

# NOVI's experience in monitoring tools and measurements

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# Overview

- What is NOVI
- The Monitoring Service component
- The use of information models
- An on-line demonstration



# NOVI facts

Full title: **N**etworking Innovations **O**ver  
**V**irtualized **I**nfrastructures

URL: `http://fp7-novi.eu`

Duration: 2.5 years since 2010

Partners:

- NTUA, MARTEL, UPMC, GARR, UvA, i2CAT, DFN, INRIA, ELTE, PSNC, Cisco, Fokus, UPC.



# NOVI objectives

## **Study control and management plane extensions for federated virtual infrastructures**

- Integrated resource discovery, allocation, and scheduling
- Efficient allocation of virtual resources
- Proof-of-concept prototype on PlanetLab-Federica

## **Provide joint monitoring and measurements**

- Support slice creation
- Synchronize measurements and monitoring tools
- Study the effect of virtual environments on existing measurement tools



# MS use cases

## **Provide monitoring data to Resource Information Service for slice creation**

- RIS can narrow the possible selection of resources for a user slice according to user constraints based on monitoring data

## **Monitoring service for the user (especially failure detection)**

- User can book monitoring tools as part of the slice
  - Delay monitoring, bandwidth monitoring
- User can introduce conditions which if met raise signals to the user and/or NOVI C&M components to take necessary actions
  - Delay exceeds a given threshold → Signal Policy → Rebuild topology



# MS functionalities

## From the resource's perspective:

- Host/Substrate monitoring: *to provide up-to-date characteristics of physical resources*
- Slice monitoring: *to provide the temporal behavior of users' slice characteristics. Optionally, signal monitoring events.*

## From the users's perspective:

- Metric monitoring: *to hide the details of specific tools*

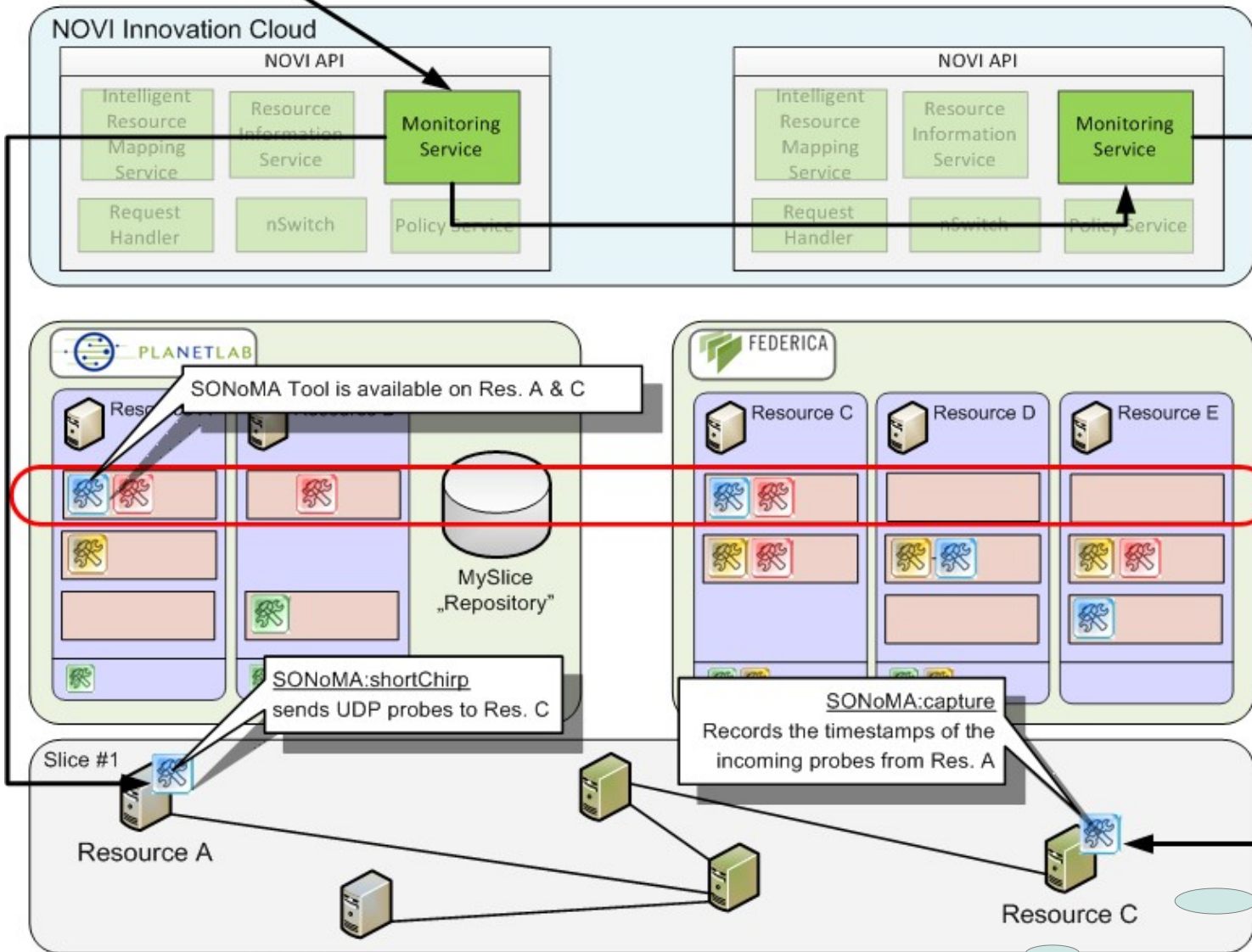


# Metrics to handle

- **Passive:** no additional sample packets inserted in the network
  - CPU load, disk usage, memory usage, resource uptime, network volume, bandwidth
- **Active:** extra traffic inserted in the network
  - Node wise:
    - RTT, packet paths
  - Multi node-wise:
    - Packet loss, OWD, OWDV, bandwidth



