FUTURE INTERNET TESTBEDS
EXPERIMENTATION BETWEEN
BRAZIL AND EUROPE

FIBRE-BR I&M Architecture
Current Status & Federation Issues

UNIFACS and UFPE teams

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COOPERATION

CNPq 60 ANOS

European Commission

Ministério da Ciência, Tecnologia e Inovação

GOVERNO FEDERAL BRASIL PAÍS RICO É PAÍS SEM POBREZA

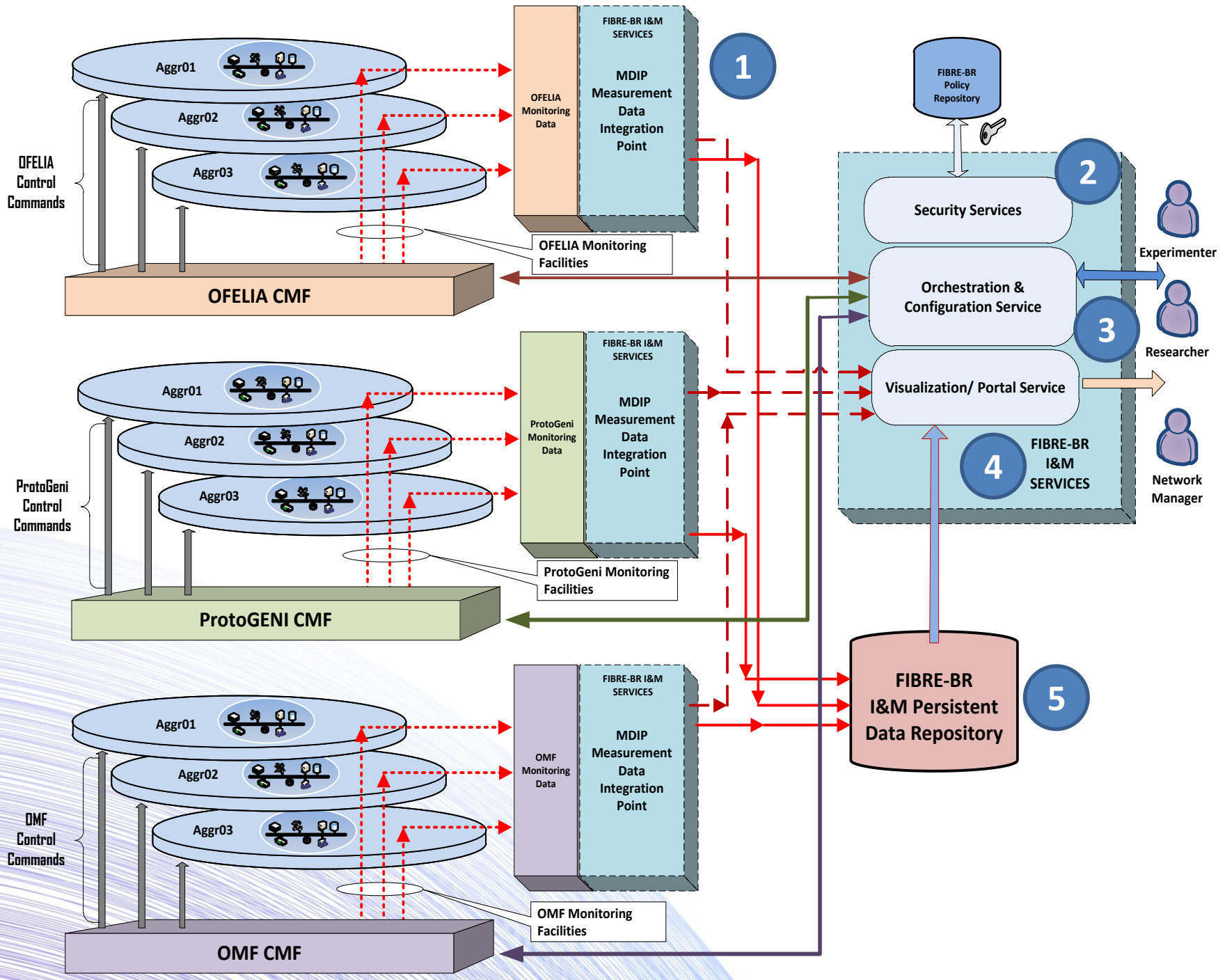
Motivation

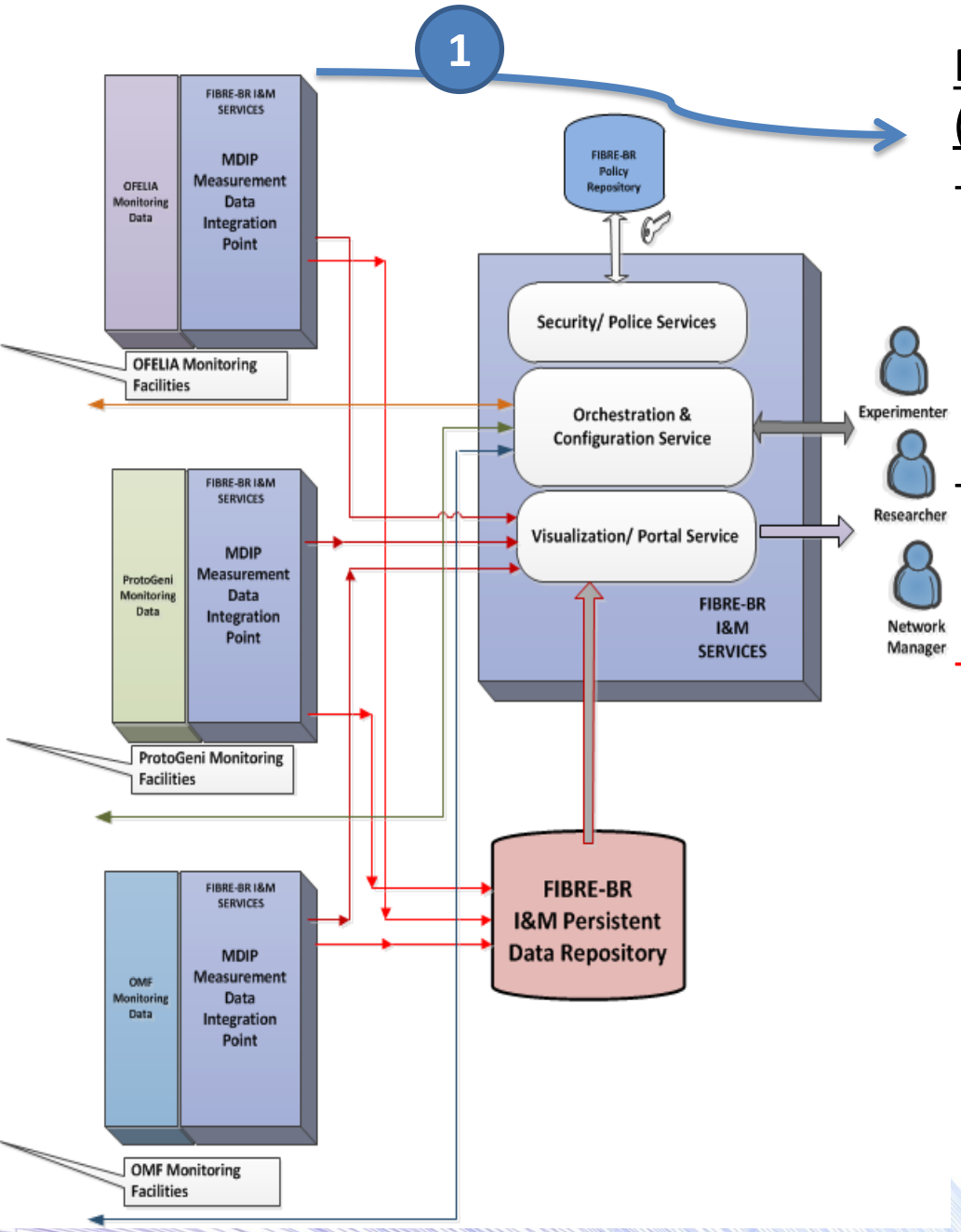
- FIBRE-BR will adopt three different control and monitoring frameworks in its nine islands:
  - OFELIA Control Framework
  - cOntrol and Management Framework (OMF) and
  - ProtoGENI
- Integration/ Federation among then is a global and final target
- Each CMF takes a different approach in addressing I&M requirements, demands and solutions
- Each CMF has its own monitoring capabilities
- I&M proposal, in general terms, addresses initially the need to “integrate” them:
  - **Comments – addressing WP4 meeting:**
    - **in effect, it’s possibly a “federation” of monitoring solutions/ strategies**

