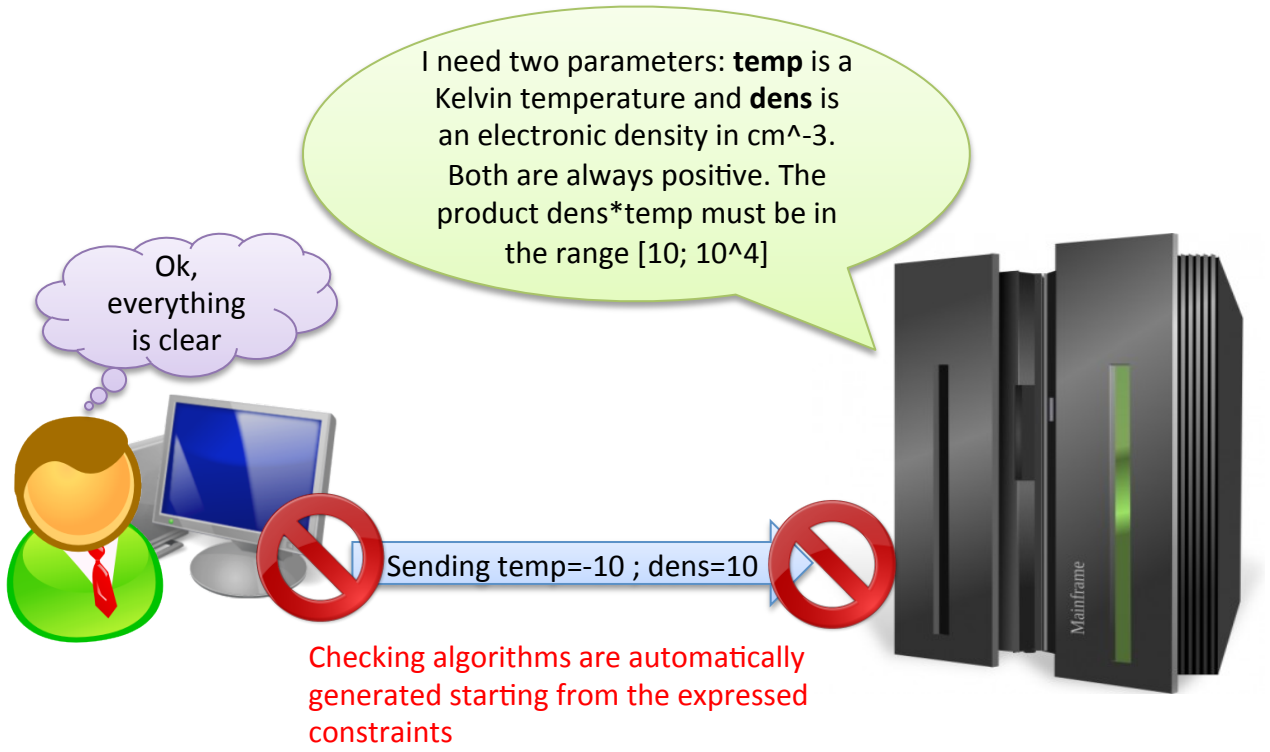

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With PDL

- PDL is intended to be a *lingua franca* of parameters

  - Describes parameters in a sufficient detail to allow workflow tools to check if parameters can be "piped" between services
    - Physical properties
      - Nature, meaning, unit, precision,…
    - Computing
      - Numerical Type, UCD, Utype, SKOS concept,…

  - Also has ability to describe constraints involving parameters
    - Physical constraints
    - Arbitrary conditions

  - Is a descriptive layer that can be overlaps existing services, regardless of the standard/technology adopted for the service implementation

  - Is an IVOA recommendation: http://ivoa.net/documents/PDL/
    - PDL sentences are composed of syntactic elements, fixed into a XML schema. Sentences are made combining those elements.

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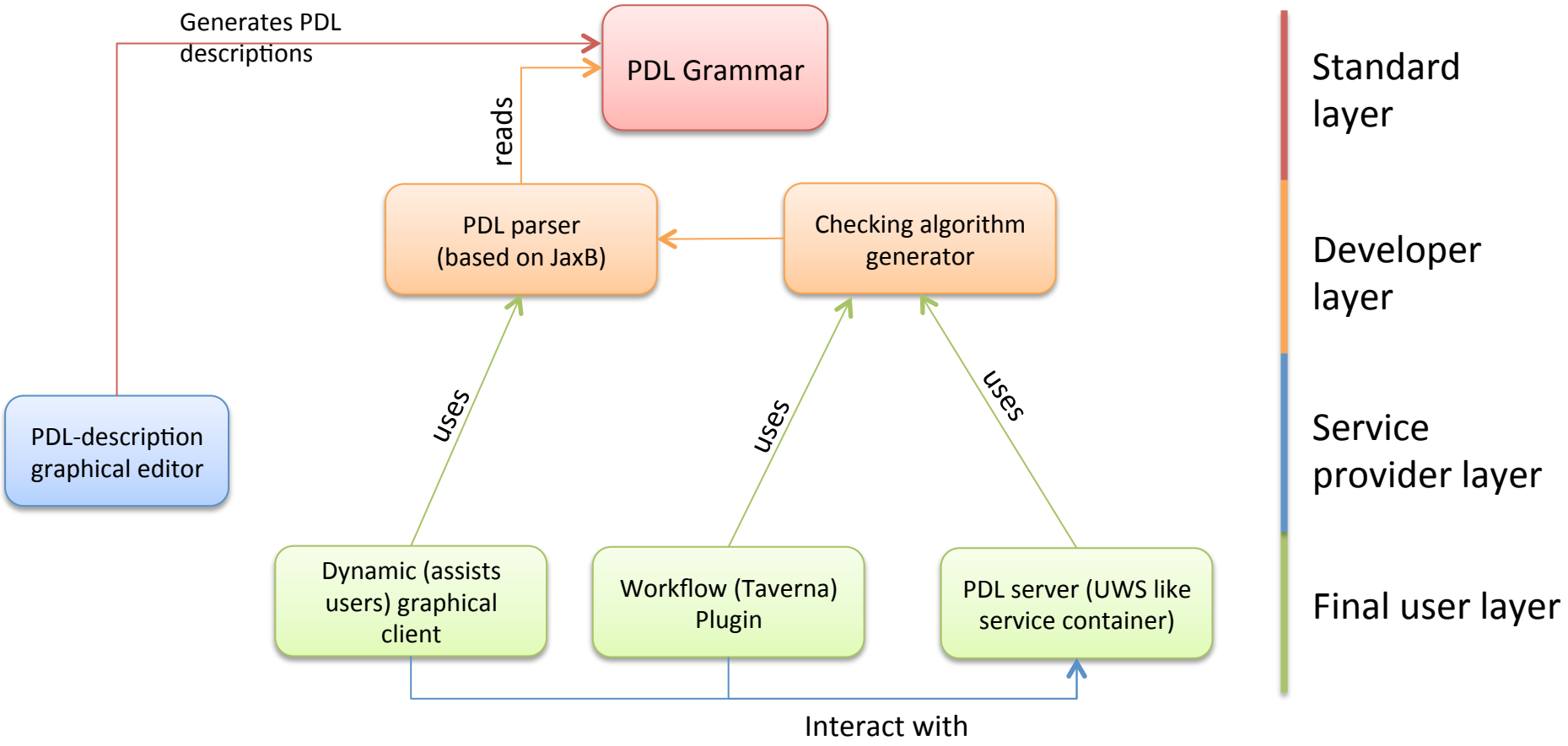
With PDL