# Tools to integrate



SONoMA Tool is available on Res. A & C

SONoMA:shortChirp sends UDP probes to Res. C

SONoMA:capture Records the timestamps of the incoming probes from Res. A

The flow of an example measurement

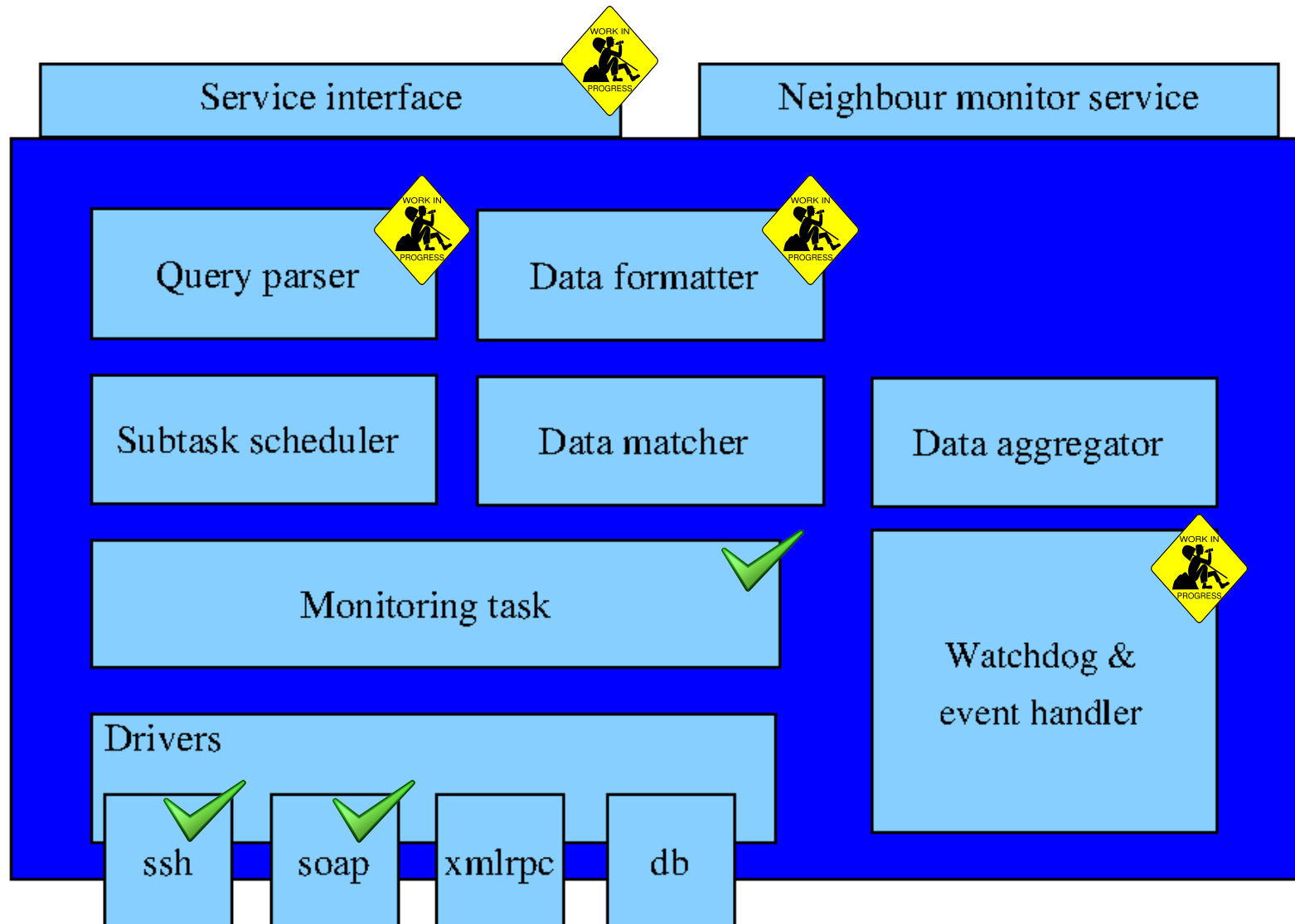
A heterogeneous set of tools accessible in platforms