Goal

- **An Instrumentation and Measurement Architecture Supporting Multiple Control Monitoring Frameworks**
- Our target is:
  - To provide, possibly, with a maximum reuse of the available CMF´s I&M services, a new integrated and federated instrumentation and monitoring structure – FIBRE I&M:
    - **Comments – addressing WP4 meeting:**
      - **we considered that, pragmatically, integrate the I&M proposals would be necessarily a first pragmatic step towards, eventually, a truly federation of monitoring actual solutions (*the final consumer dream*)**
      - **Reuse will always prevail as a basic architectural approach and tools choice among the existing alternatives**
  - To provide instrumentation and monitoring considering different I&M Services through FIBRE (Monitoring Orchestration)
  - Multiple CMFs I&M data integration.
    - **FIBRE-BR is being till now considered as the first approach for orchestration and data integration and FIBRE BR-EU is the final approach**

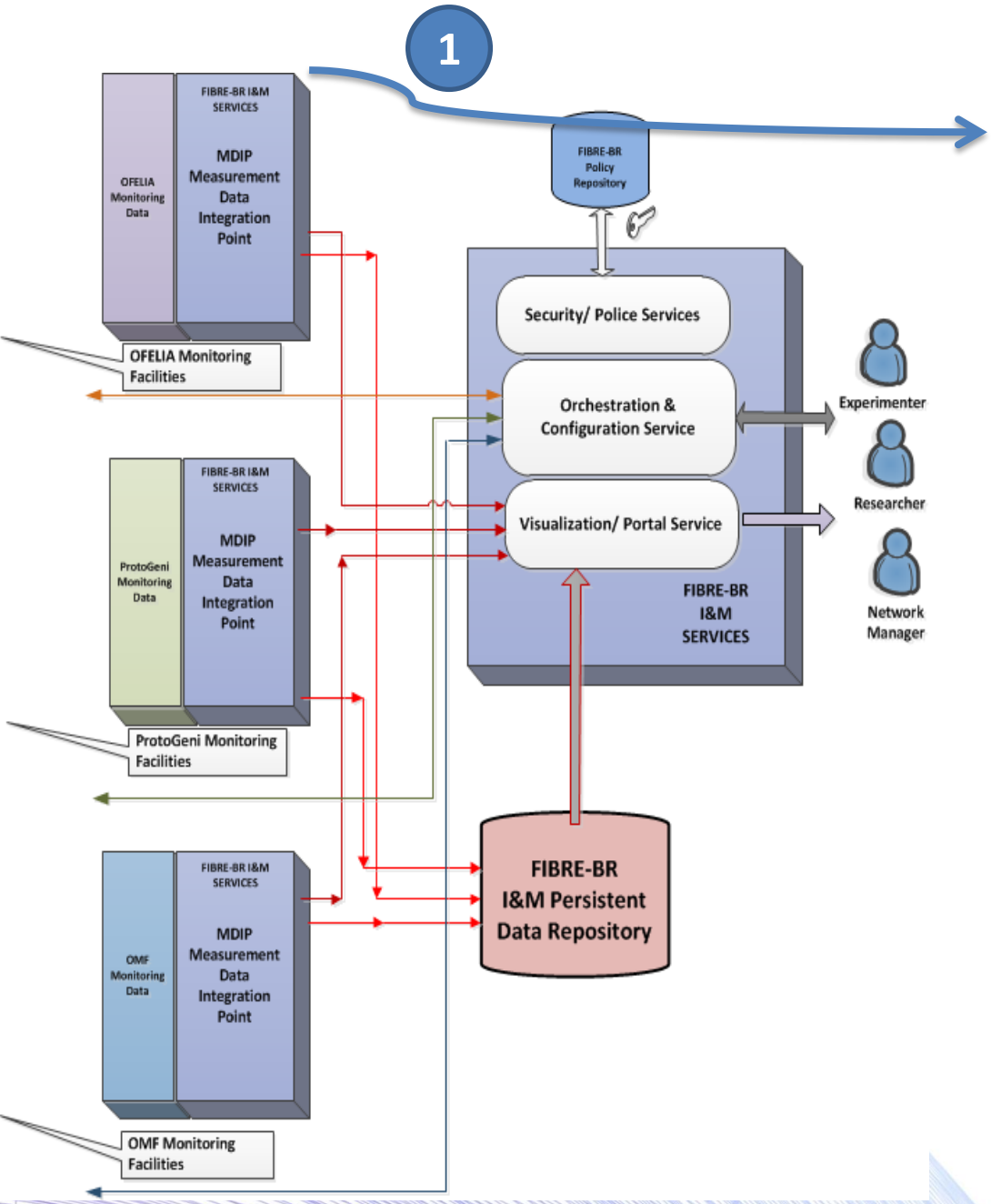
FIBRE-BR I&M ARCHITECTURE


Aggr01
Aggr02
Aggr03
OFELIA Control Commands
OFELIA CMF
OFELIA Monitoring Data
FIBRE-BR I&M SERVICES
MDIP Measurement Data Integration Point
OFELIA Monitoring Facilities
1
FIBRE-BR Policy Repository
2
Security Services
Orchestration & Configuration Service
3
Visualization/ Portal Service
4
FIBRE-BR I&M SERVICES
Experimenter
Researcher
Network Manager
ProtoGeni Control Commands
ProtoGENI CMF
ProtoGeni Monitoring Data
ProtoGeni Monitoring Facilities
FIBRE-BR I&M Persistent Data Repository
5
OMF Control Commands
OMF CMF
OMF Monitoring Data
OMF Monitoring Facilities