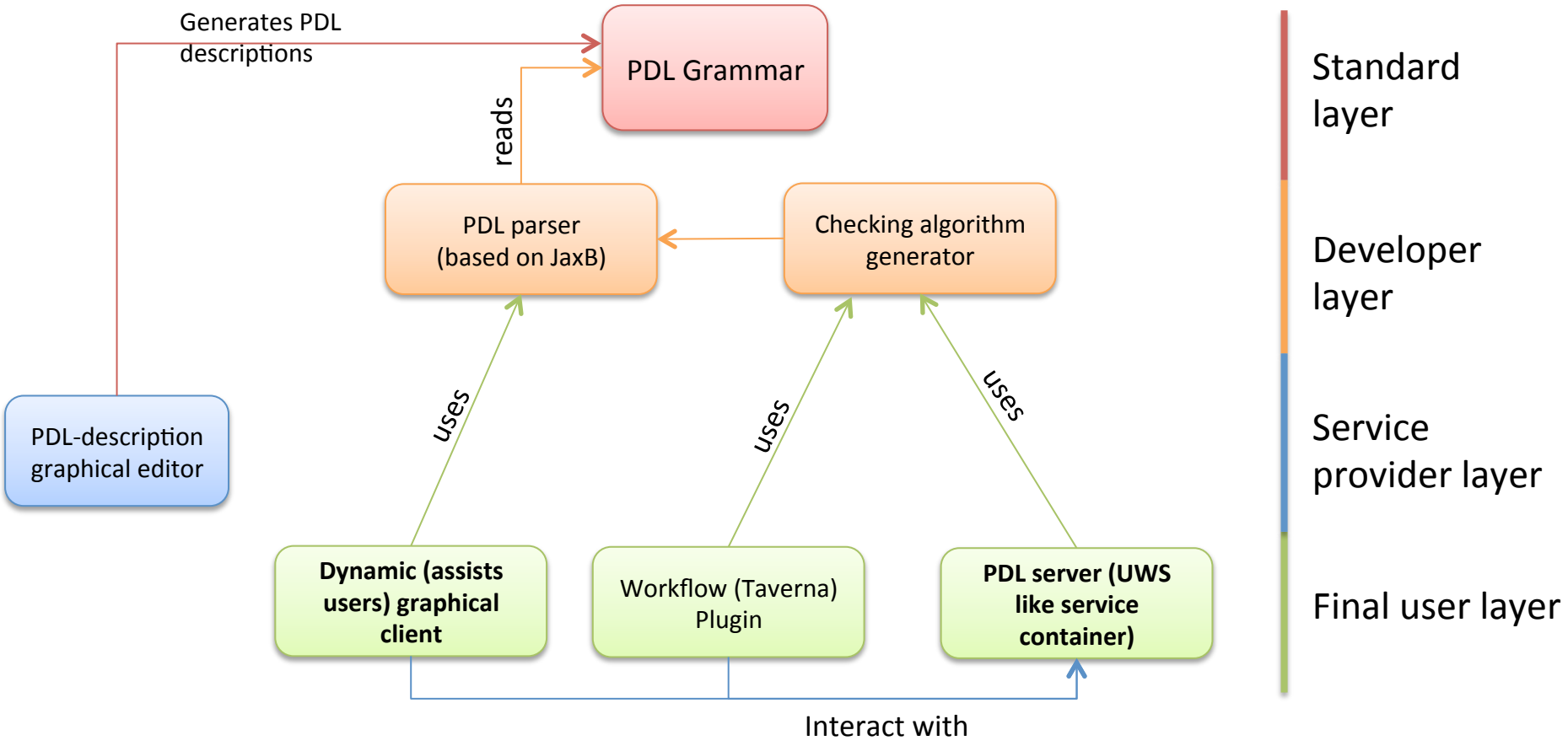
USES

- Searching for compatible services
  - Definitions in registry
- Auto generation of user interfaces (dynamic client)
  - Descriptions allow automatic generation of client applications
- Generic service containers are configured with a PDL description instance to create new services quickly.
- Automatic (on the fly and/or a priori) computation of interoperability graphs between services

Components of the PDL framework



Components of the PDL framework



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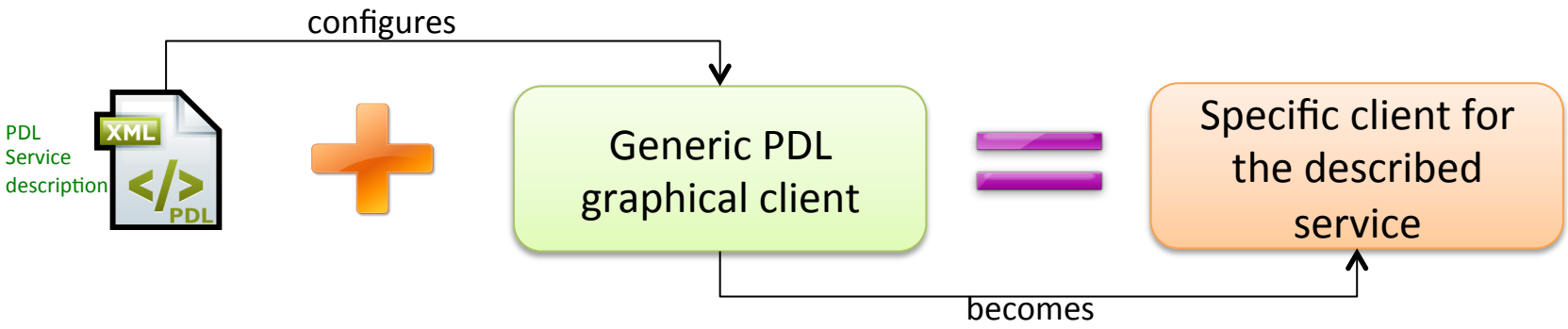

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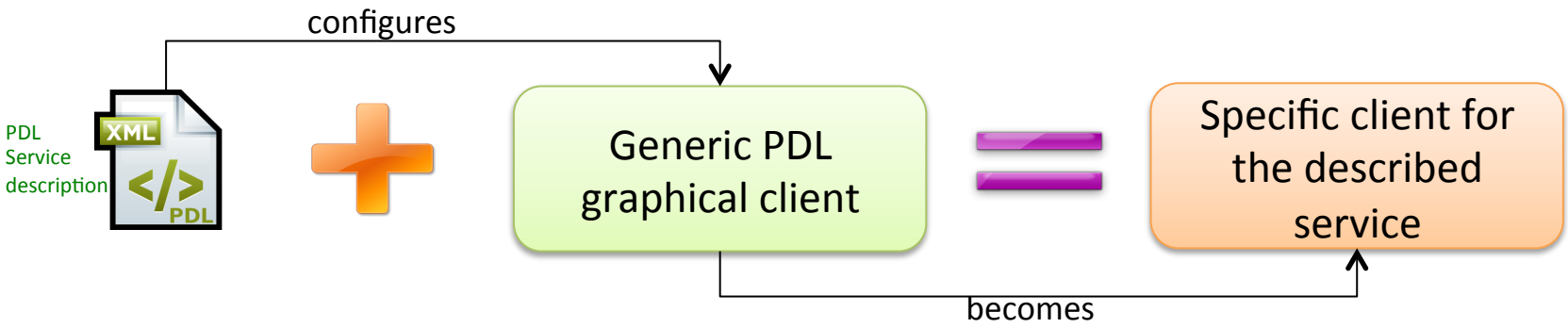

Why dynamic? It automatically reshapes following description and user actions:

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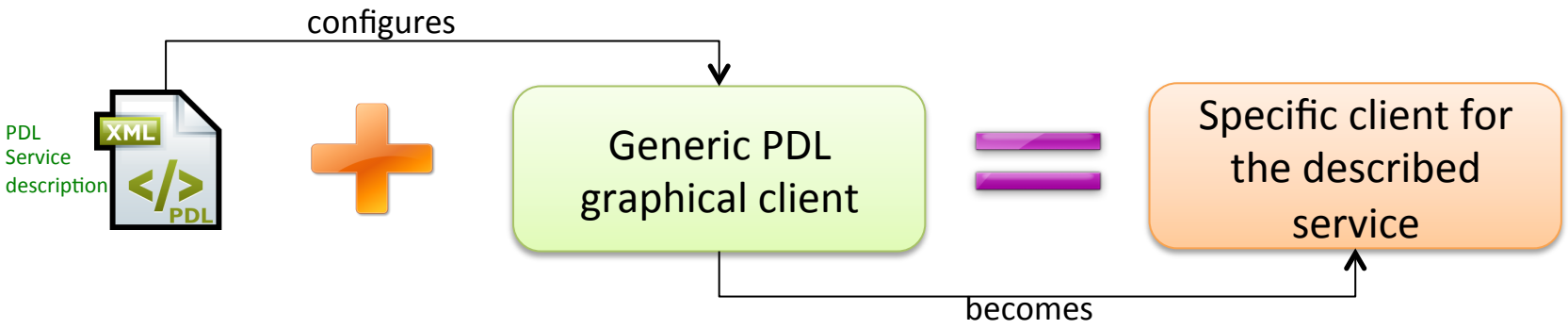

