design patterns for theoretical data access

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how it began

problem

- variety of code domains, quantities, units, …

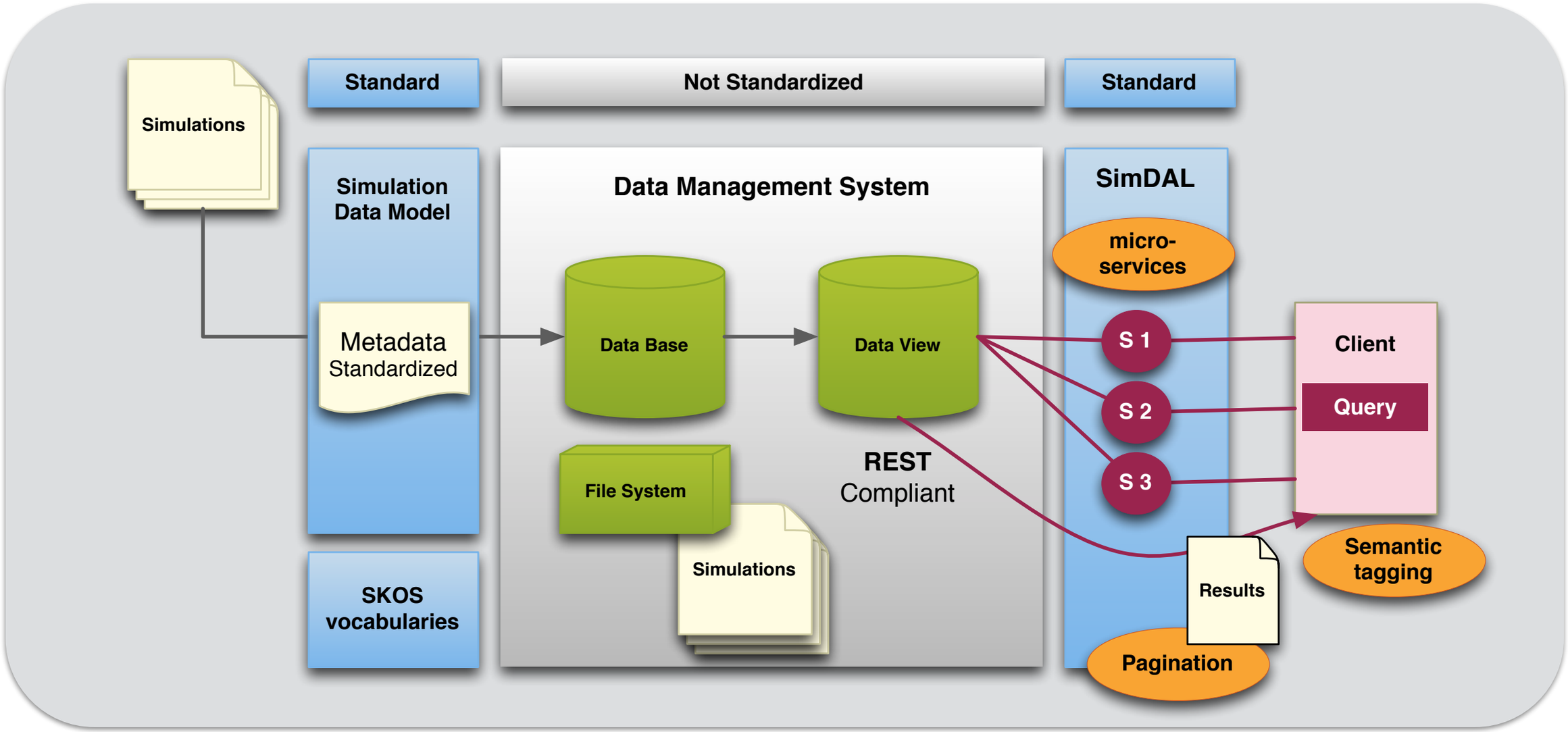
solution

- **standard description format** as an abstract data-model : SimDM

the end already ?