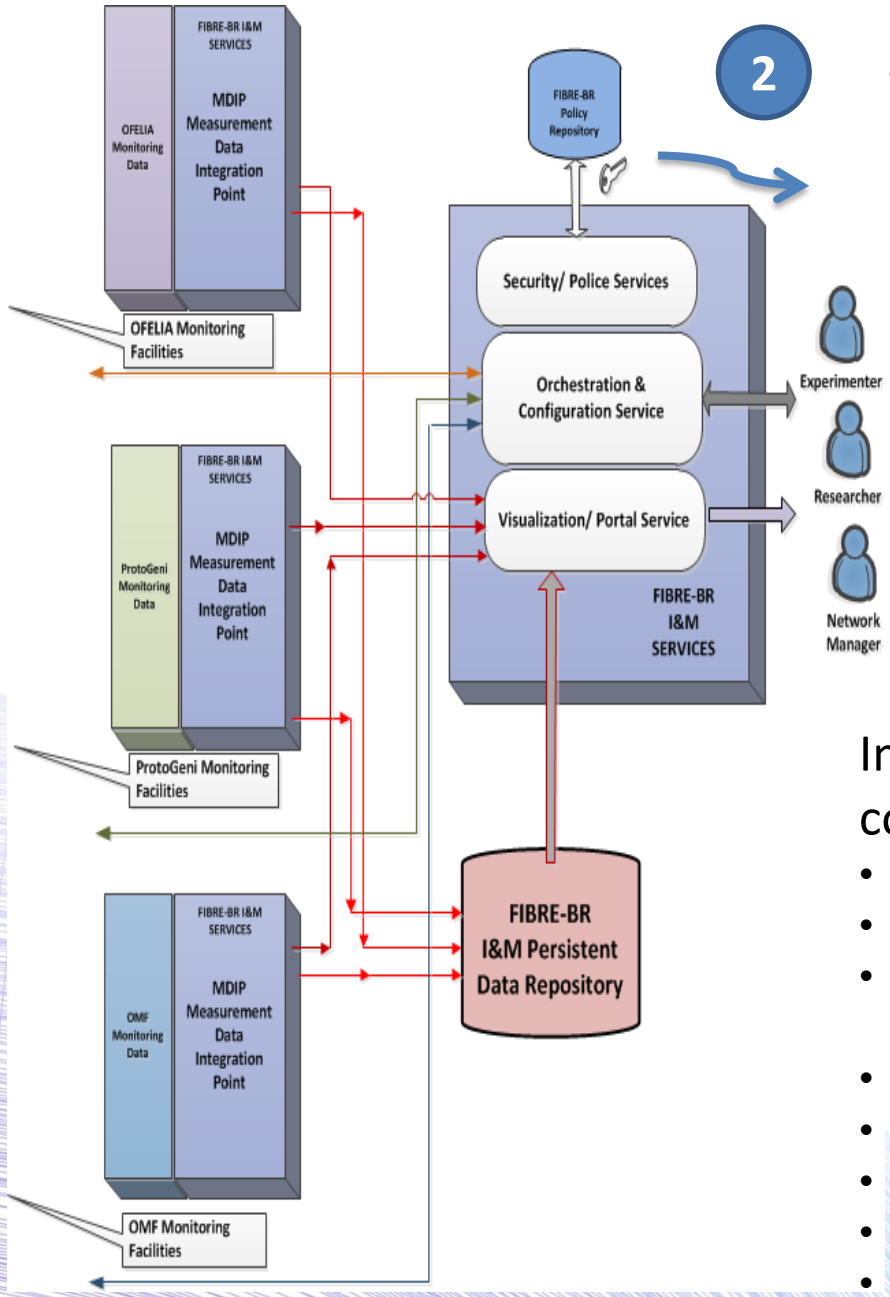
Measurement Data Integration Point (MDIP):

- conforms the collected data from the available CMFs / tool to FIBRE-BR I&M standard format (NM-WG), representation and distribution (including visualization).
- NM-WG is assumed considering that perfSONAR would be the monitoring data integration tool
- **Comment – WP4:**
  - **We assume perfSONAR as the integration monitoring infrastructure in I&M terms**
  - **Intended to have monitoring features beyond only infrastructure measurements**
  - **Monitoring "provisioning" is not addressed yet with this solution – pragmatically, each CMF uses its own**



Measurement Data Integration Point (MDIP):

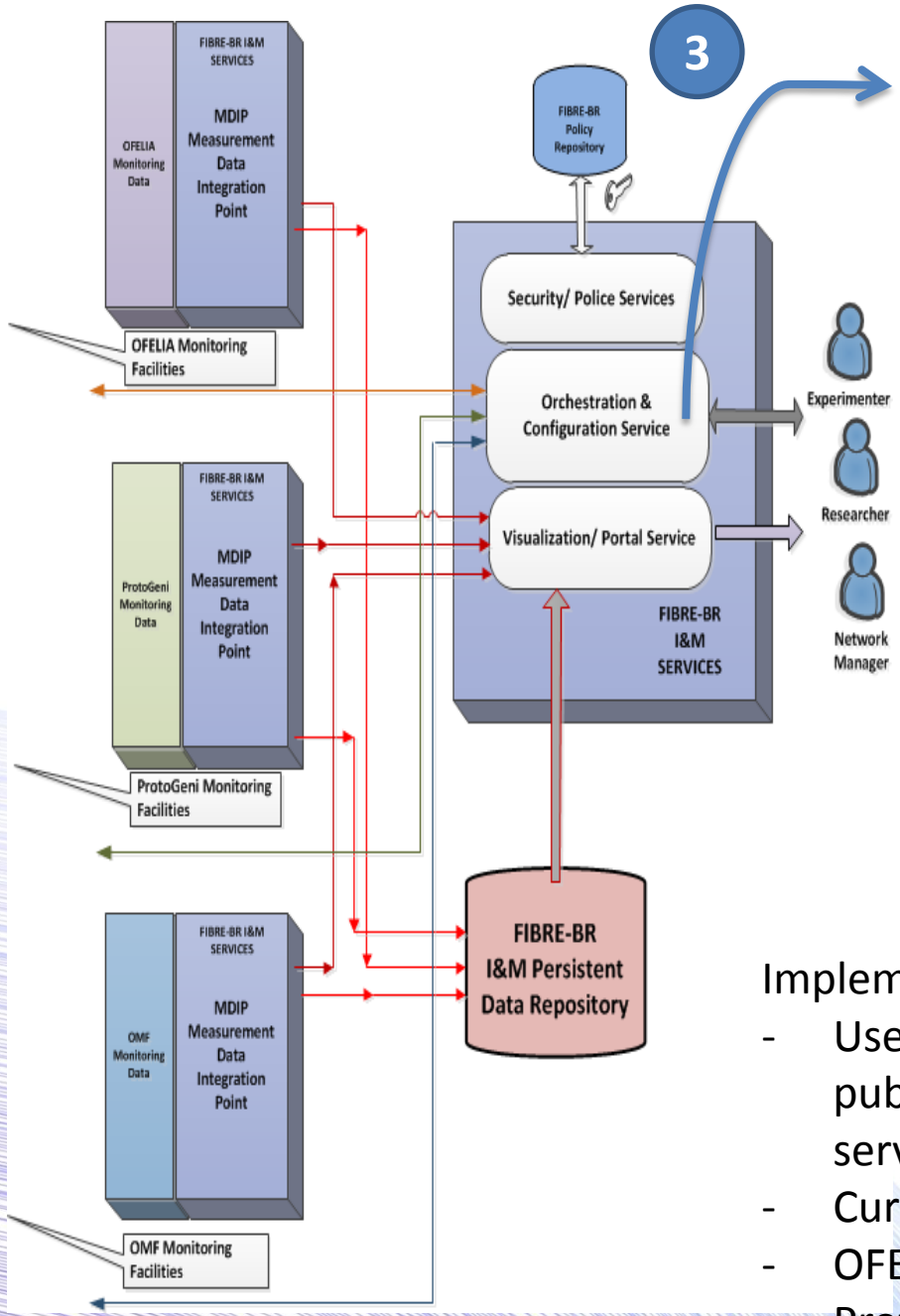
- This service includes all measurement data processing related aspects such as, message format, message transport protocol and/or service, access privileges and common data storage or on-the-fly data distribution.