Tools: like HADES, SONOMA, CLI, Packet Tracker





# Status of implementation



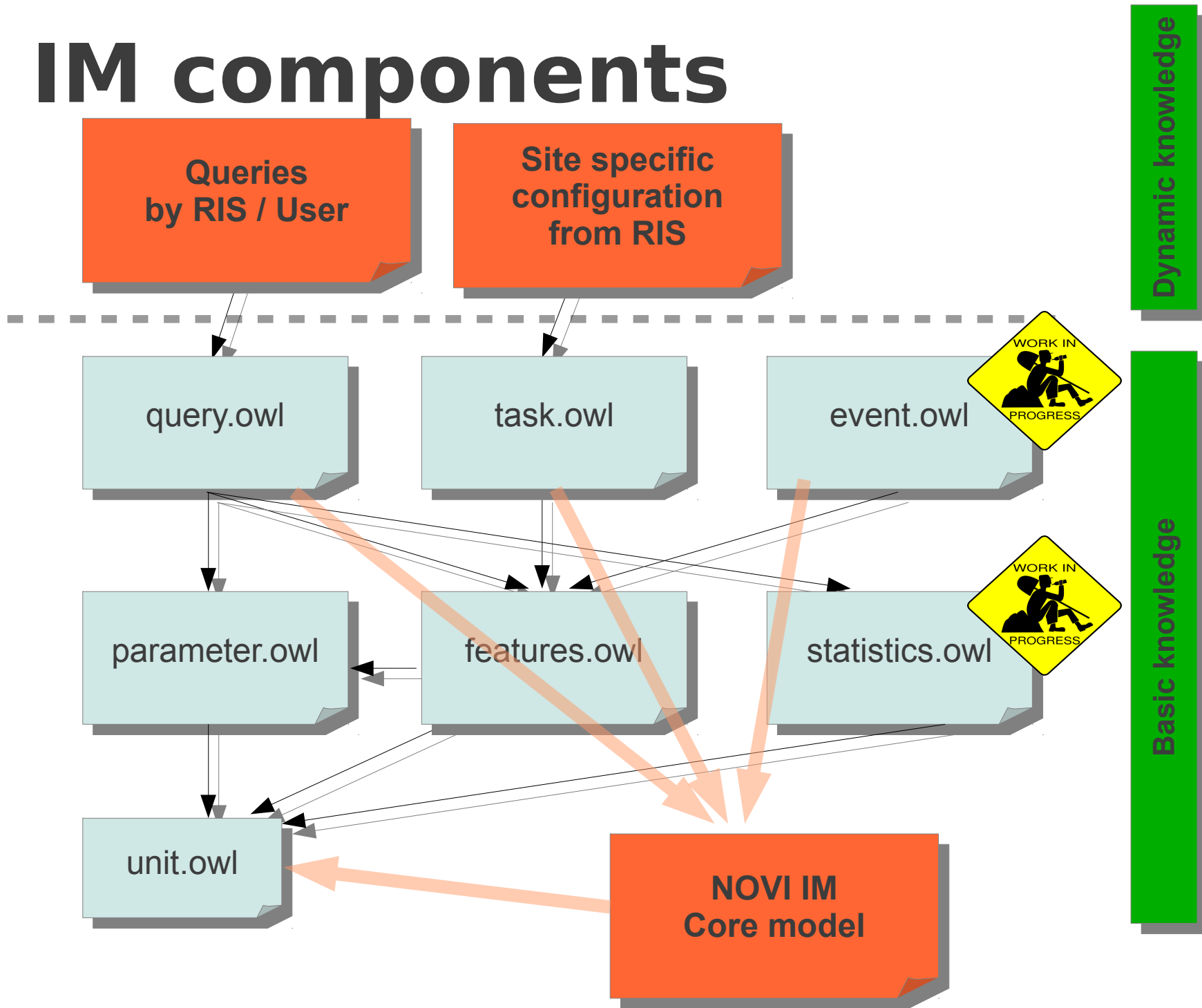
# Information model

- Unit aware metrics
- Abstraction of tools and control
- Statistical transformation of data

