



FUTURE INTERNET TESTBEDS  
EXPERIMENTATION BETWEEN  
BRAZIL AND EUROPE

# Monitoring in Federated Future Internet Testbeds: the FIBRE case

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2nd perfSONAR Workshop  
Arlington – February 20, 2014



European Commission

Ministério da  
Ciência, Tecnologia  
e Inovação





# The FIBRE Project

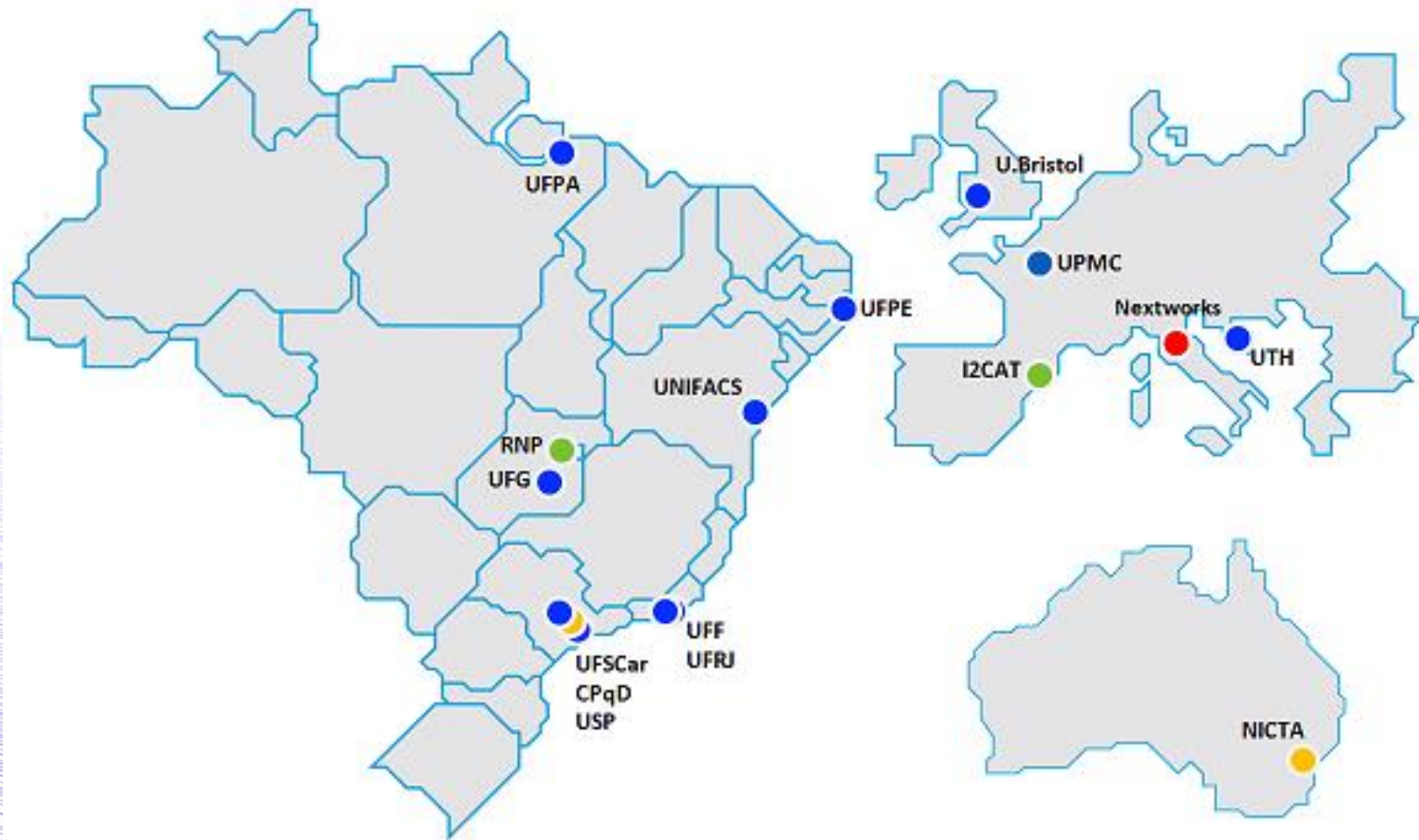
The main objective of this project is to **create** a common space between **the EU and Brazil** for **Future Internet (FI) experimental research** into network infrastructure and distributed applications, by **building and operating a federated EU-Brazil Future internet experimental facility**