- practical implementations of the standard format
  - descriptions **can be huge**
    - ✓ deep hierarchy of nested atomic elements
    - ◉ long nested **collections of large elements**
- code **raw output data** handling issue remains

theoretical service architecture



solution patterns encountered in our problem solving journey

- meta-model
- micro services architecture
- generalized space cutout
- pagination
- semantic tagging
- streams*

meta-model

- Simulation Data-Model
  - Model whose instance is also a model
    - Abstract model to make concrete models
      - 1 concrete model per simulation code
      - ex of concrete model for observations : Simple Spectral DataModel

micro services

- micro service 1
    - get available semantic tags **like “proton density”** for **project P**
- micro service 2
    - get models from project P producing objects with **“proton density” < T**
- micro service 3
    - get the **datalink file** for a specific model

micro services

- composite service
    - get **datalink file** for models from **project P** having calculated **property matching “proton density”** string **< T**
- orchestrate : ms1 -> ms2 -> ms3

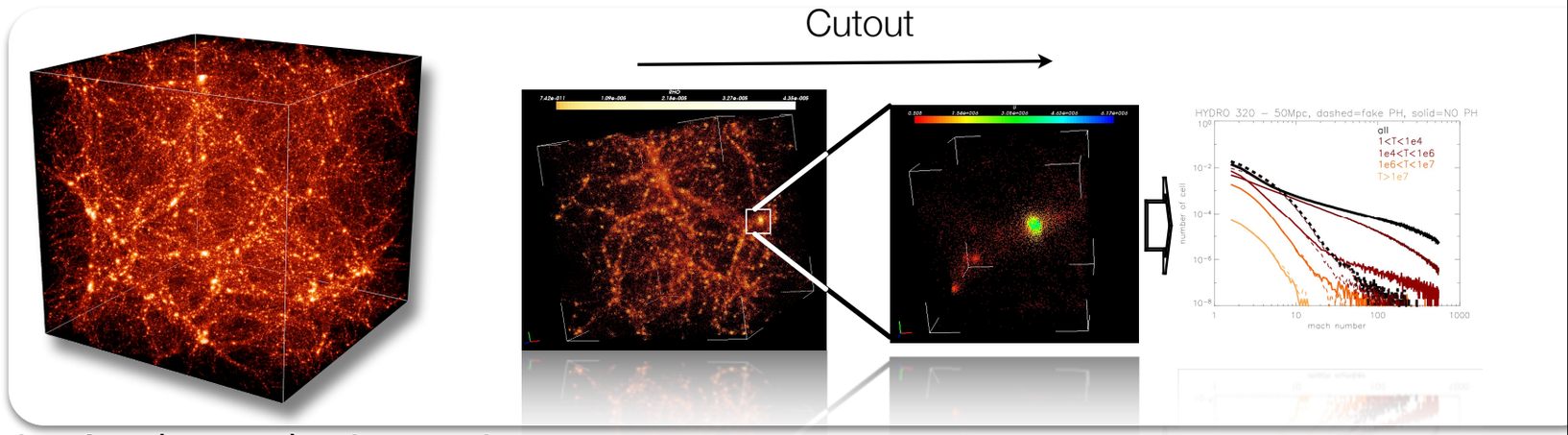
micro services

- do 1 small thing well
  - simple api (simple restful service)
- ~~easy~~ very easy to debug / maintain
- composable / reusable
  - layered web service system

micro services

- TAP based services (ADQL)
  - **tightly coupled to Relational Database Systems**
    - bottleneck number of columns
    - bottleneck query complexity, EAV pattern
  - TAP compliant service is not trivial to setup
- API based services
  - **loosely coupled with implementation details**
    - specific technologies can be used for specific problems
    - more user/developer friendly