- Police and security services/ issues will adopt the FIBRE global definitions implemented and controlled by, possibly, the ClearingHouse or another entity (NOC, …):
- **Comment – WP4:**
  - **In effect, we left policies and security issues to be "addressed/ defined" in FIBRE-BR and FIBRE BR-EU architecture**
  - **A lot of issues common to surface on that: FIBRE-BR arch, federation issues, others**

Implementation issues either necessary or considered by I&M solution:

- Trust relationship (CA, SASL, etc)
- Identity credentials
- Integrated authentication/authorization or not (XMPP to help on that???)
- Federation level policies
- Slice behavior
- Data access policy
- Policy enforcement
- FIBRE-BR policy document
- …

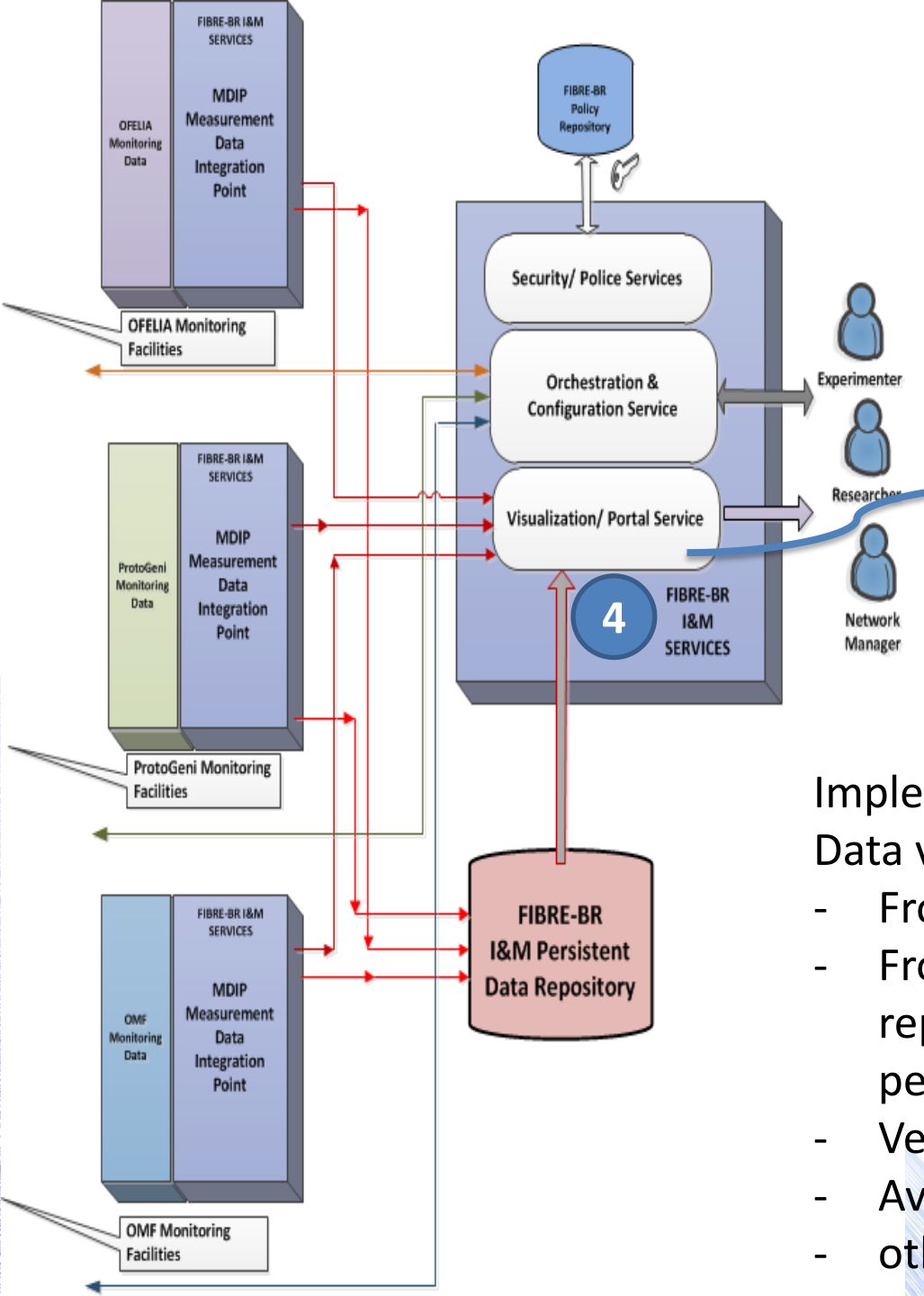


The Orchestration and Configuration Services act on behalf of the users allowing them to configure, to define measurement points, and to orchestrate these measurement data collection facilities according to each individual CMF.

- **Comment – WP4:**
  - **Basic assumption is: "let the CMF instrument/ configure all possible measurements for the experiment (infrastructure, experiment dependent, customized, …)"**

Implementation basic ideas:

- Use of publish/ subscribe approach: XML pub/sub messaging service, based on XMPP server or equivalent
- Currently supported by OMF
- OFELIA? (OF directed)
- ProtoGENI? (limited scope – infrastructure)



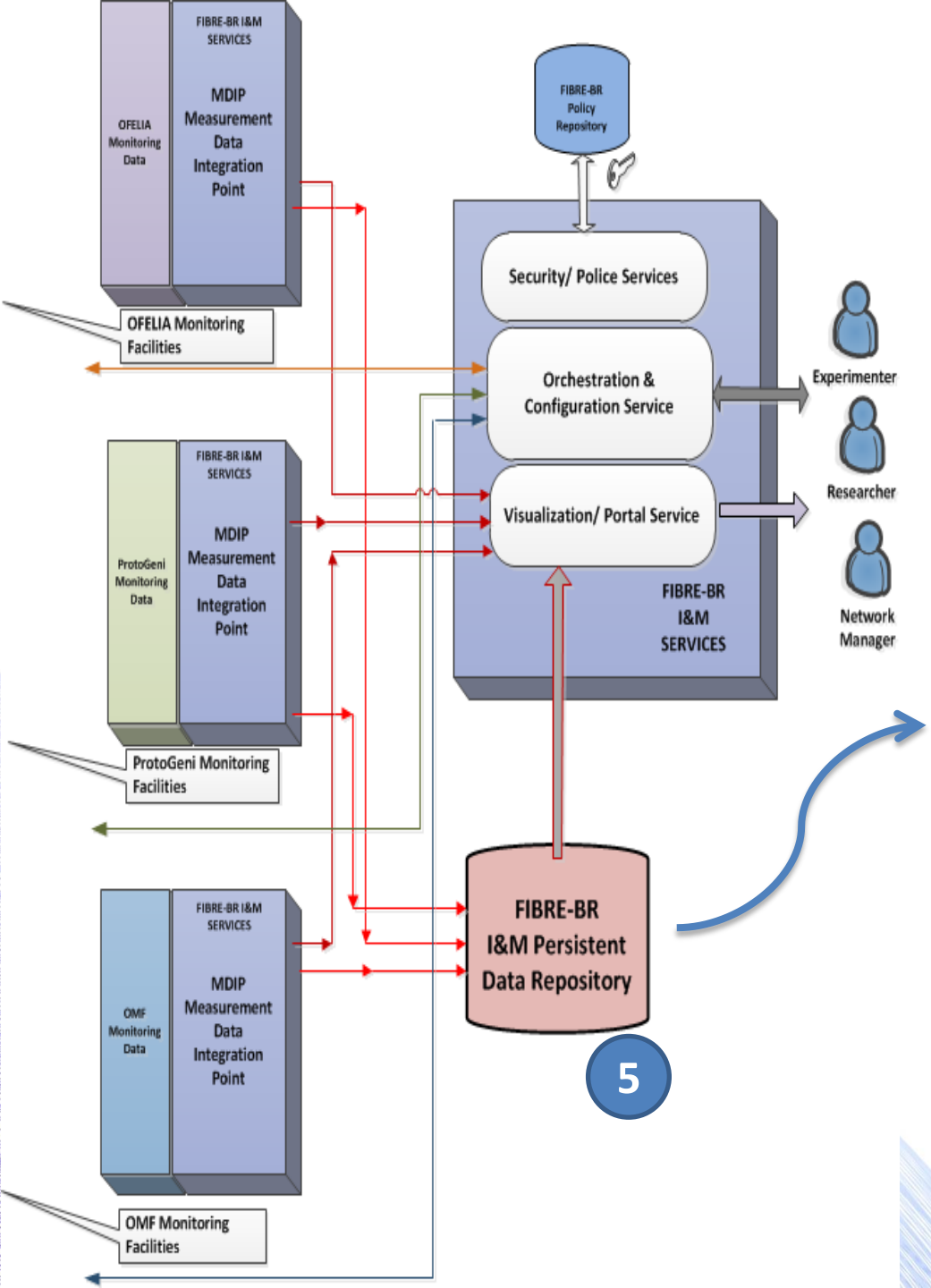
The I&M Portal main functionality is to provide a user friendly and light interface to control and access the measured data.