The project is designing, implementing and validating a shared Future Internet research facility between Brazil and Europe, supporting joint Future Internet experimentation of European and Brazilian researchers

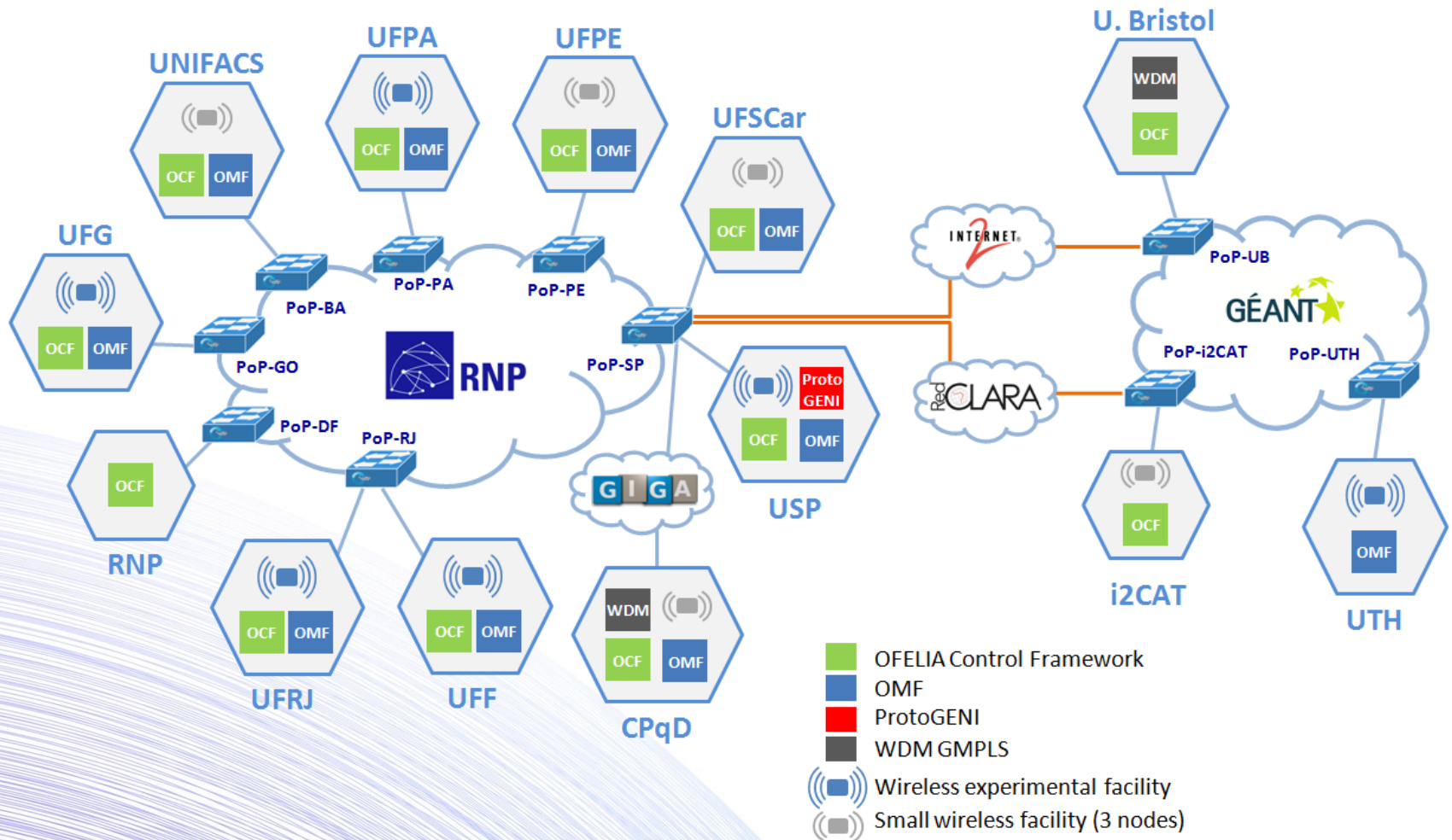
# FIBRE Partners

- Universities
- R&E Network
- R&D Center
- SME / Industry

## FIBRE members



# FIBRE Testbeds



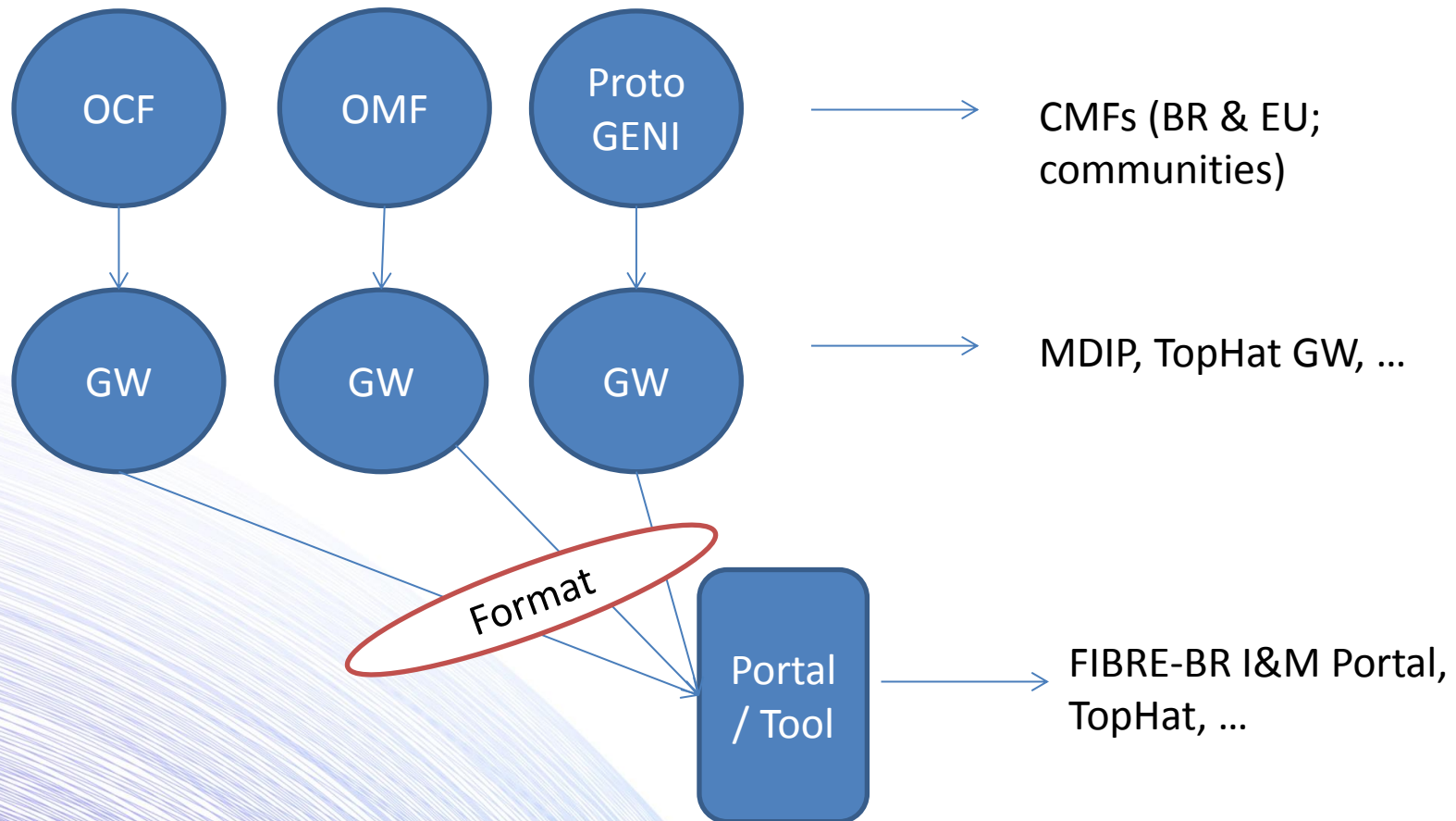