generalized space cutout

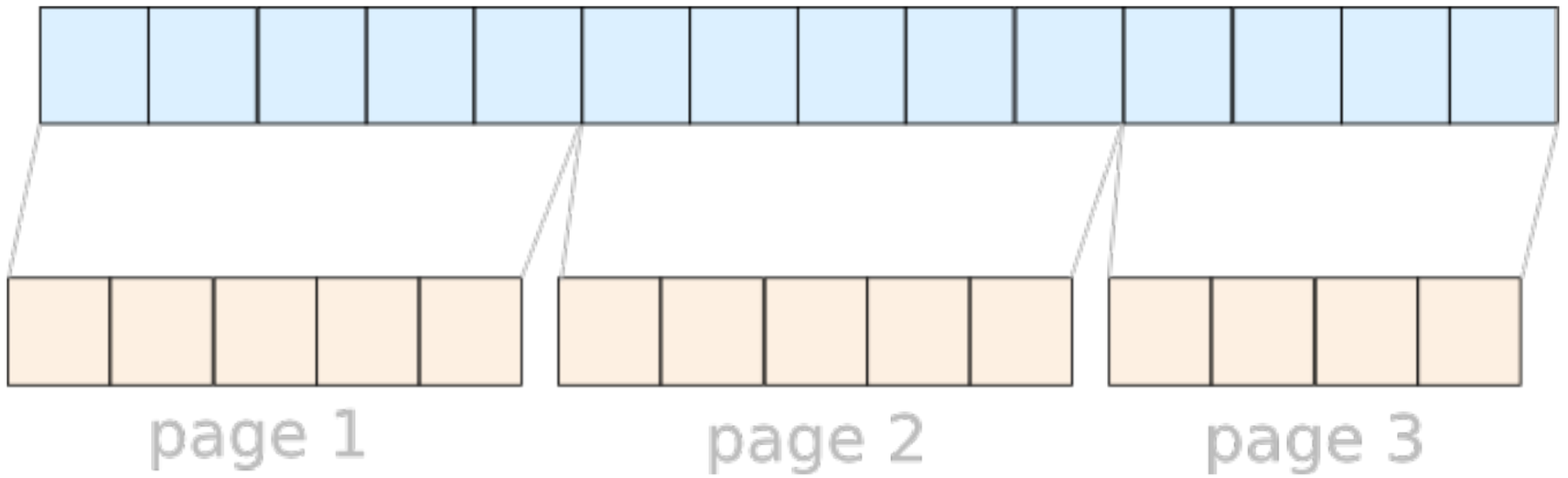


- common specific case
  - (x,y,z, property)
  - get cube inside the whole (x,y,z) domain

- general case (numerical simulation calculated objects)
  - (property1, property2, …)
  - **get hyper-cube inside the whole properties space**
  - ex : cutout on (mass, velocity, temperature)
  - generalized cutout on any axis system through simple query language “ala” sql

pagination

- **split potentially infinite collections into pages**



- manageable amount of memory & network latence. **Allows interactive interface**

pagination

- display a huge query result through a web interface
  - page 1 from result 0 to result 10
  - page 2 from 10 to 20 …
- The user very rarely goes farther than the first pages. **Avoid unnecessary backend work**

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Goooooooooogle ›
1 2 3 4 5 6 7 8 9 10 **Next**