- **Comment – WP4:**
  - **We do not necessarily need to create a new portal or solution**
  - **Again, the pragmatic idea is to reuse whatever is available and, possibly, customize it to FIBRE-BR-EU requirements**

Implementation issues:

Data visualization:

- From real-time experiments
- From data stored Persistent Data repository in each individual CMF (I&M perspective)
- Verify privileges access
- Available only to authorized users
- other



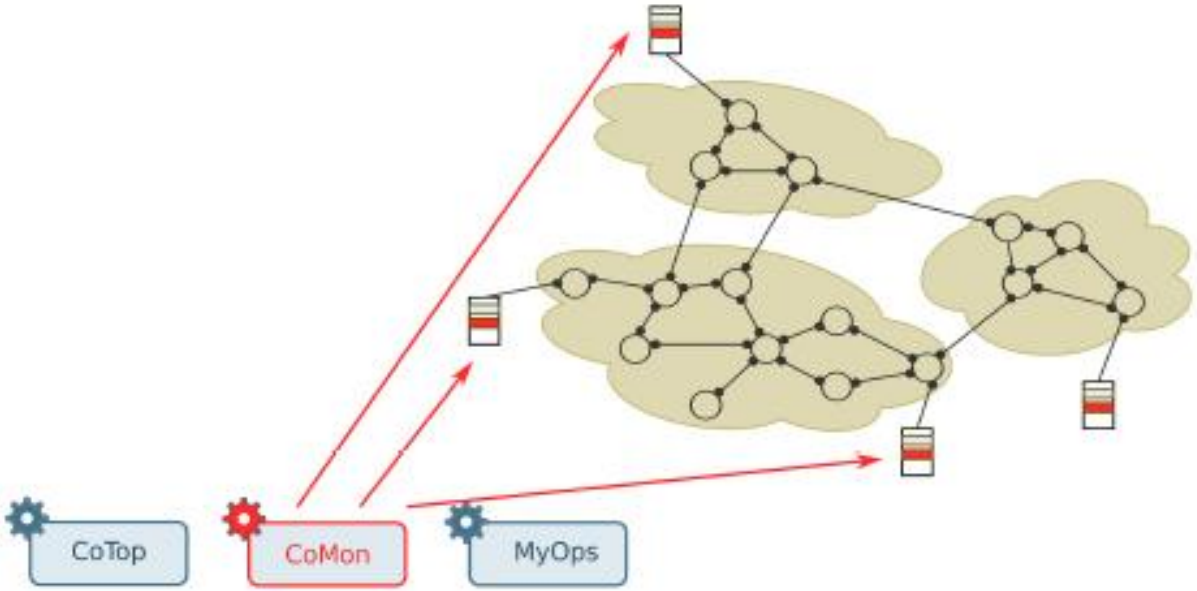
The architecture has a storage strategy that allows users to retrieve data from their own or from others previous experiments, according to their access privileges. The persistent storage option is an experimenter decision that must comply with FIBRE-BR retention policy.

Implementation steps:

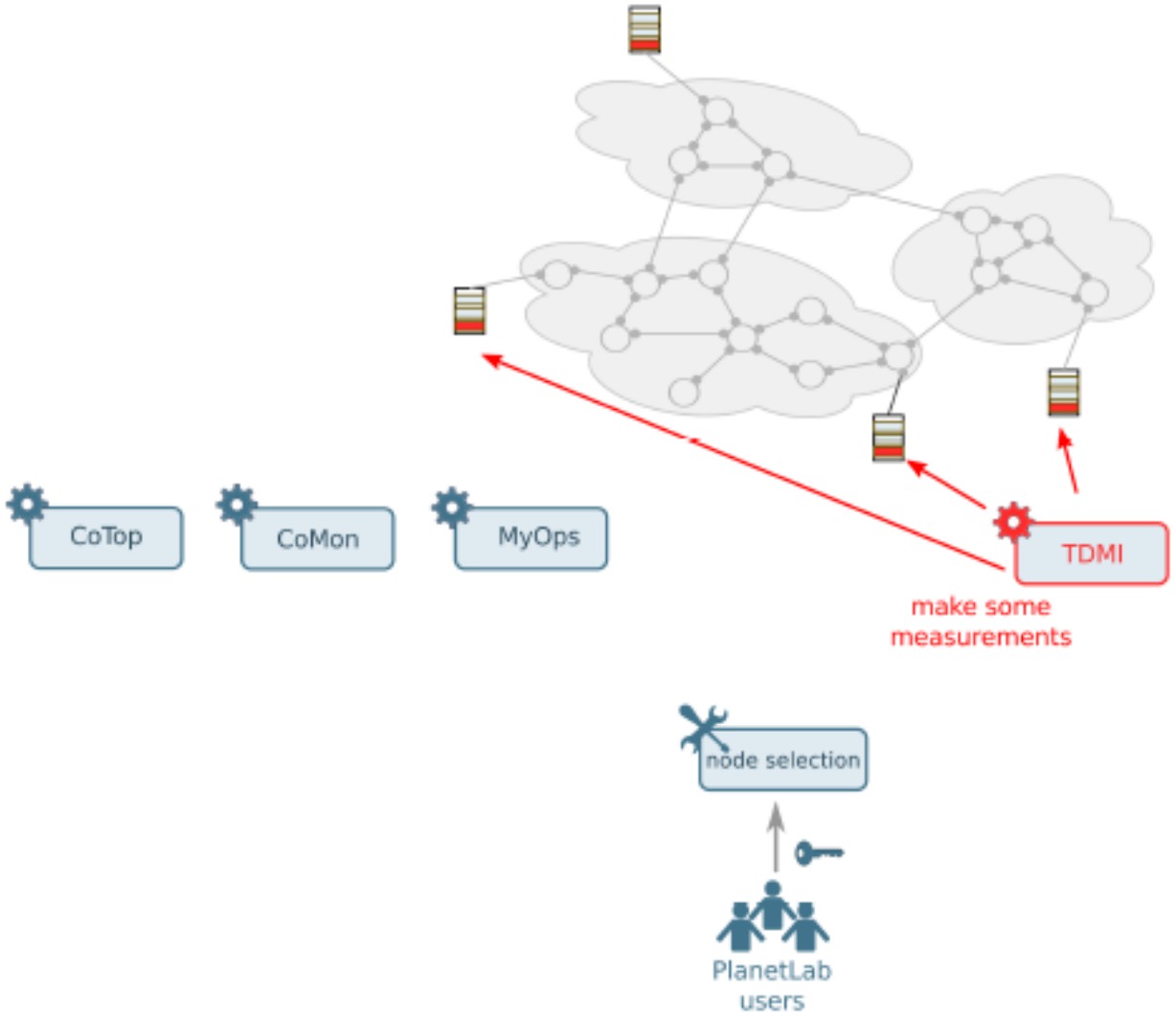
- MDIP will be in charge of saving it persistently
- Data retention policy
- MySQL/RRD database (access from I&M solution)
- I&M Standard storage
- Each CMF will keep its storage mechanism. I&M will, eventually, store it centrally or access it based on users demand and/or privilege (being discussed)
- Logs storage is being discussed