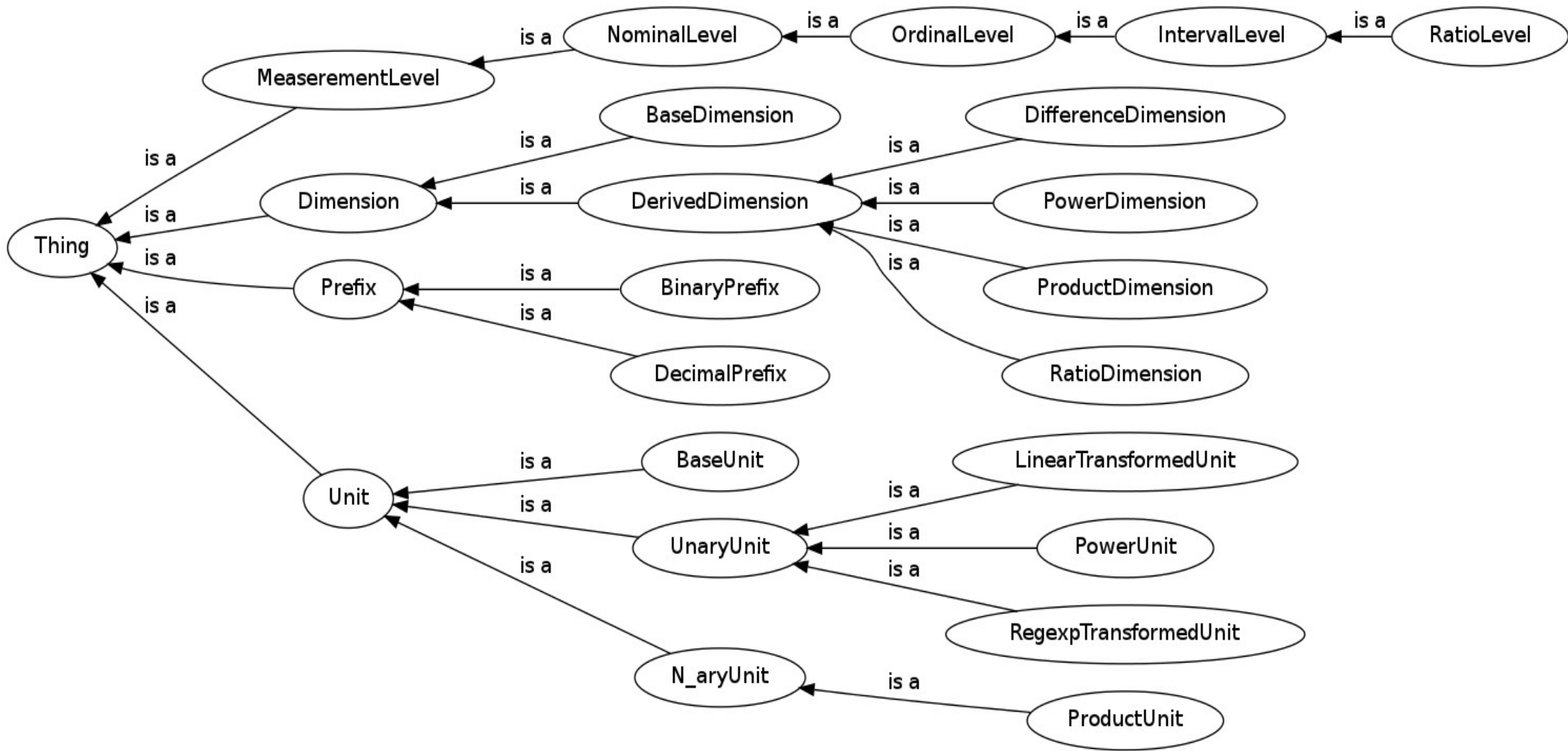
*Root of the model comes from Moment (FP7 STREP)*