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Service description:

- $p_1 \in \mathbb{R}$, $p_2 \in \mathbb{N}$ and p_3 is boolean.
- if $p_1 > 0 \implies p_2 \in \{2; 4; 6\}$ and p_3 must be false.
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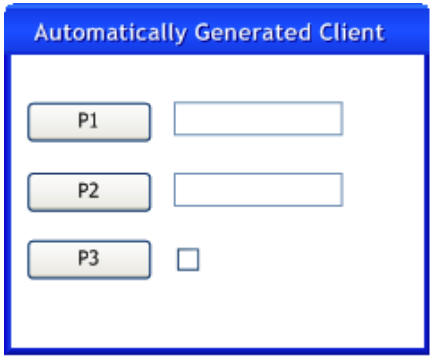

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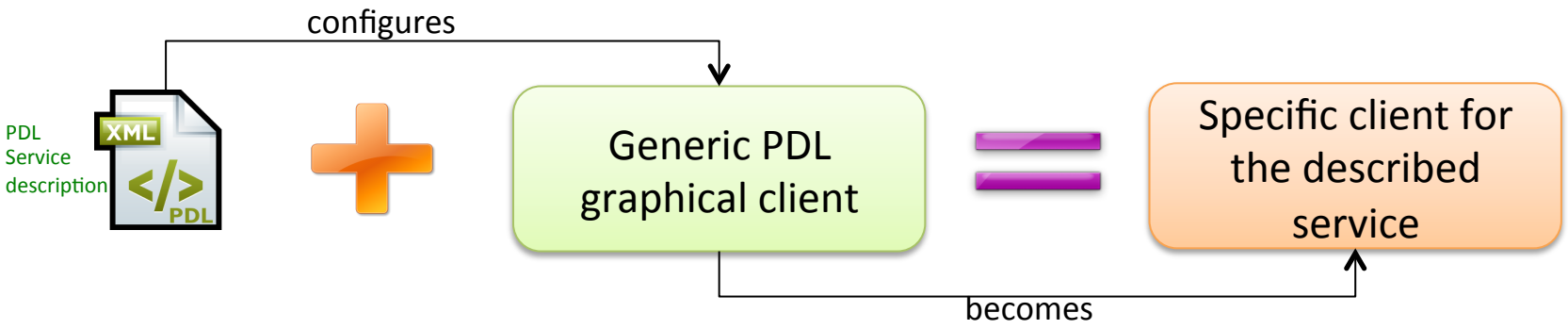

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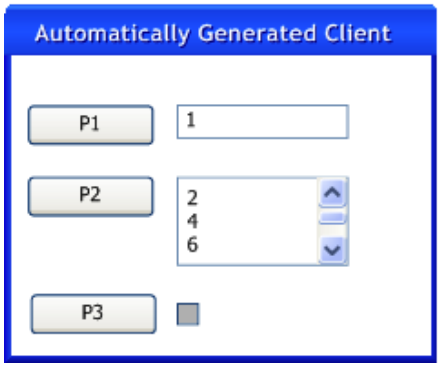

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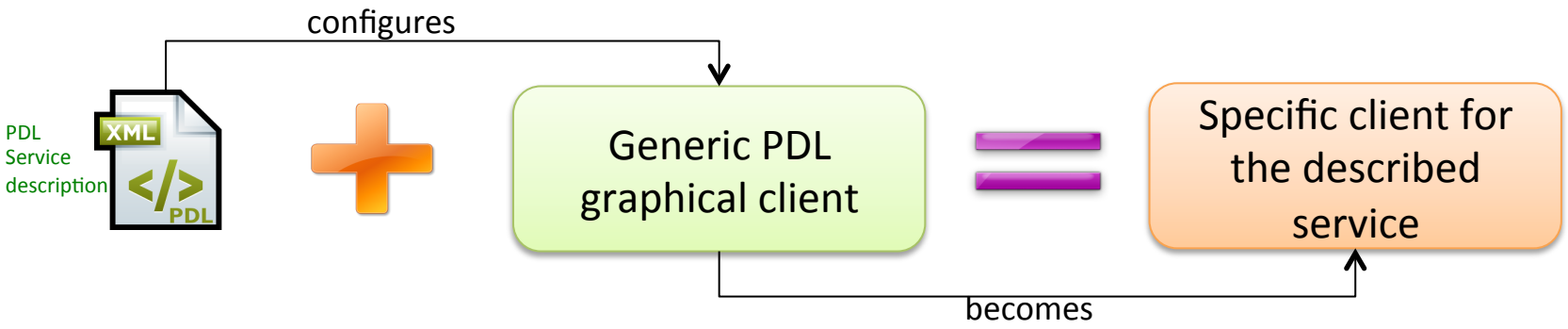

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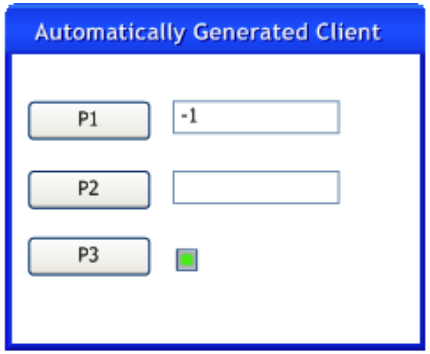

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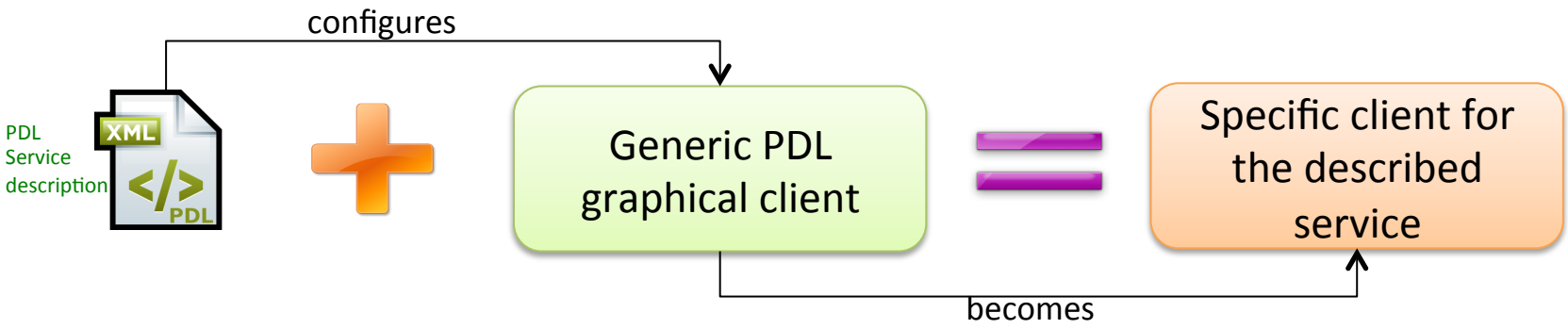

Why dynamic? It automatically reshapes following description and user actions:

- The client implementation developed for the RFC is based on Java Swing
- The French SME Artenum (www.artenum.com) adopted PDL and has developed a Java FX version, based on our parser and checking algorithms generator.