MySlice and TopHat

PlanetLab users' needs



PlanetLab users' needs



TDMI characteristics

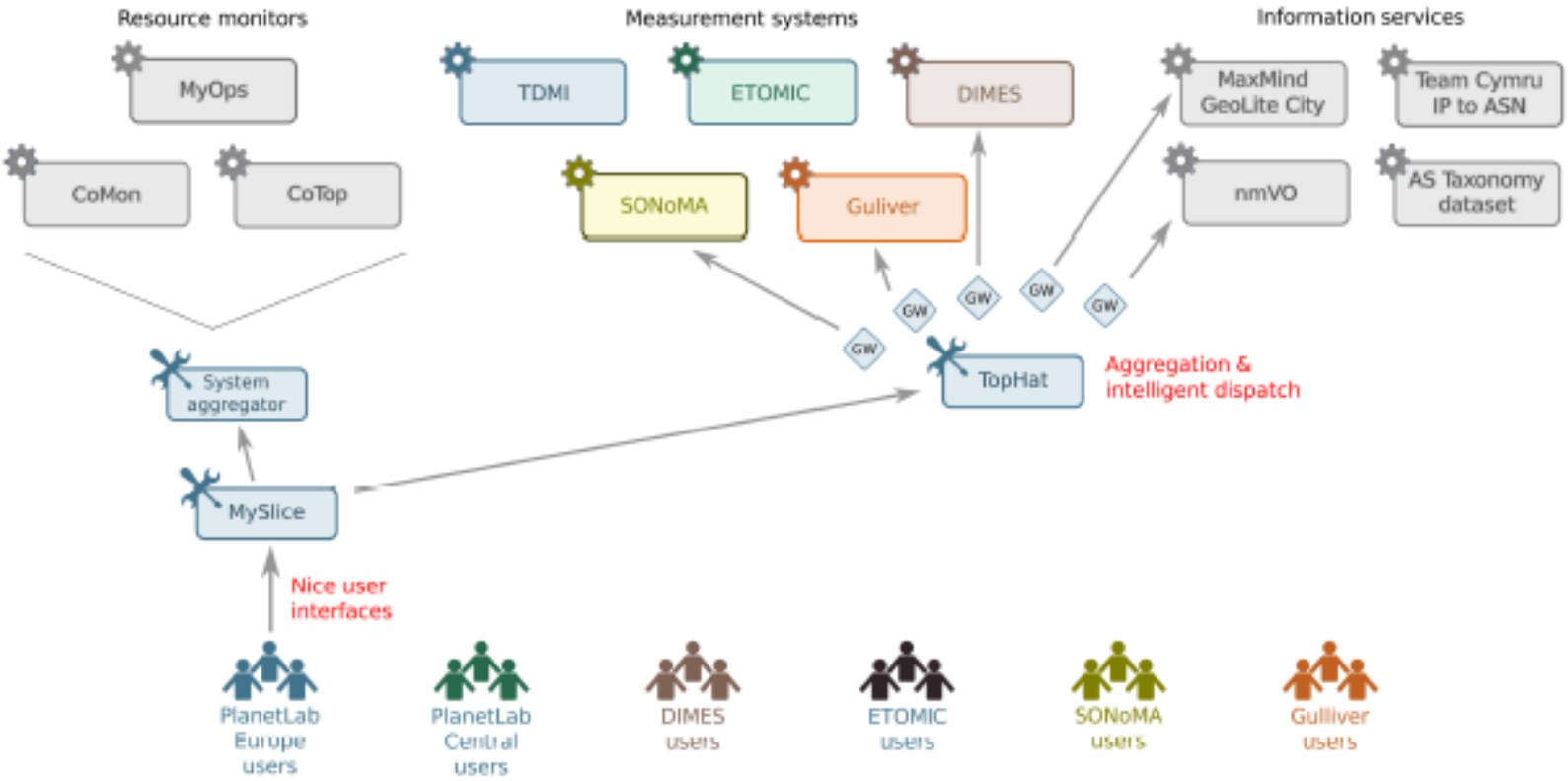
Sources: ~400 active PlanetLab nodes

Tools: ping, traceroute, Paris Traceroute, dnsprobe

Measurements:

- Full-mesh measurements towards all PL nodes every 5 minutes
- Extending to a set of external destinations