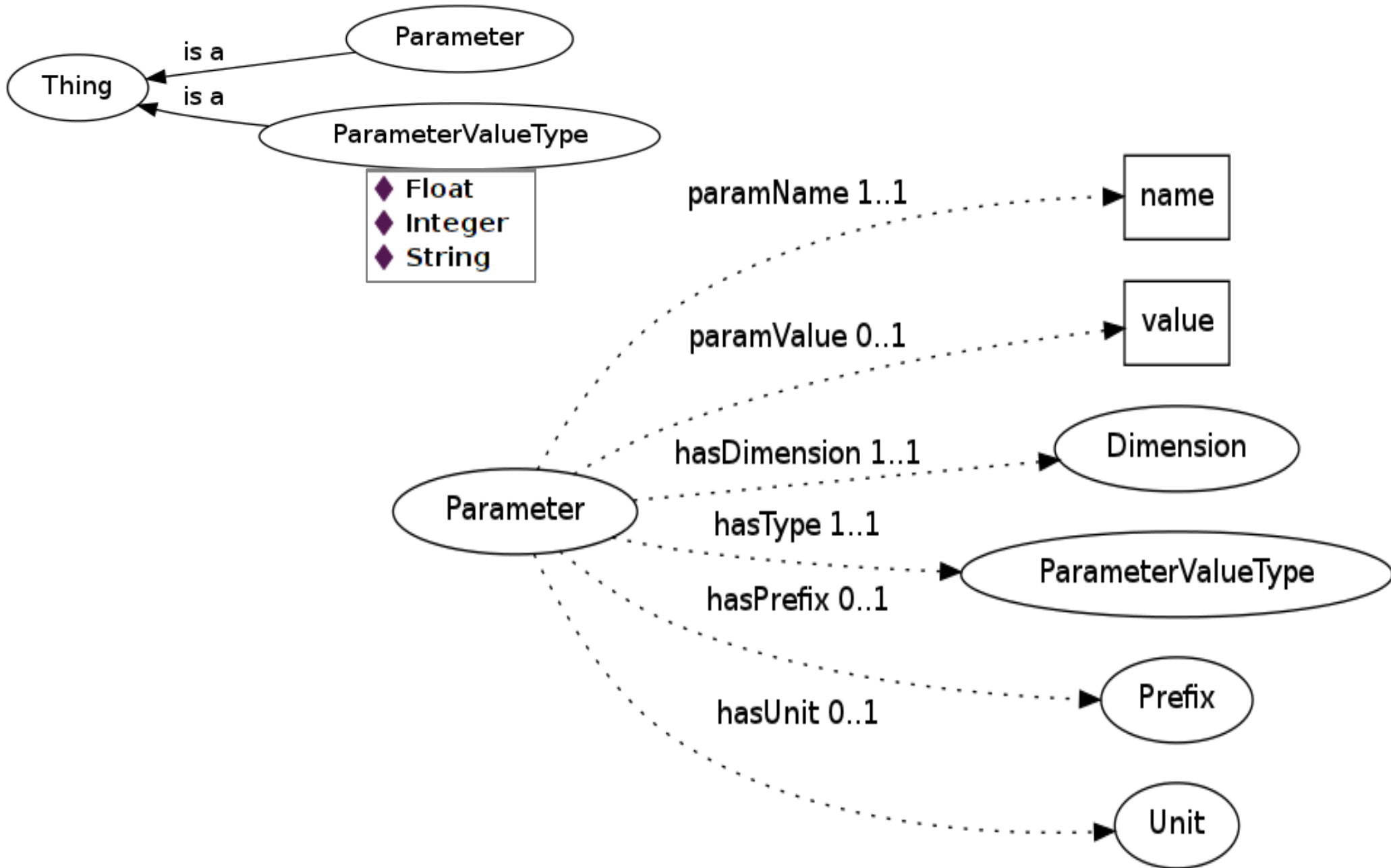
# IM components



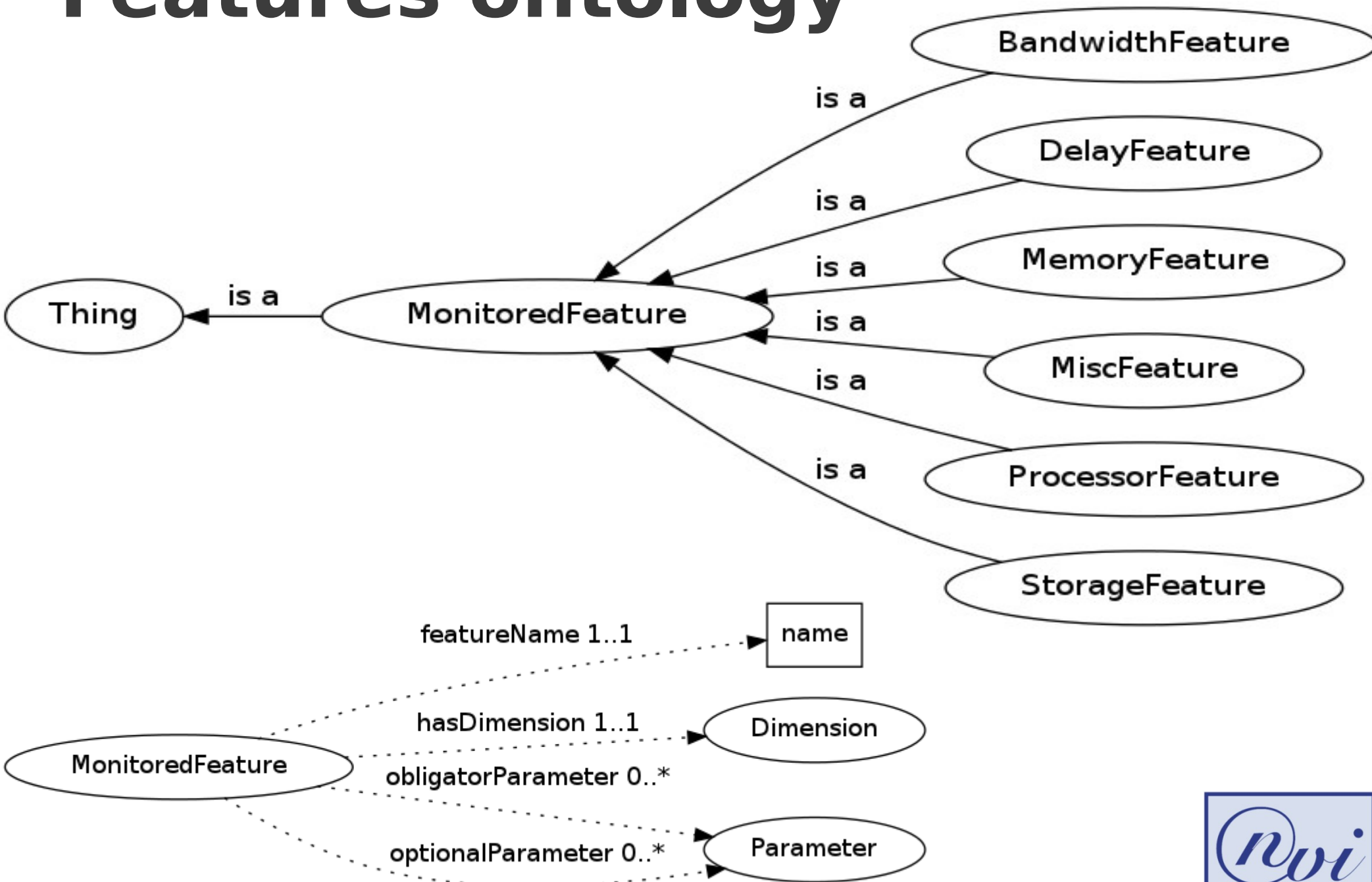
# Unit ontology



# Parameter ontology



# Features ontology



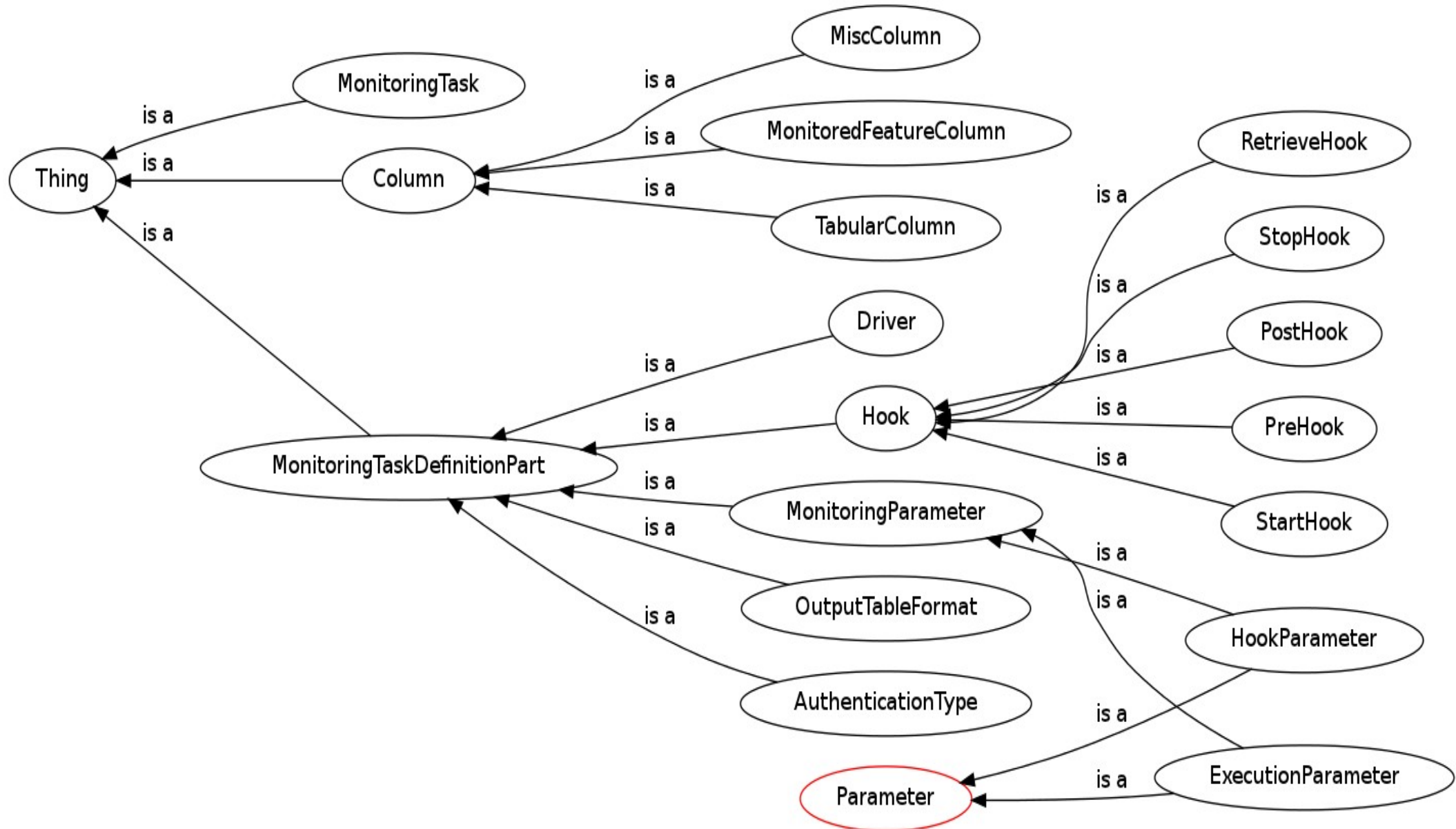
# Define a metric

Extension of the basic knowledge

The screenshot shows the Protege OWL editor interface. The top menu bar includes File, Edit, View, Reasoner, Tools, Refactor, Window, and Help. The address bar shows the URL `http://fp7-novi.eu/monitoring_features.owl#`. The main workspace is divided into several panes:

- Class hierarchy:** Shows a tree structure starting with `Thing`, followed by `Dimension`, `MonitoredFeature`, and `DelayFeature`. Other classes include `BandwidthFeature`, `MemoryFeature`, `MiscFeature`, `ProcessorFeature`, `StorageFeature`, `ParamValueType`, `Parameter`, `Prefix`, and `Unit`.
- Members list:** Shows the members of the `RoundtripDelay` class, including `OnewayDelay` and `RoundtripDelay`.
- Annotations:** Shows the annotations for the `RoundtripDelay` class.
- Description:** Shows the description of the `RoundtripDelay` class, including its types (`DelayFeature`), same individuals, and different individuals.
- Property assertions:** Shows the property assertions for the `RoundtripDelay` class, including object property assertions (e.g., `optionalParameter PFM_NetworkInterface`, `optionalParameter PFM_TimeToLive`, `optionalParameter PFM_Count`, `optionalParameter PFM_PacketSize`, `obligatoryParameter PFM_DestinationNode`, `hasDimension timeinterval`, `optionalParameter PFM_Delay`, `obligatoryParameter PFM_SourceNode`) and data property assertions (e.g., `featureName "Round Trip Delay"`).