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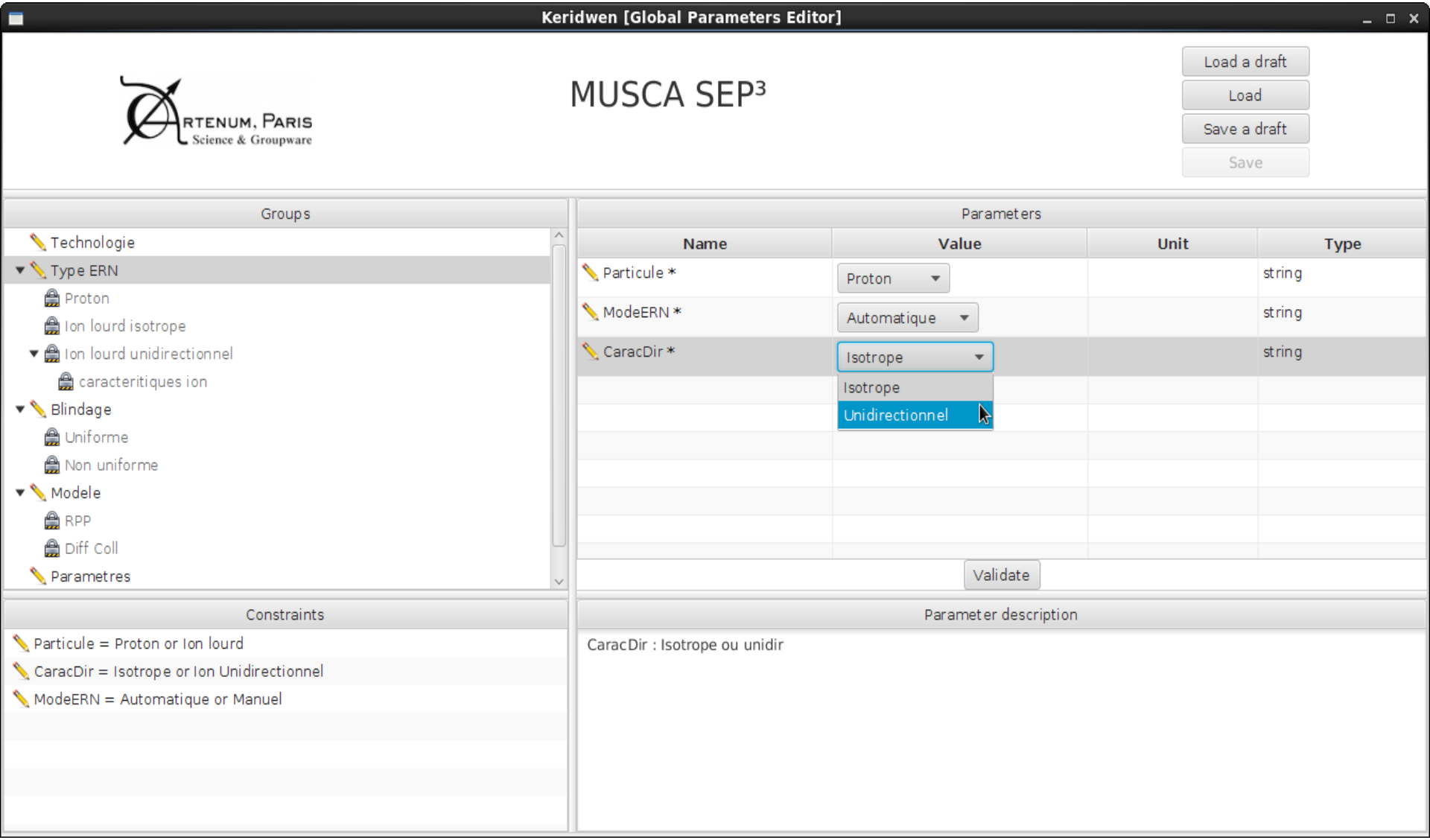

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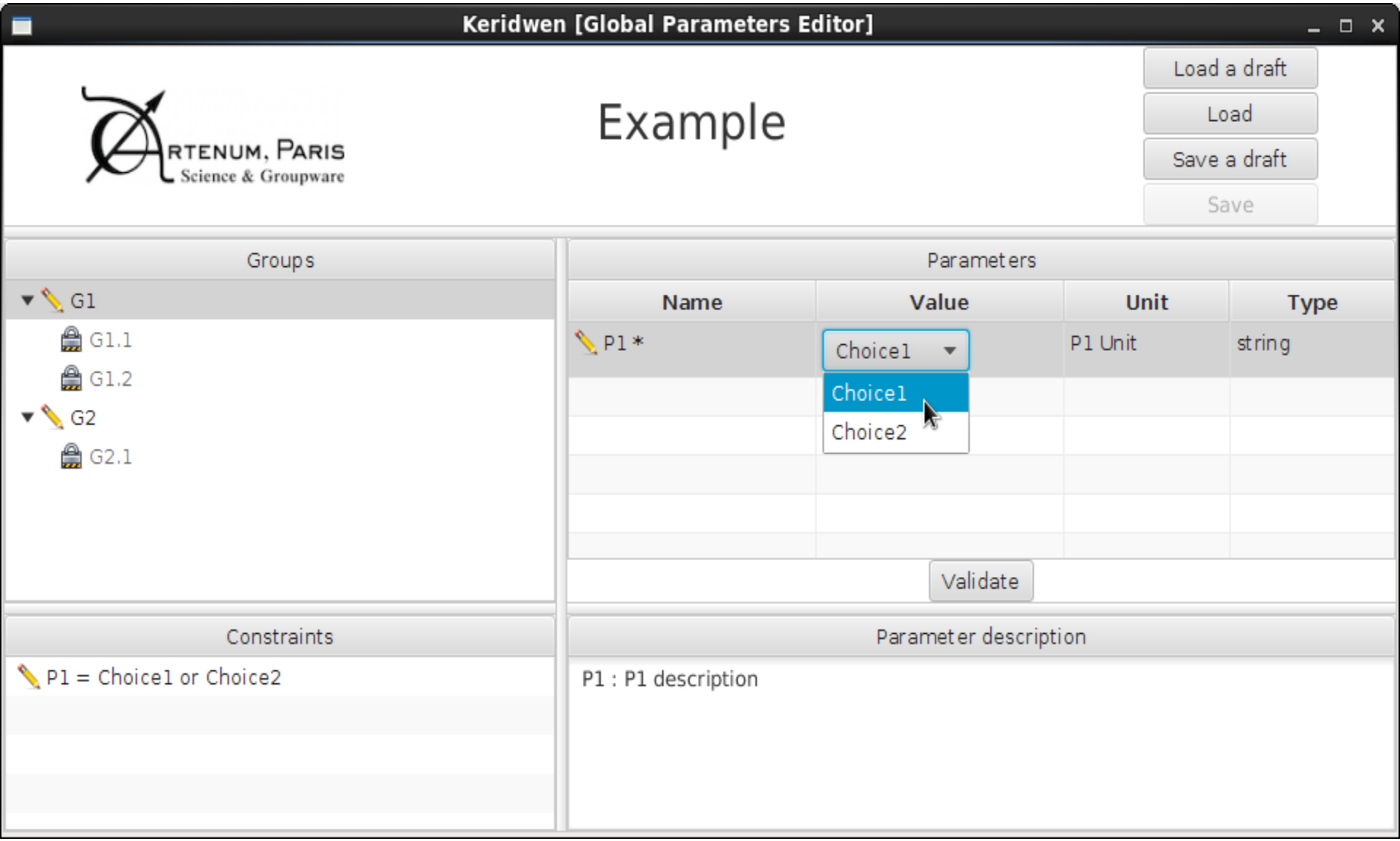