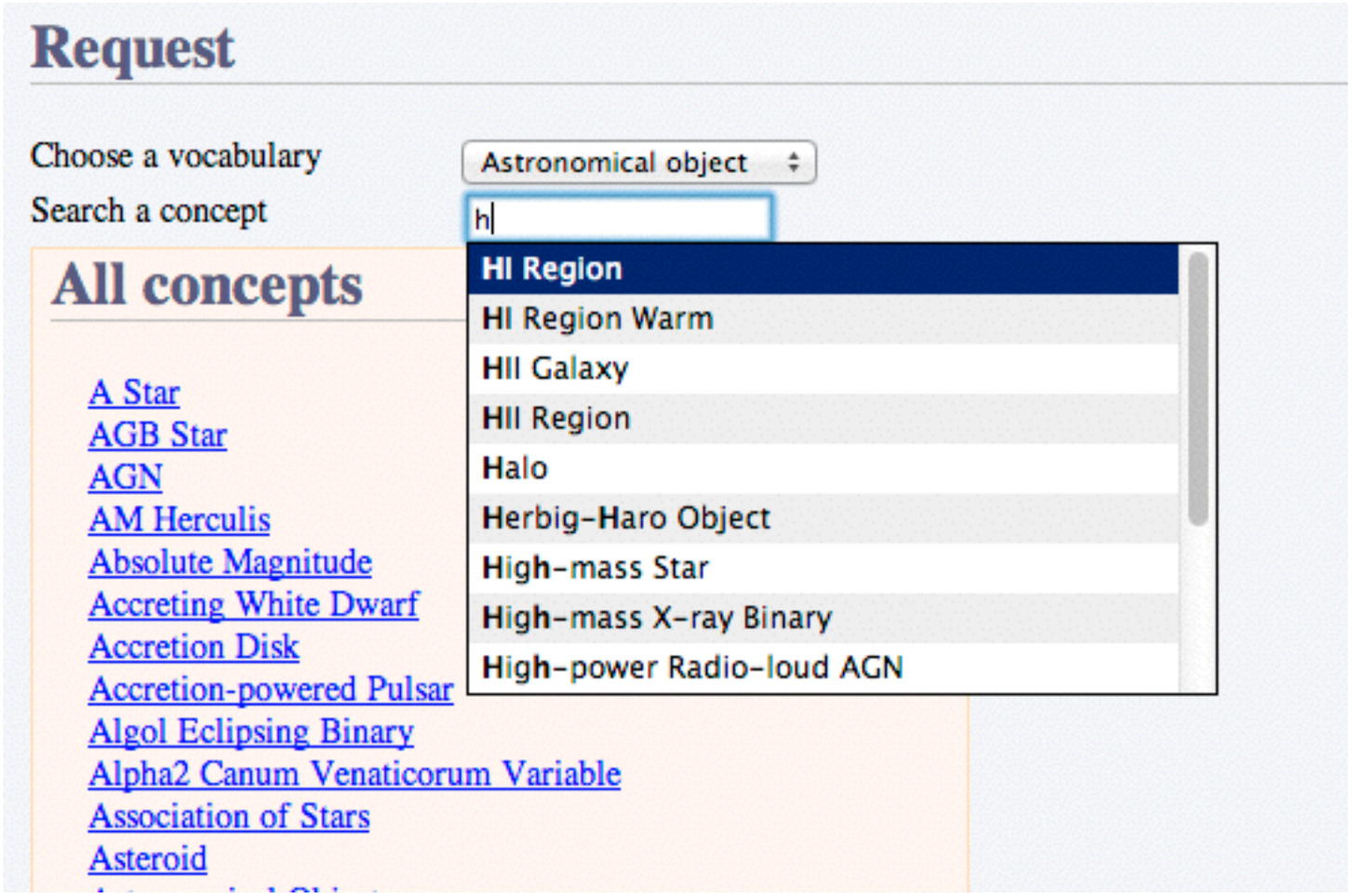
pagination

```
Simplified SimDM description

{
    property1 : atom,
    property2: object,
    property3 : list
}


Simplified SimDM description instance example

{
    property1 : "atom1",
    property2 : {
        property21 : "atom21",
        property22 : "atom22"
    },
    property3: [
        {property31: "atom31", property32 : "atom32"},
        {property31: "atom31", property32 : "atom32"}
        ...
    ]
}
```

semantic tagging

- user1 calls “halo mass” *massh1*
- user2 calls “halo mass” *masst2*
- How do we achieve consistency ?
  - semantic tagging from standard vocabulary
- How do we deal with very large amount of metadata/ semantic tags ?
  - smart autocomplete VS infinite length select box

autocomplete



http://votheory.obspm.fr

(Nicolas Moreau)

Conclusion

- Hide implementation details : API/Rest VS ADQL
- splited, manageable collections
- small, manageable pieces of software
- standard exchange format : datamodel serialization
- generalized interface to extract cube of any space