# Task ontology





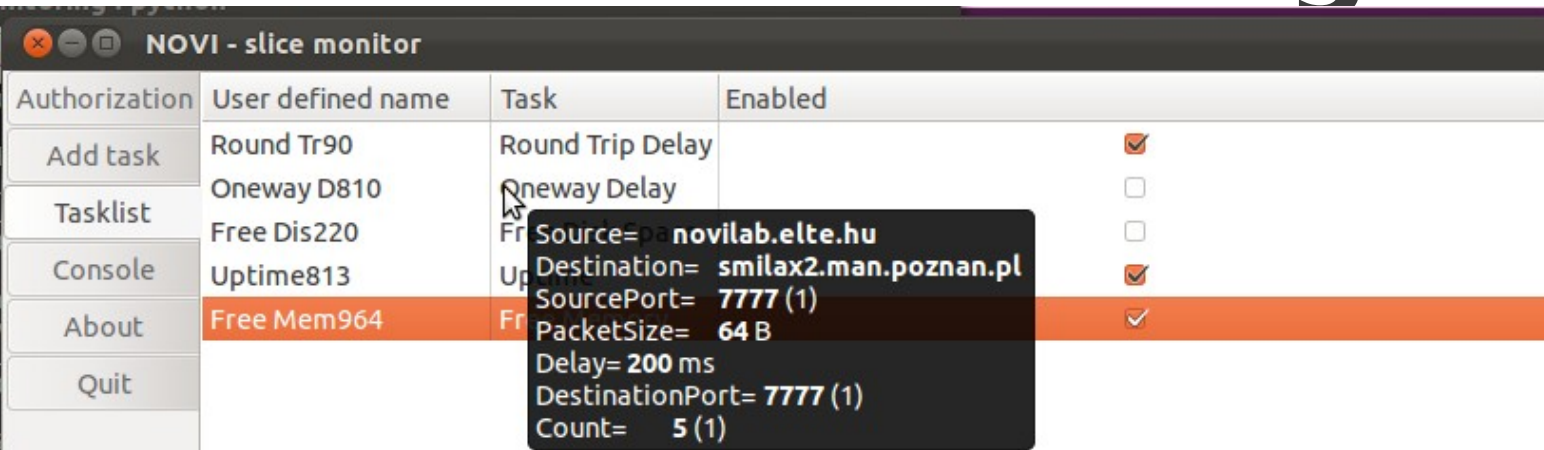
# Bind tools to metrics

Platform specific configuration details

The screenshot shows the Protege OWL editor interface. The top menu bar includes File, Edit, View, Reasoner, Tools, Refactor, Window, and Help. The address bar shows the URL `http://fp7-novi.eu/monitoring_example.owl`. The main workspace is divided into several panes:

- Class hierarchy:** Shows a tree view of classes including Thing, Column, Dimension, MonitoredFeature, MonitoringTask, MonitoringTaskDefinitionPart, ParamValueType, Parameter, Prefix, and Unit.
- Members list:** Displays a list of members for the selected class `T_SSHMemInfo`, including `T_SONoMAChirp`, `T_SONoMAPing`, `T_SSHDiskInfo`, `T_SSHMemInfo` (highlighted), and `T_hadesaggregate`.
- Annotations:** Shows the annotations for the selected class.
- Description:** Shows the description for the selected class, including the type `MonitoringTask`.
- Property assertions:** Displays a list of property assertions for the selected class, including object property assertions like `hasMonitoringDomain Slice`, `hasOutputTableFormat sshmemorytable`, `hasPreHook HPRE_sshMeminfo`, `hasRetrieveHook HR_sshMeminfo`, `hasDriver SSH`, `hasAuthenticationType UsernamePassword`, `hasMonitoringDomain Substrate`, `hasAuthenticationType UsernameRSAKey`, and `hasExecutionParameter EP_SourceAddress`. It also shows data property assertions like `name "sshMeminfo"`.