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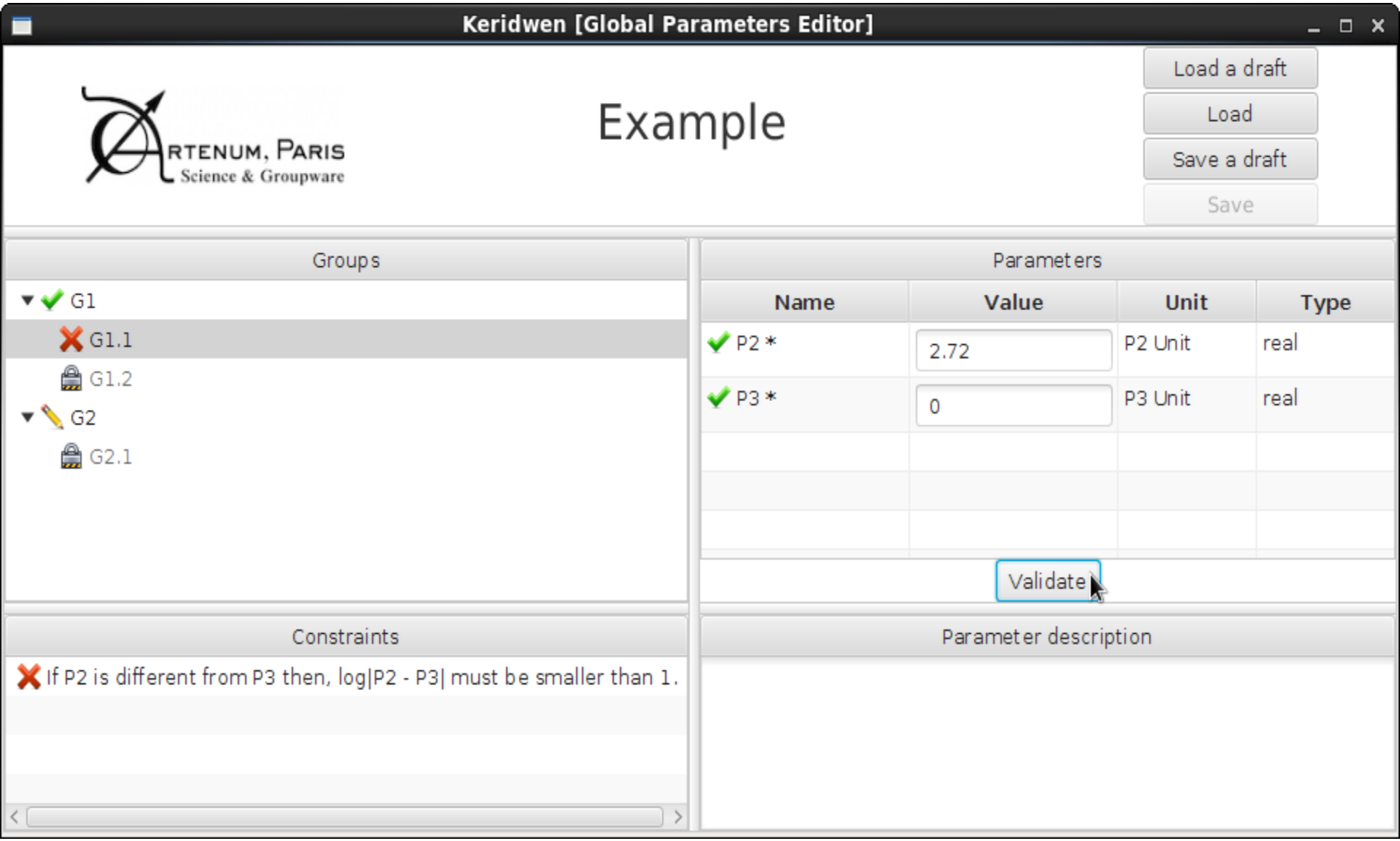

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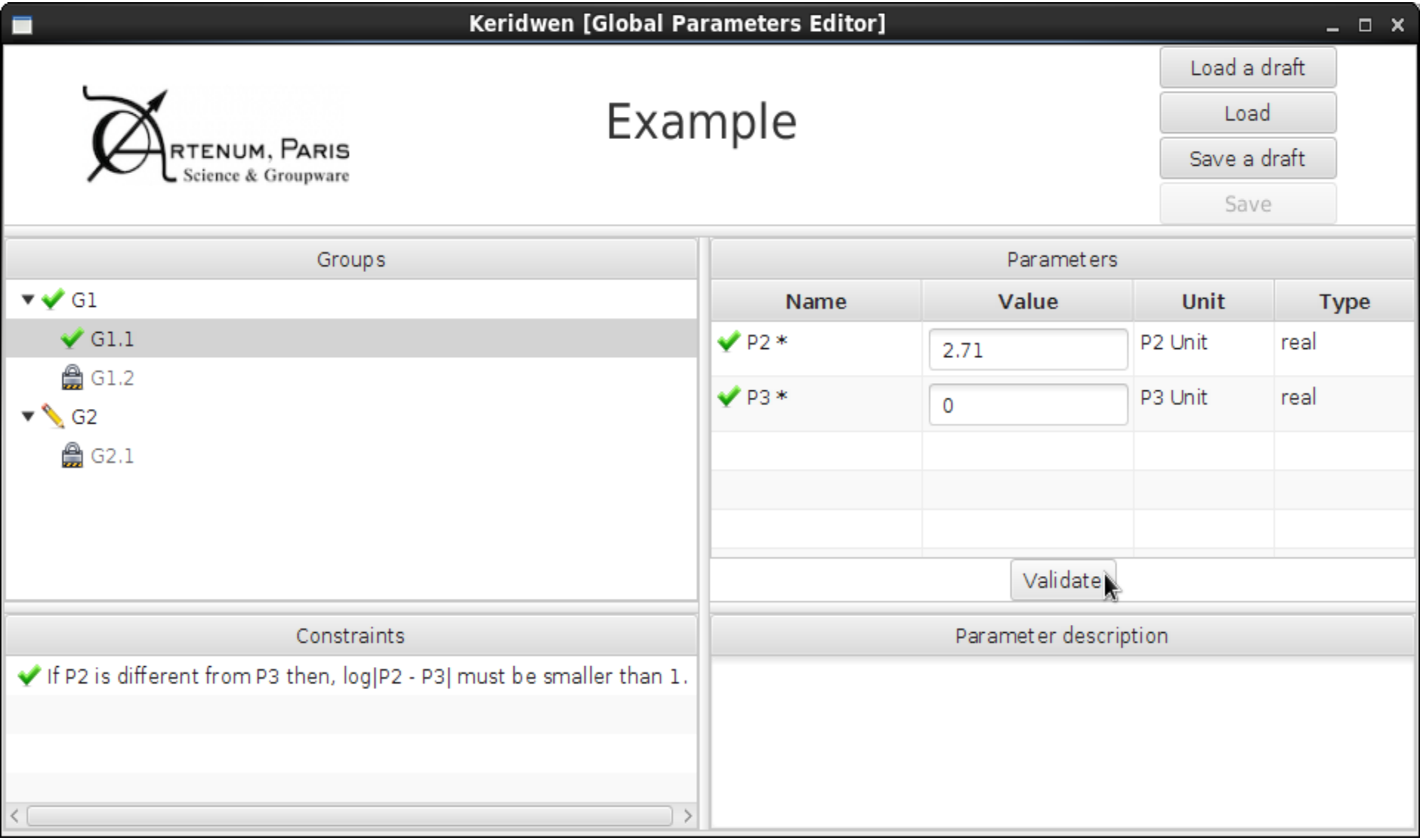

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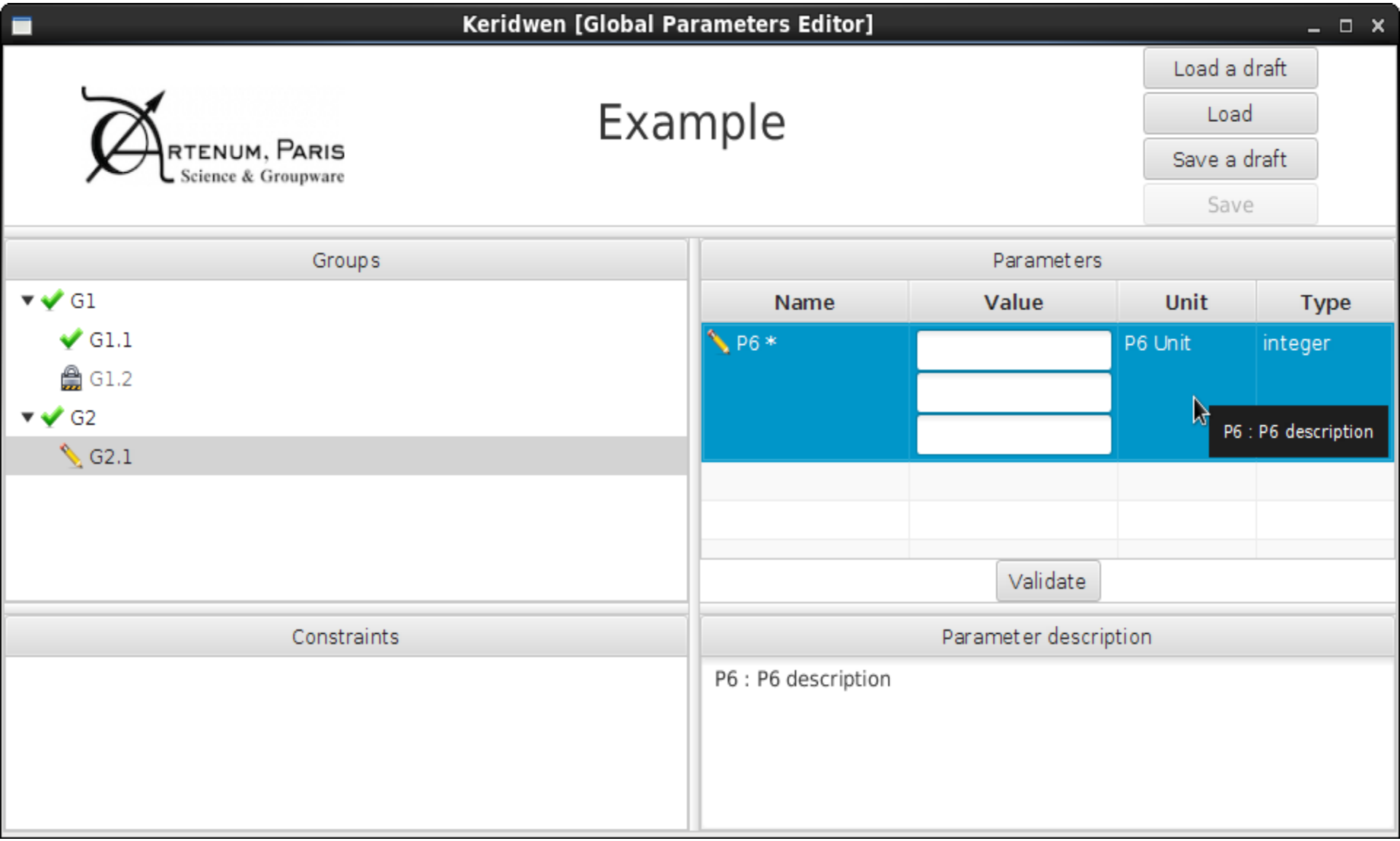