Current interconnection framework



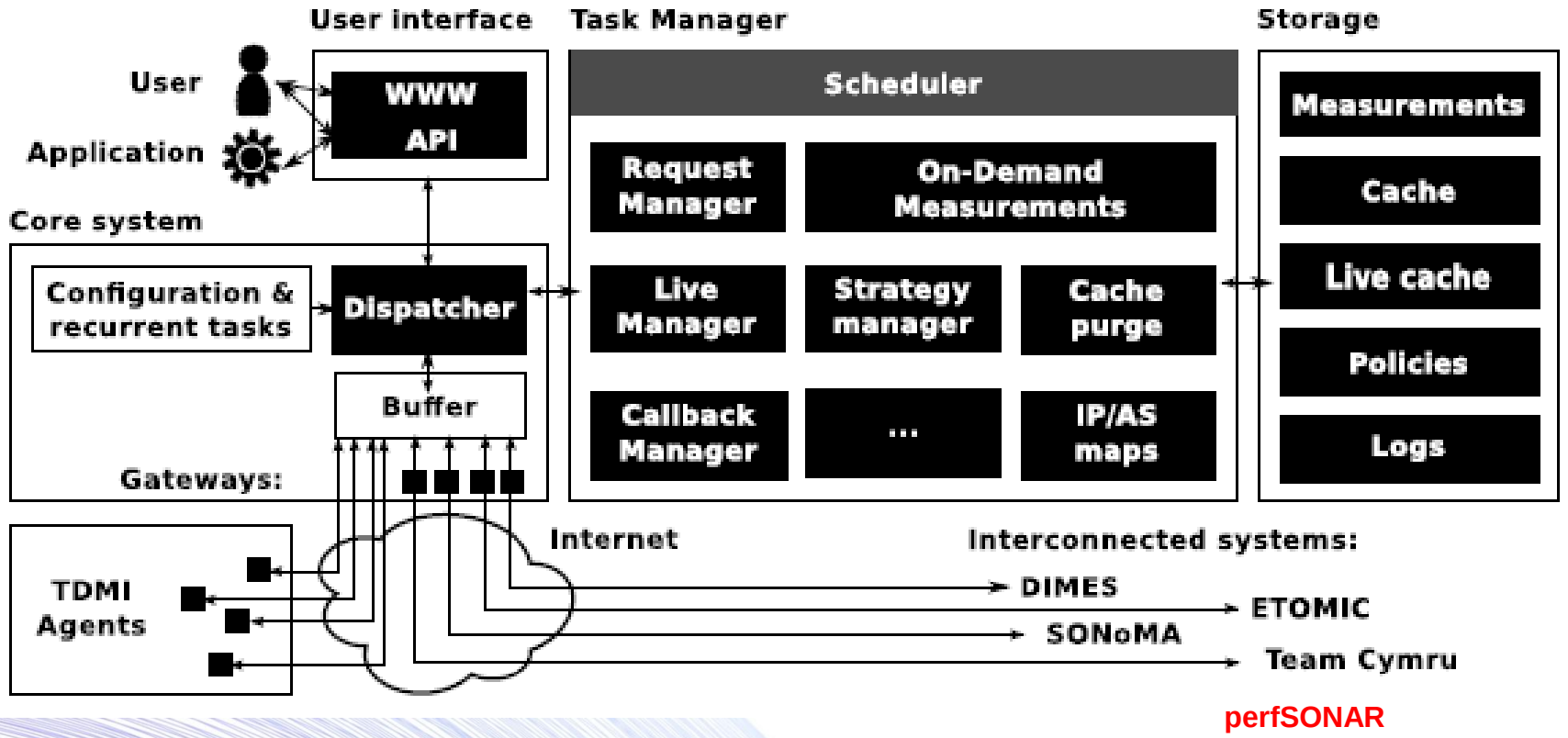
TopHat

- http://www.top-hat.info/
- PlanetLab Europe's active measurement component
- Part of OneLab's effort: global federated environment
- TopHat provides PlanetLab applications with a topology monitoring service for the entire lifecycle of an experiment.
- Uses DIMES and ETOMIC for specialized Services

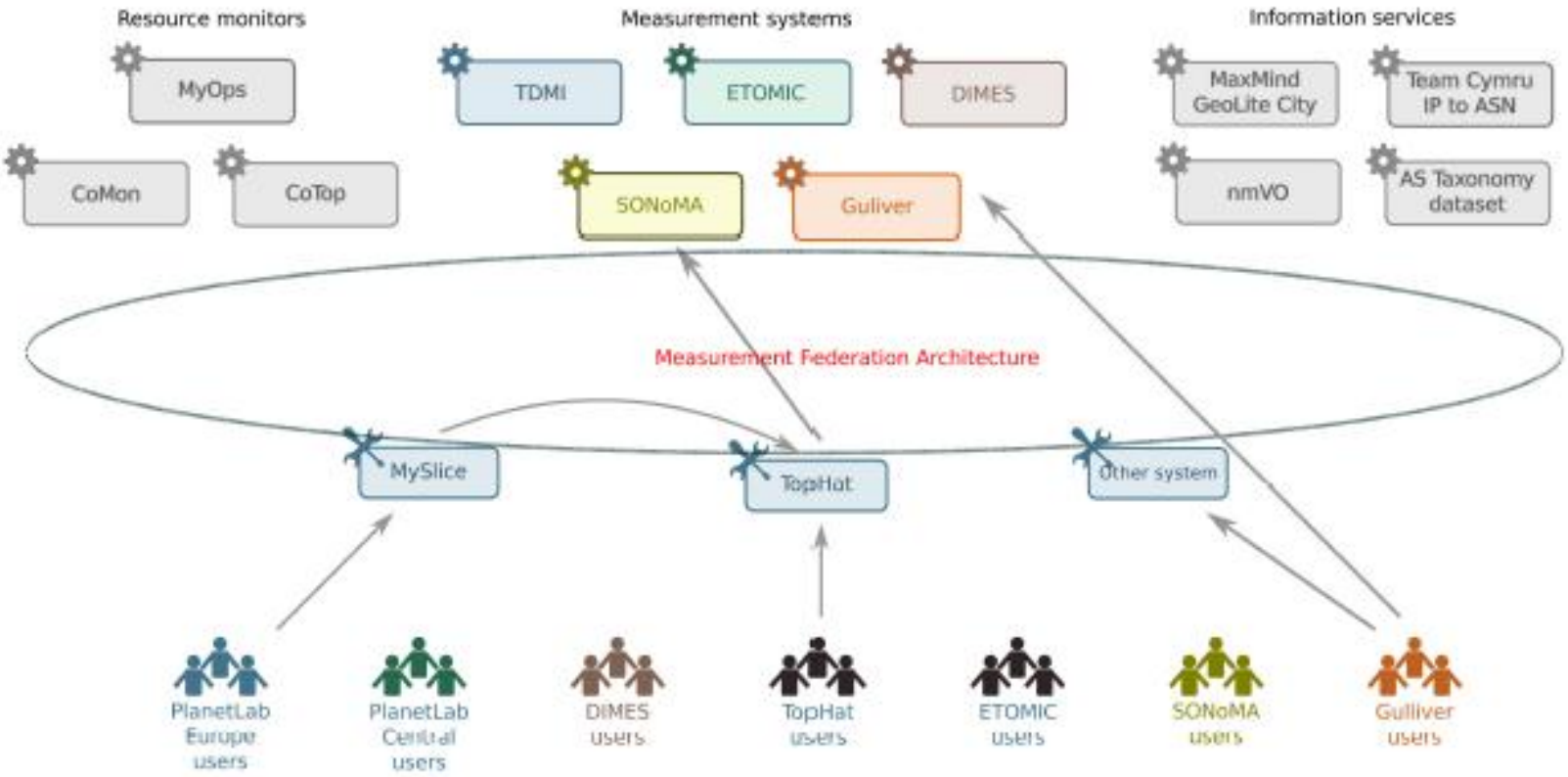
Experiment Lifecycle Support

- Experiment set up:
  - Assist users in choosing the nodes for their experiments based on measured characteristics of the network
- Run time:
  - Provides info to support adaptative applications and experiment control.
- Post-morten data:
  - Data are archived for further analysis.