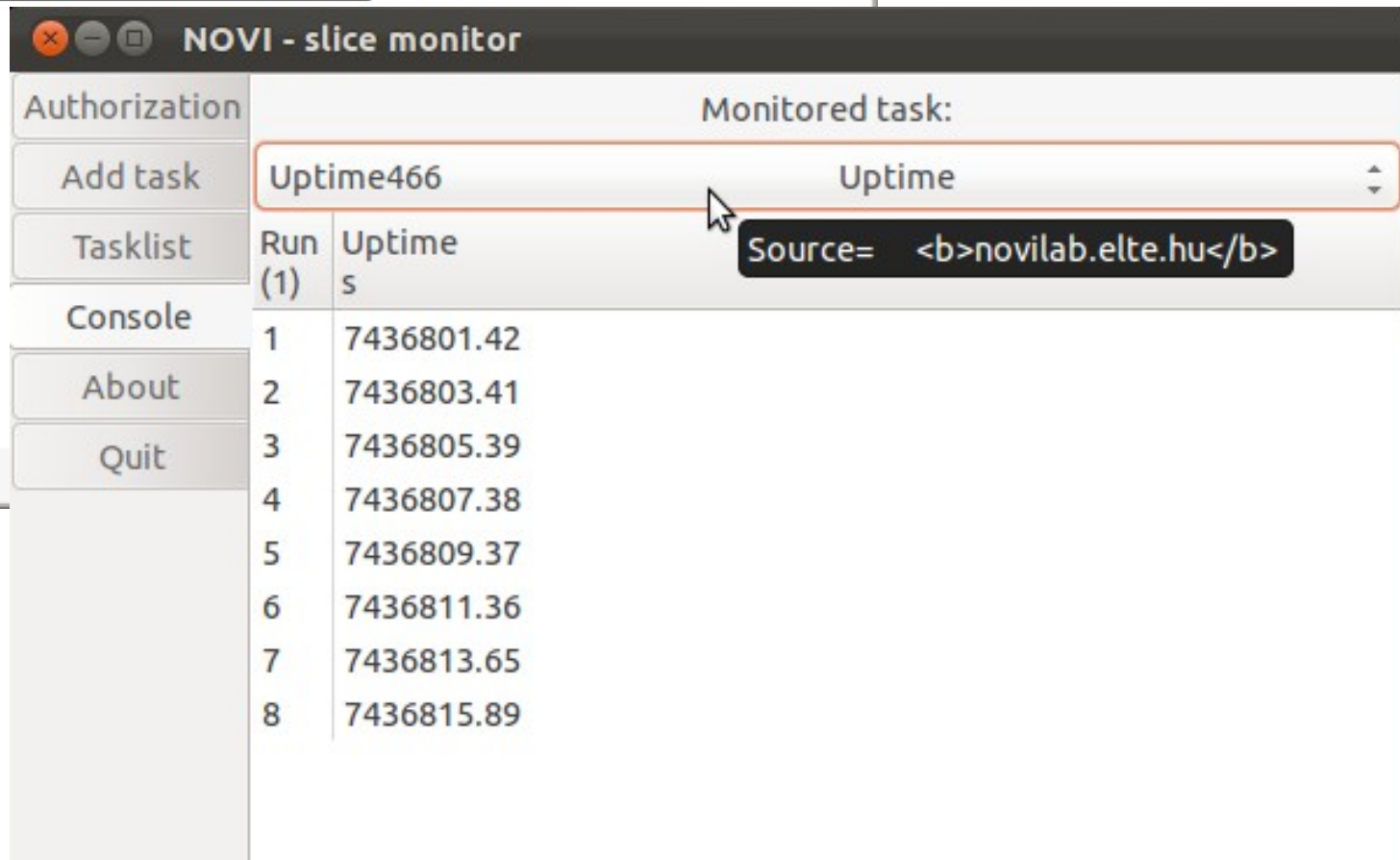
# Demonstrate using GUI



NOVI - slice monitor

| Authorization | User defined name | Task             | Enabled                             |
|---------------|-------------------|------------------|-------------------------------------|
| Add task      | Round Tr90        | Round Trip Delay | <input checked="" type="checkbox"/> |
| Tasklist      | Oneway D810       | Oneway Delay     | <input type="checkbox"/>            |
| Console       | Free Dis220       | Free Delay       | <input type="checkbox"/>            |
| About         | Uptime813         | Uptime           | <input checked="" type="checkbox"/> |
| Quit          | Free Mem964       | Free Mem         | <input checked="" type="checkbox"/> |

Source= **novilab.elte.hu**  
Destination= **smilax2.man.poznan.pl**  
SourcePort= **7777 (1)**  
PacketSize= **64 B**  
Delay= **200 ms**  
DestinationPort= **7777 (1)**  
Count= **5 (1)**



NOVI - slice monitor

Authorization

Monitored task:

Add task

Uptime466

Uptime

Tasklist

Run (1)

Uptime s

Console

About

Quit

1 7436801.42

2 7436803.41

3 7436805.39

4 7436807.38

5 7436809.37

6 7436811.36

7 7436813.65

8 7436815.89

Source= **<b>novilab.elte.hu</b>**

# Conclusion

The monitoring information model

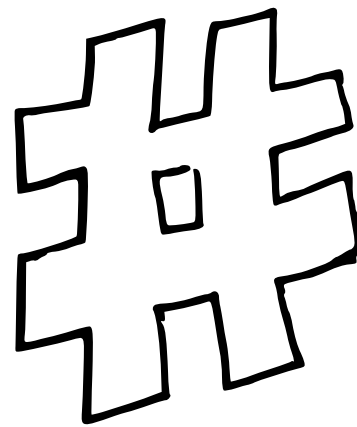
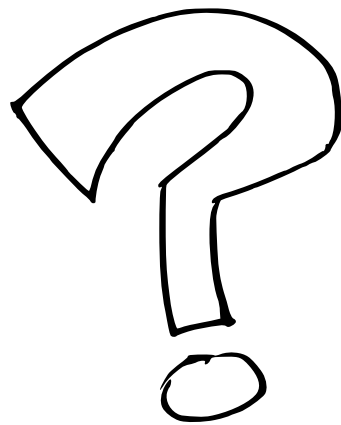
- abstracts measurable metrics
- describes the control flow
- represents data in a unit aware form
- enables transformation

MS is a framework

- hides the details of tools from caller
- caters for synchronization of tools
- delivers data in a uniform way



Thank You for your attention!



# Backup notes

## Calibration:

- Reference node at ELTE (pass through DAG card and GPS synchronization)
- Nodes in NOVI are NTP synchronized
- Different tools measuring the same metrics

## Investigate the effect of virtualization:

- How precision of geolocation is deviated