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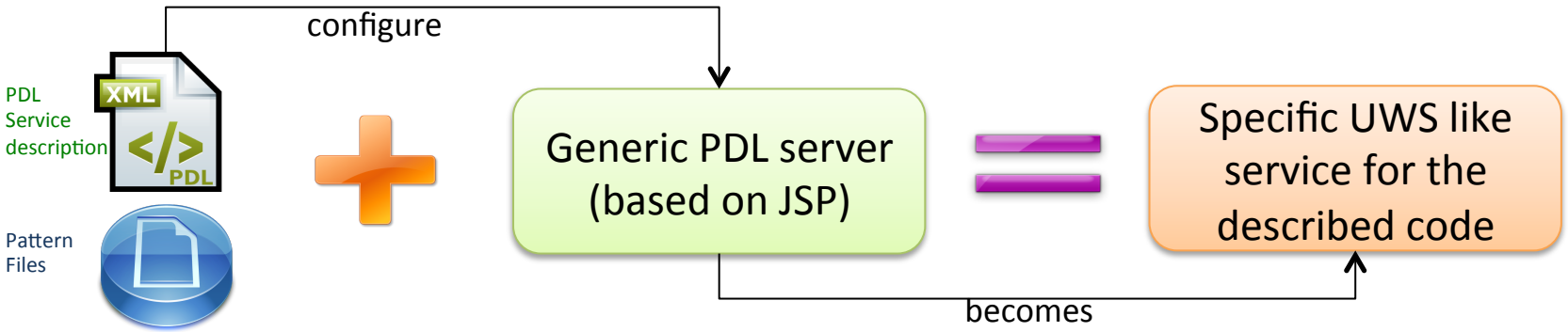

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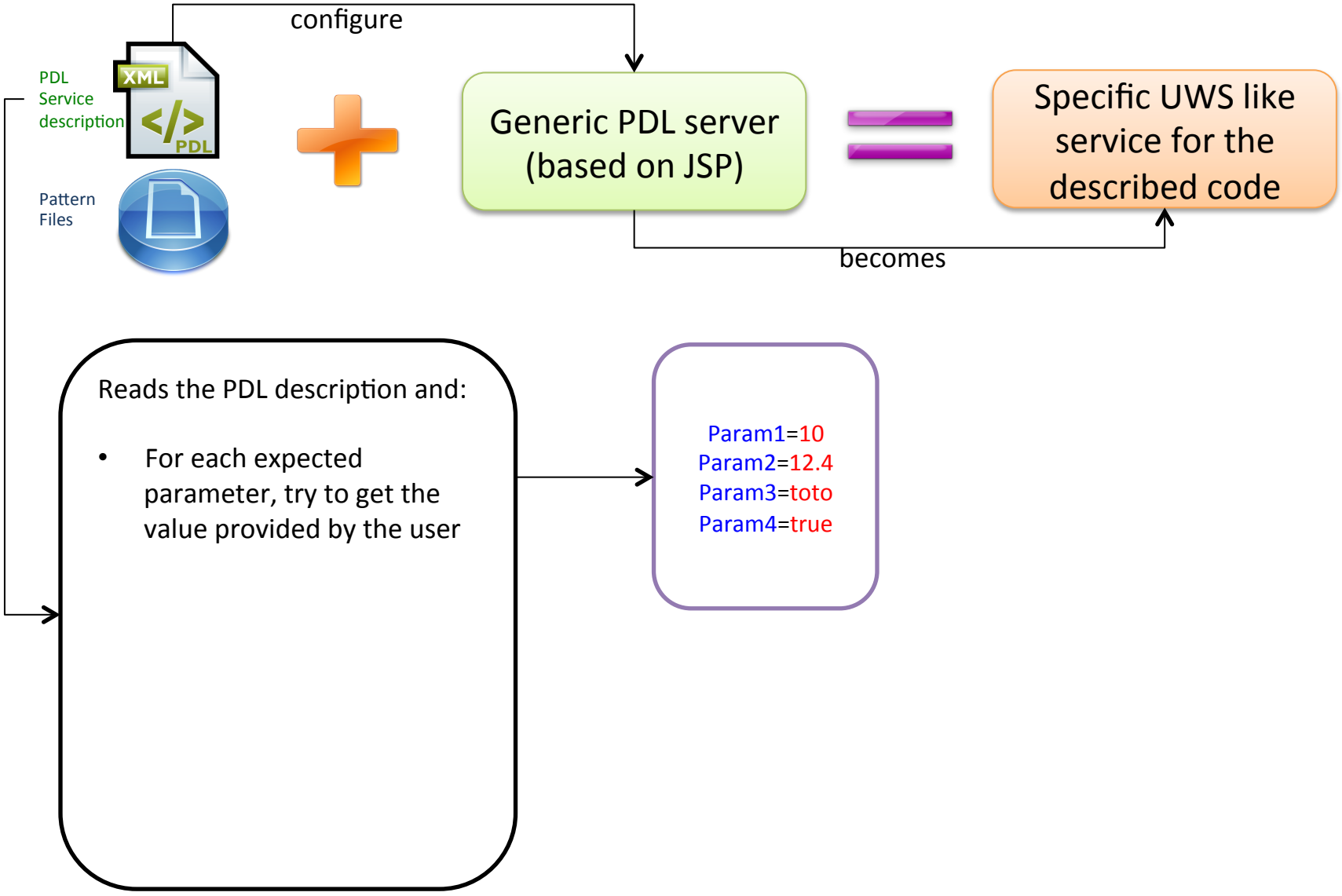

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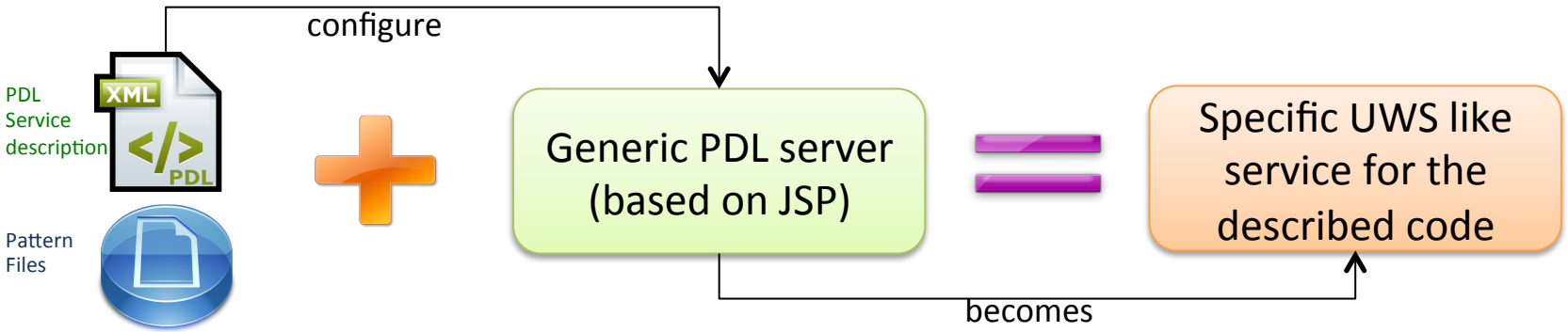