TopHat Architecture

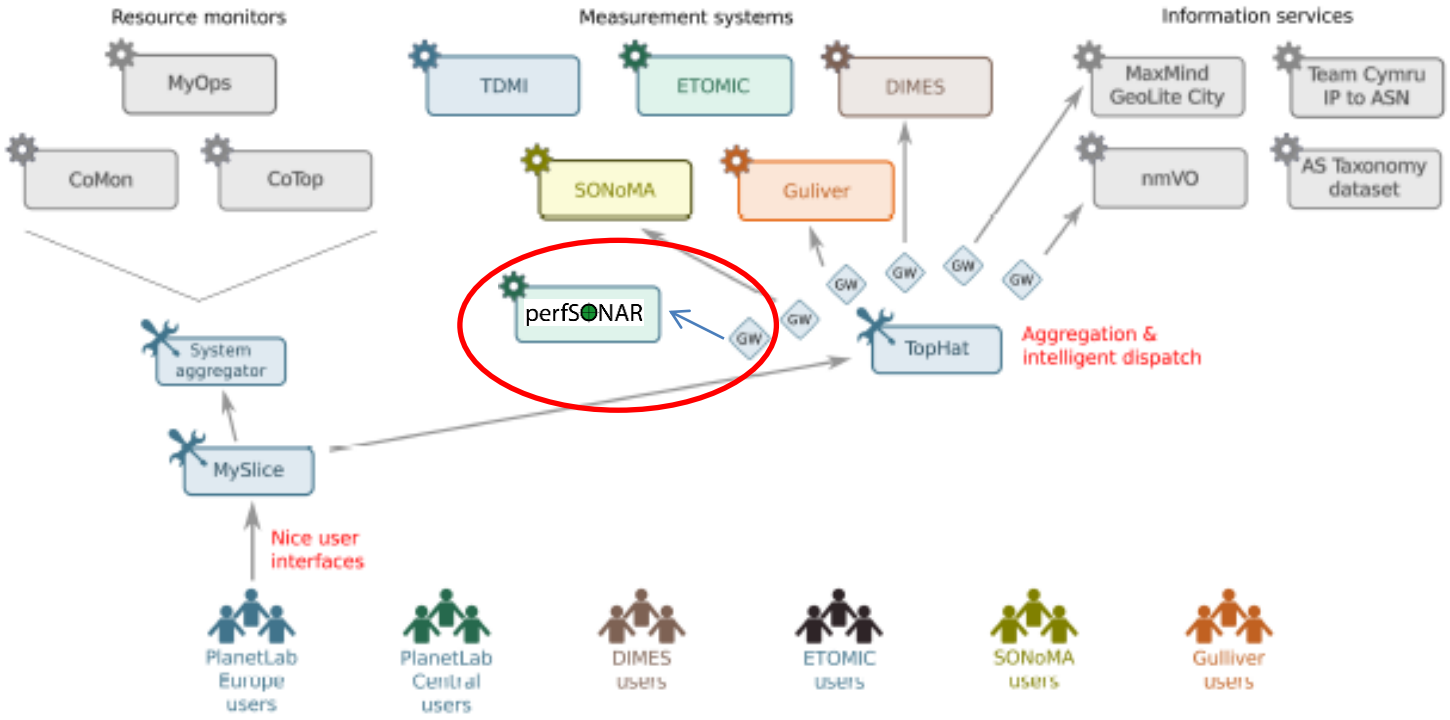


Towards a Measurement Federation Architecture ?



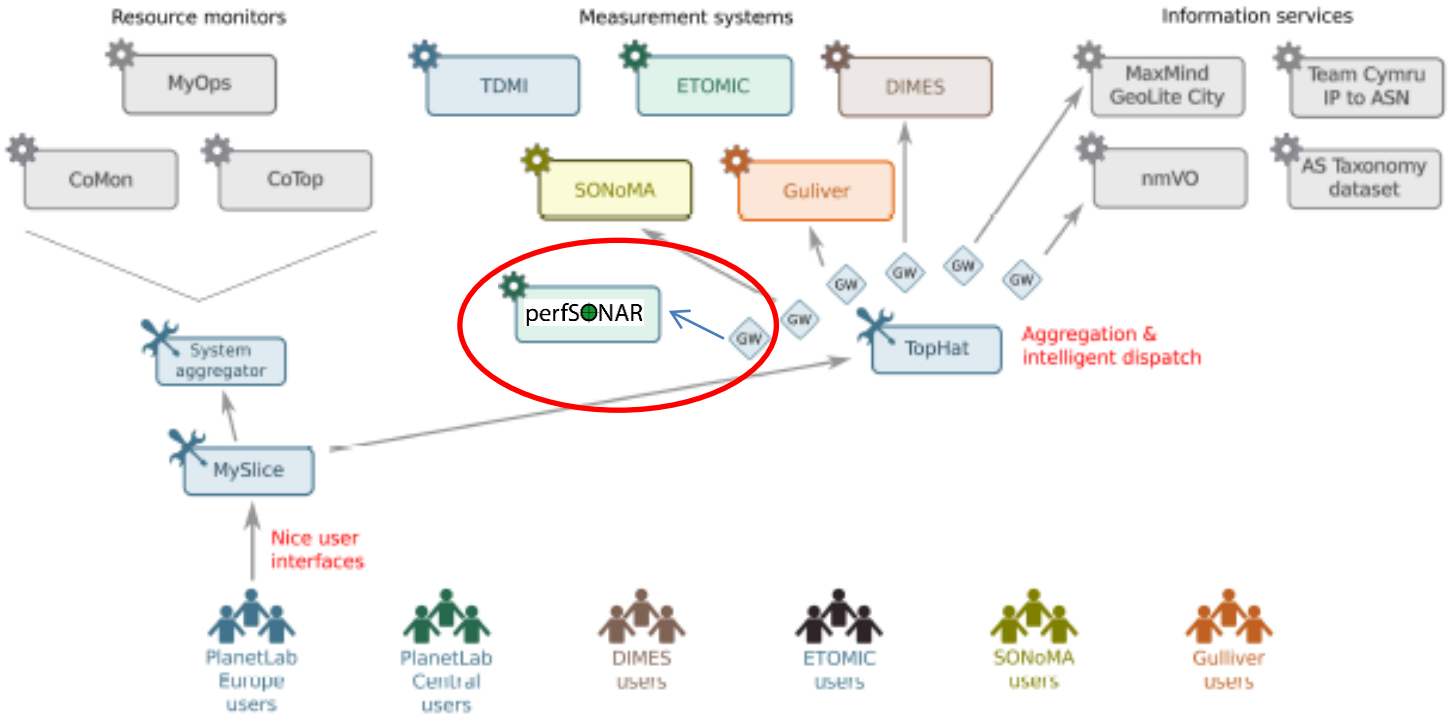
Preliminary Thoughts on the Integration of TopHat and FIBRE-BR I&M Services

TopHat and perfSONAR



- perfSONAR is being deployed by NRENs (Europe, US, Brazil, Latin America) and other networks such as LHC.
- It could be developed a gateway between TopHat and pS services, to leverage the collected data in such networks.

TopHat and FIBRE-BR I&M System



- FIBRE-BR I&M System will be perfSONAR based.
- The collected data could also be made available through TopHat.
- But, both have similar goals wrt a common/standard API
  - In the pS case it uses OGF standardized schemas and protocol.

- Makes more sense for virtual nodes such as PL’s
- In OMF and ProtoGENI, nodes are not virtualized
  - we could allocate physical resources for measurements
- In OFELIA the servers are virtualized, but their connectivity depends on the configured "flowspace".
  - Therefore, even if we assign a given slice for measurements during an experiment, the results do not necessarily match the performance perceived on a particular experiment slice.

Relation with current Testbed monitoring tools

- OML:
  - data collected by the experimenter on his/her slice.
- INSTOOLS:
  - similar to TDMI (both use existing tools) but allocating machines per experiment/slice.
- LAMP:
  - perfSONAR MPs instantiated on machines per experiment.

- In all of them, as opposed to the current version of TopHat, it is possible to collect experiment/slice measurement data
- Does CoMon provide similar services?

FIBRE-BR Infrastructure Measurements

- FIBRE-BR Islands interconnected via VMANs on RNP's backbone (Rede Ipê).
  - How many? One per slice + control and measurement plane?
- Is it helpful to have pS MPs on the control VMAN in order to have an idea of network conditions for selecting a given island for the experiment?
- Of course, pS MPs could also be deployed in a given slice.

TopHat and FIBRE-BR I&M Architecture

- Hypothesis: MySlice is used to discover FIBRE resources for experiments (as suggested by Serge)
- Question: which TopHat services would be available?
  - not any of external sources, for instance, topology data.
  - could use pS data for selecting the best set of resources...
  - interoperability issues with, for instance, ETOMIC in EU OneLab Islands (is there any?)
  - In FIBRE-BR islands it is not planned to instal ETOMIC nodes.
  - We should be able to use existing pS MPs in EU or installing specific ones also in FIBRE-EU Islands in order to allow tests among them.
  - An alternative would be to use TDMI to collect measurements among FIBRE islands (both EU and BR).

- Functionalities not present in its current version:
  - Access to experiment slice measurements.
  - Integration with specific CMF monitoring tools
    - (OML, LAMP, etc.)

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Thank you / Obrigado

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