Reads the PDL description and:

- For each expected parameter, try to get the value provided by the user
- Check if the set of the provided values fits with all the PDL constraints
  - No → constraint(s) violation are notified to user as server response
  - OK

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Param2=12.4
Param3=toto
Param4=true

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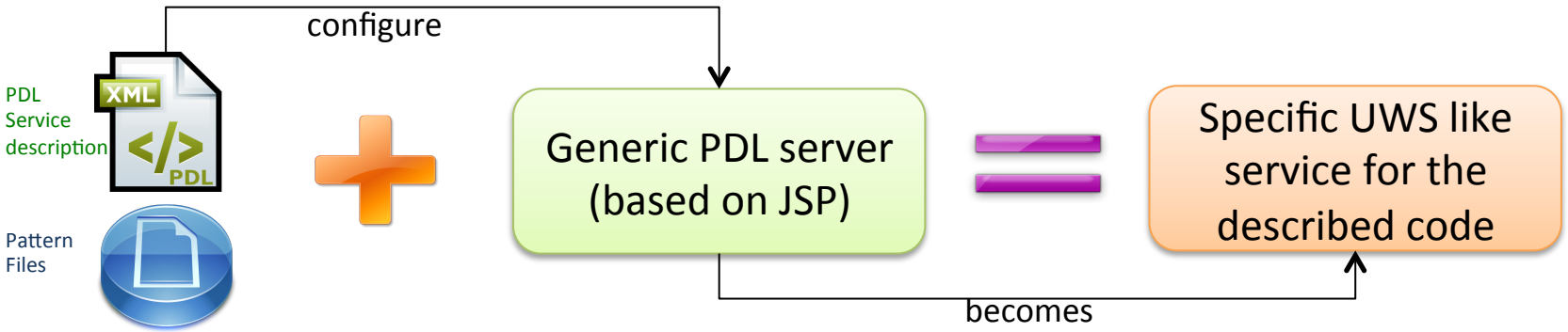

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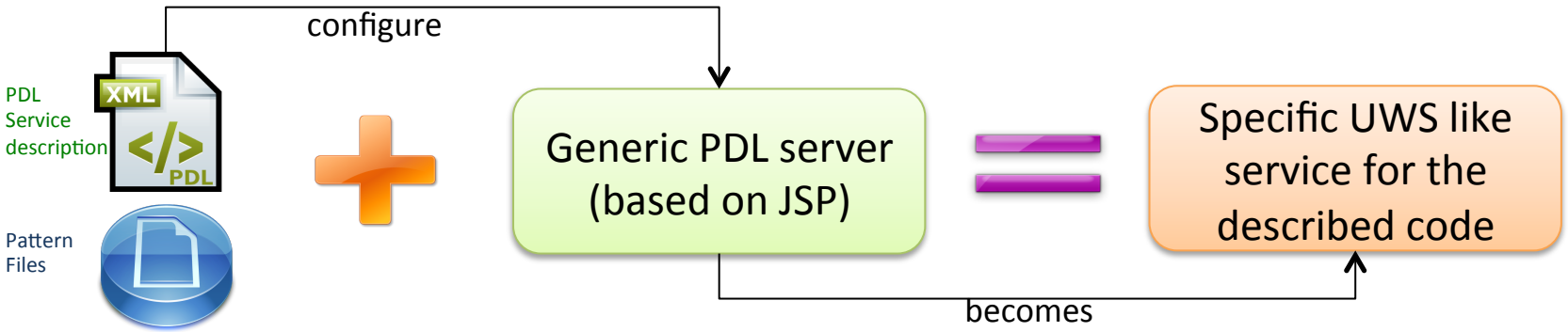

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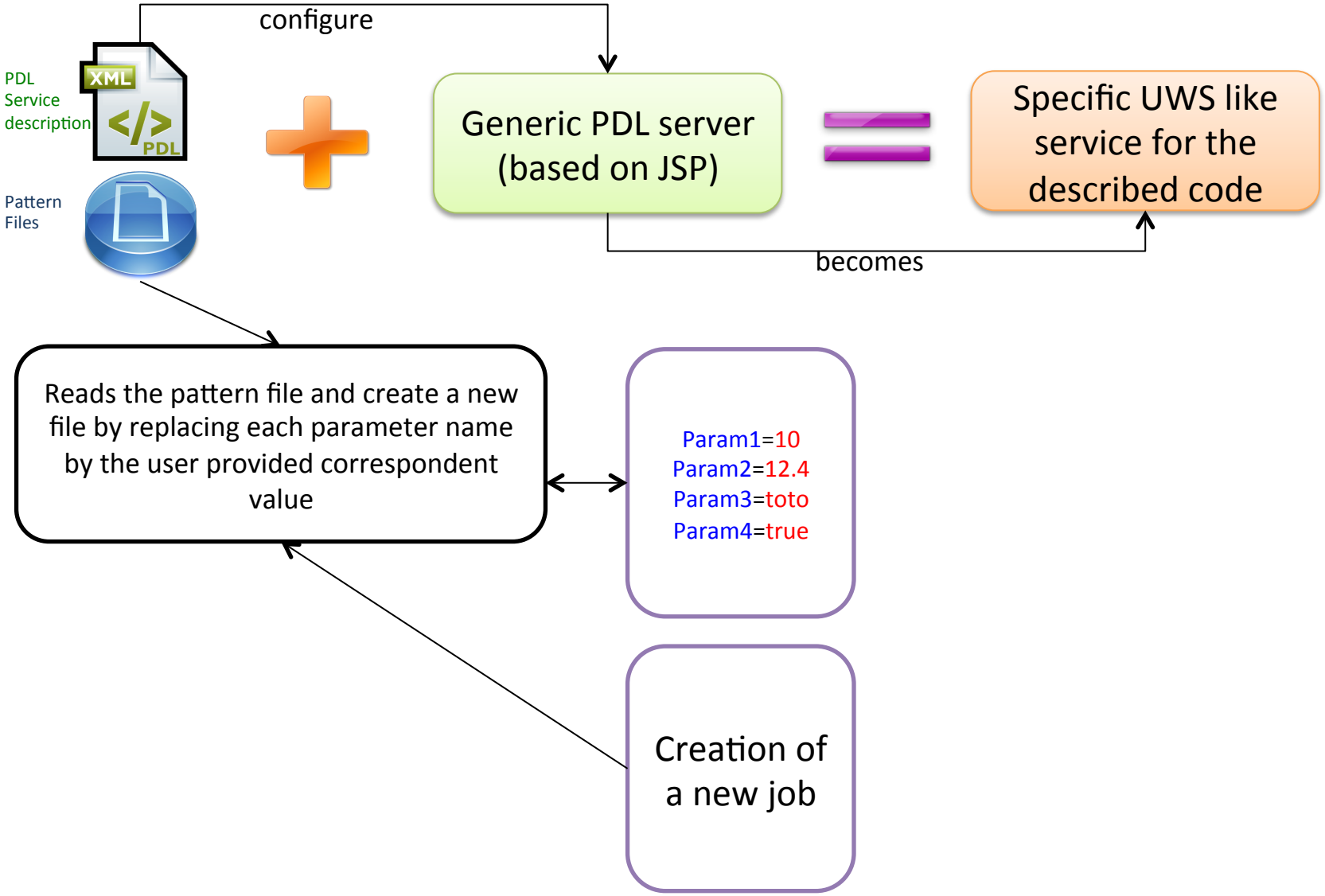

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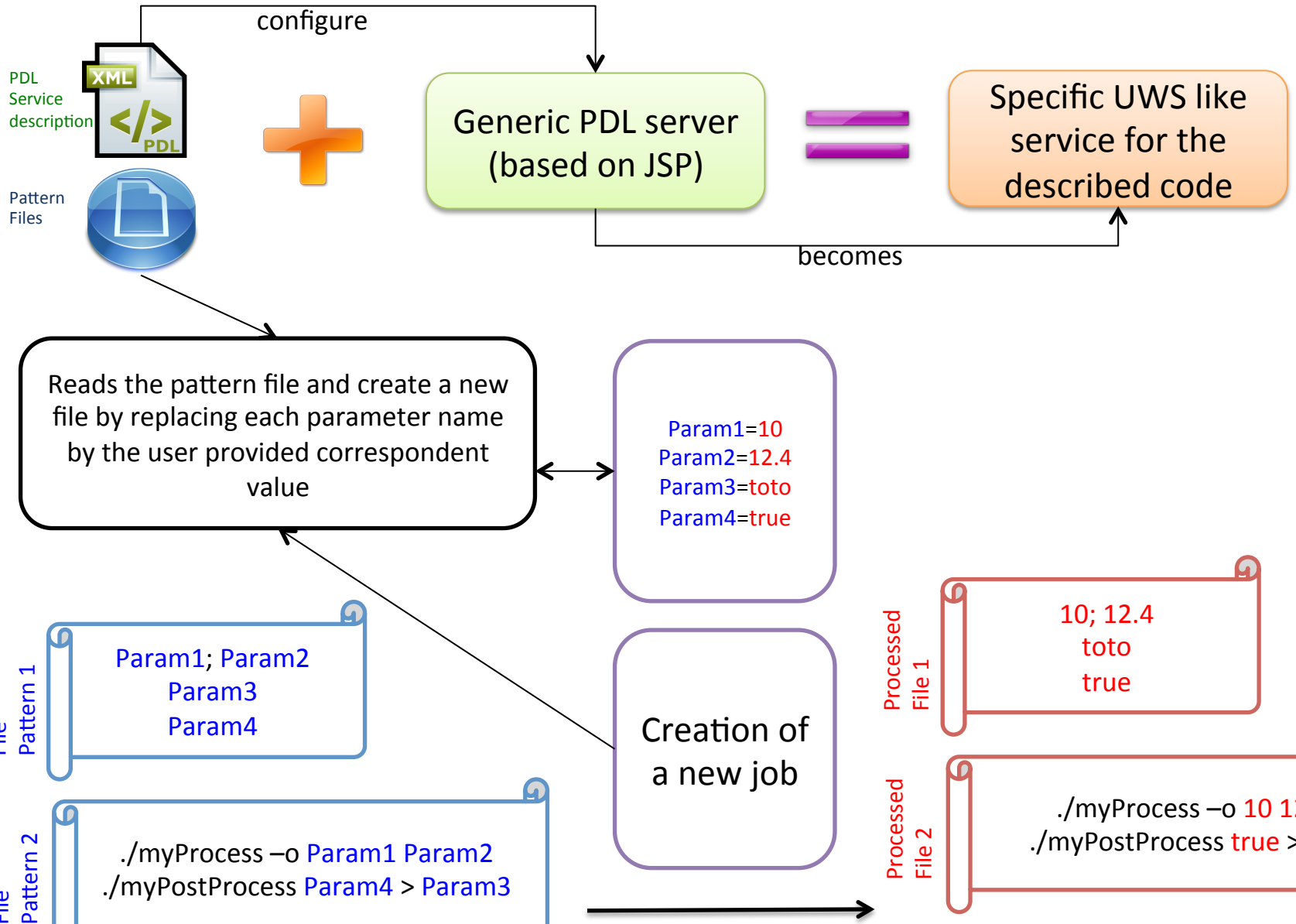

Focus on the PDL server

PDL server main features

Supports user authentication
(a user cannot see the jobs of other users)

Supports grids of models
(jobs are grouped by users in arbitrary sets of runs)

Has three interfaces for job administration. Two are machine actionable, the other is for humans

- "speaking" XML (for Taverna plugin)
- "speaking" JSON (for alternate clients)
- Web client based on Google Web Toolkit

Based on UWS, but

- Uses JSP for Job Management instead of REST.
  Recall REST is just a binding example for UWS. It is not the core part of the norm (historically a soap binding was proposed)
- Has extra features for dealing with
  - Grid of Jobs (e.g. search jobs by Id of Grid)
  - User authentication/authorisation
  - Live notification of violated constraints

Focus on the PDL server


```
{
   "errors": [
      {
         "errorMessage": "the following condition is not verified in the Grains Properties group: Grains max radius
                          belongs to range 1e-6 - 1e-4",
         "involvedParameter(s)": [
            "los_ext",
            "rrr",
            "metal",
            "cdunit",
            "gratio",
            "q_pah",
            "alpgr",
            "rgrmin",
            "rgrmax",
            "F_DUST_P"
         ]
      }
   ]
}
```

```
{
   "ExpectedResultsURLs": [
      "http://tepig.obspm.fr:8081/pdrlight//output/PDRlight.zip"
   ],
   "UserMail": "test-pdr@obspm.fr",
   "JobID": 8,
   "ManagementURL": "http://tepig.obspm.fr:8081/pdrJobManager/userId=27&mail=test-pdr@obspm.fr",
   "UserID": 27,
   "ServiceId": "http://tepig.obspm.fr:8081/pdrlight/"
}
```

PDL Service

Job list for user antoine.gusdorf@googlemail.com

Job Id	Job Phase	Demand Date	End Date
233	finished	2015/04/08 15:13:26	2015/04/10 09:45:02
232	running	2015/04/08 11:47:13	
201	finished	2014/10/14 11:14:52	2014/10/14 12:30:03
182	finished	2014/04/21 11:52:16	2014/05/02 22:21:03
181	finished	2014/04/21 11:33:51	2014/05/02 22:12:02
180	finished	2014/04/21 11:32:59	2014/05/02 21:41:02
179	finished	2014/04/21 11:32:22	2014/05/02 21:27:02
178	finished	2014/04/21 11:29:30	2014/05/01 20:57:03
172	finished	2014/04/21 11:44:29	2014/04/27 00:01:02
169	finished	2014/04/21 11:45:05	2014/04/25 20:56:02
138	finished	2014/04/21 11:43:39	2014/04/19 19:02:02
135	finished	2014/04/21 11:42:55	2014/04/19 16:51:03
132	finished	2014/03/24 15:42:30	2014/03/24 16:49:02
131	finished	2014/03/24 15:40:25	2014/03/24 16:32:03
130	finished	2014/03/24 15:40:07	2014/03/24 16:19:03

1-15 of 37

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181	finished	2014/04/21 11:33:51	2014/05/02 22:12:02
180	finished	2014/04/21 11:32:59	2014/05/02 21:41:02
179	finished	2014/04/21 11:32:22	2014/05/02 21:27:02
178	finished	2014/04/21 11:29:30	2014/05/01 20:57:03
172	finished	2014/04/21 11:44:29	2014/04/27 00:01:02
169	finished	2014/04/21 11:45:05	2014/04/25 20:56:02
138	finished	2014/04/21 11:43:39	2014/04/19 19:02:02
135	finished	2014/04/21 11:42:55	2014/04/19 16:51:03
132	finished	2014/03/24 15:42:30	2014/03/24 16:49:02
131	finished	2014/03/24 15:40:25	2014/03/24 16:32:03
130	finished	2014/03/24 15:40:07	2014/03/24 16:19:03

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Detail for the selected Job (Id=233)

Delete this job

ParisDurhamFileResult: http://pdl-calc.obspm.fr:8081/ParisDurham/output/233.pdshock.tgz

Parameter Name	Parameter Value
xll	1e9
shockType	C
nHi	1e4
ikinH2	2
iforH2	1
epsV	1e-8
Zeta	5e-17
Vs	26.5
Vdi	1e3
TimeJ	2e7
Ti	10
Tg	15
SOS	FD
OpH2	3
NstepW	5
NstepMax	10000
Nfluids	3
NH2Lines	200
NH2Lev	150
MaxTimeN	1e6
LIOS	integrated
LEOS	ln(N/g)
Bbeta	1

1-23 of 23

Concluding remarks

The Parameter Description Language

- is a very convenient way for exposing codes:
  - It is fast to deploy new services using the PDL framework
  - avoids “dummy computation” (runs with non-sense parameters): parameters are verified before job creation
  - PDL server architecture natively fits with distributed (clusters, grids, cloud) resources

- Enables “semantic interoperability” between services
  - May be seen as a meta-language for describing workflows

- May be used to bring processes to data.