# Monitoring & Federation Context

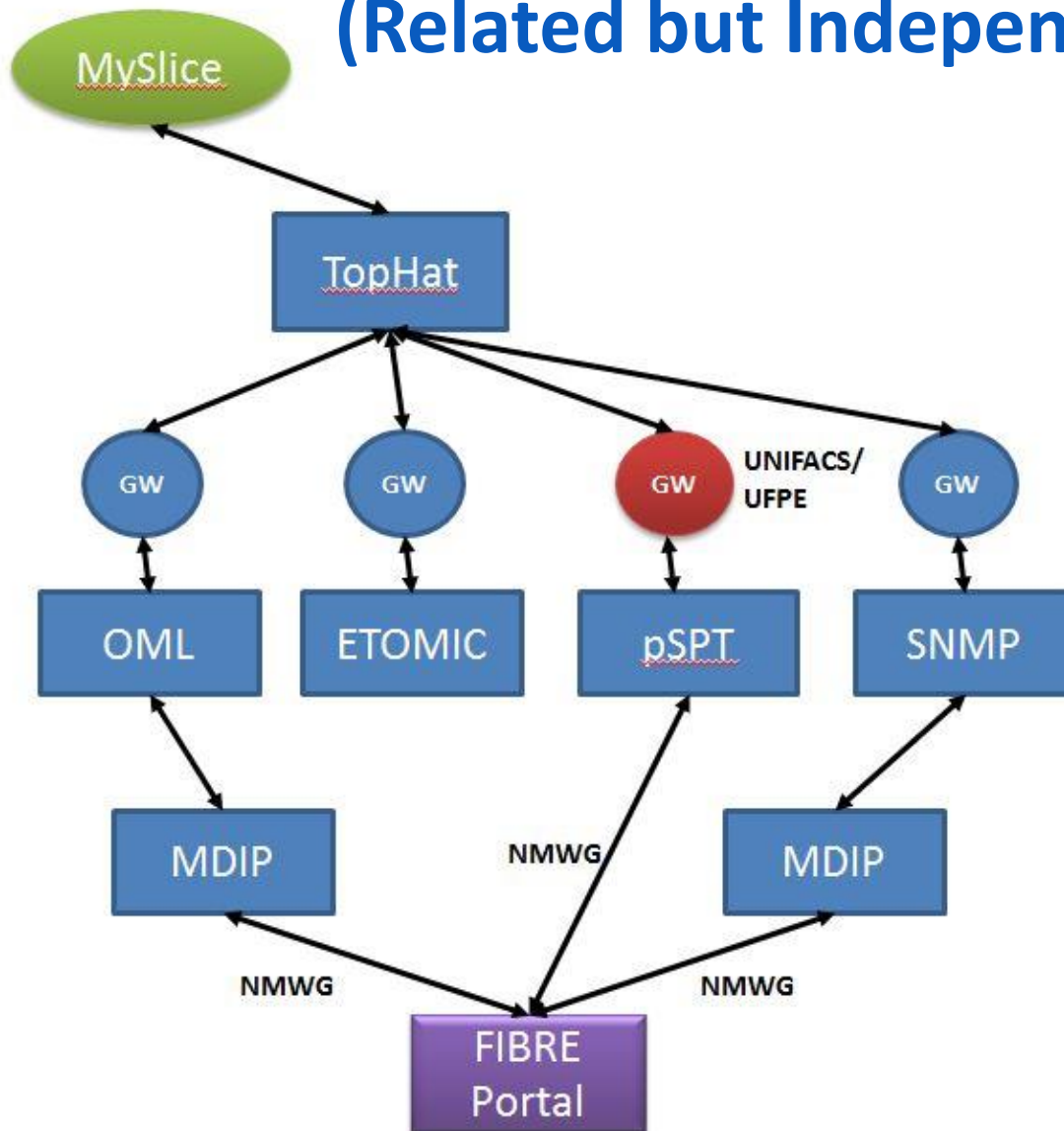
- Monitoring Scope:
  - Infrastructure:
    - Objective: support NOC/administrators in **FIBRE facility management** and experimenters in finding out alternatives in terms of available and usable **resources** (links, machines, switches, ...)
  - Experiment (slice):
    - Objective: support the experiment itself monitoring parameters like, throughput, loss, ... in a specific slice (experiment context)
- Monitoring Types:
  - Active Measurements
  - Passive Measurements
- Measurement tools per CMF:
  - OCF: none native
  - OMF: OML (-> GIMI)
  - ProtoGENI: LAMP (pS) + INSTOOLS (-> GEMINI)

# Monitoring & Federation Context

- Portal/Monitoring GUI and gateway(s) global view:



# Monitoring & Federation Context (Related but Independent Solutions)



# Monitoring Federation Use Cases

## Measurement Configuration and Types

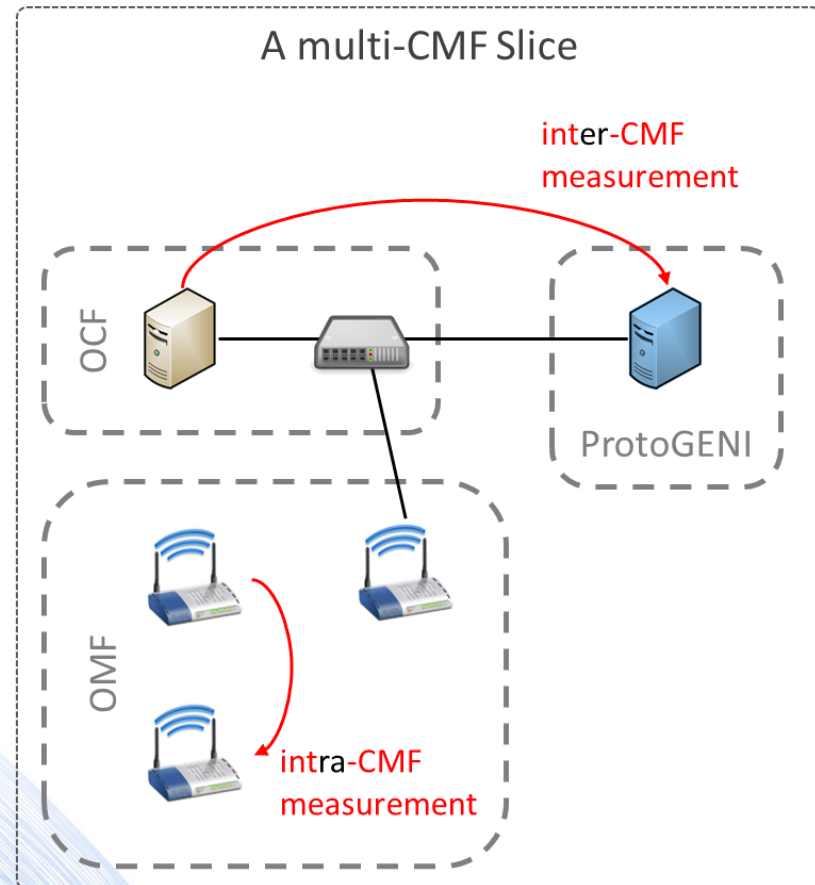
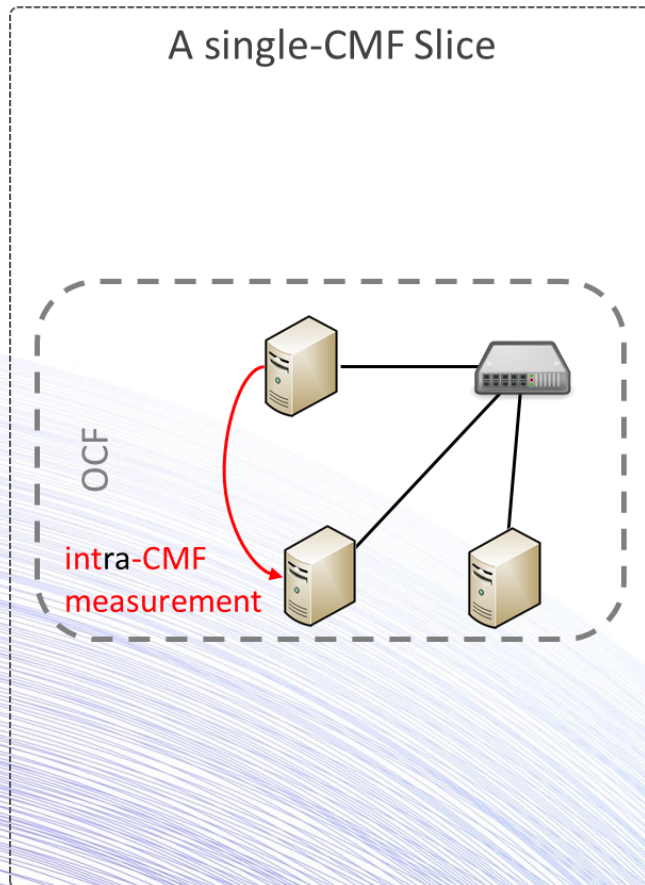
- Measurement Configuration:
  - Intra-CMF
  - Inter-CMF
- Measurement Use Cases
  - Infrastructure measurements:
    - UC 1: Active measurements
    - UC 2: Passive measurements
  - Experiment/Slice measurements
    - UC 3: Intra-CMF
    - UC 4: Inter-CMF



# Monitoring Federation Use Cases

## Measurement Configuration Alternatives

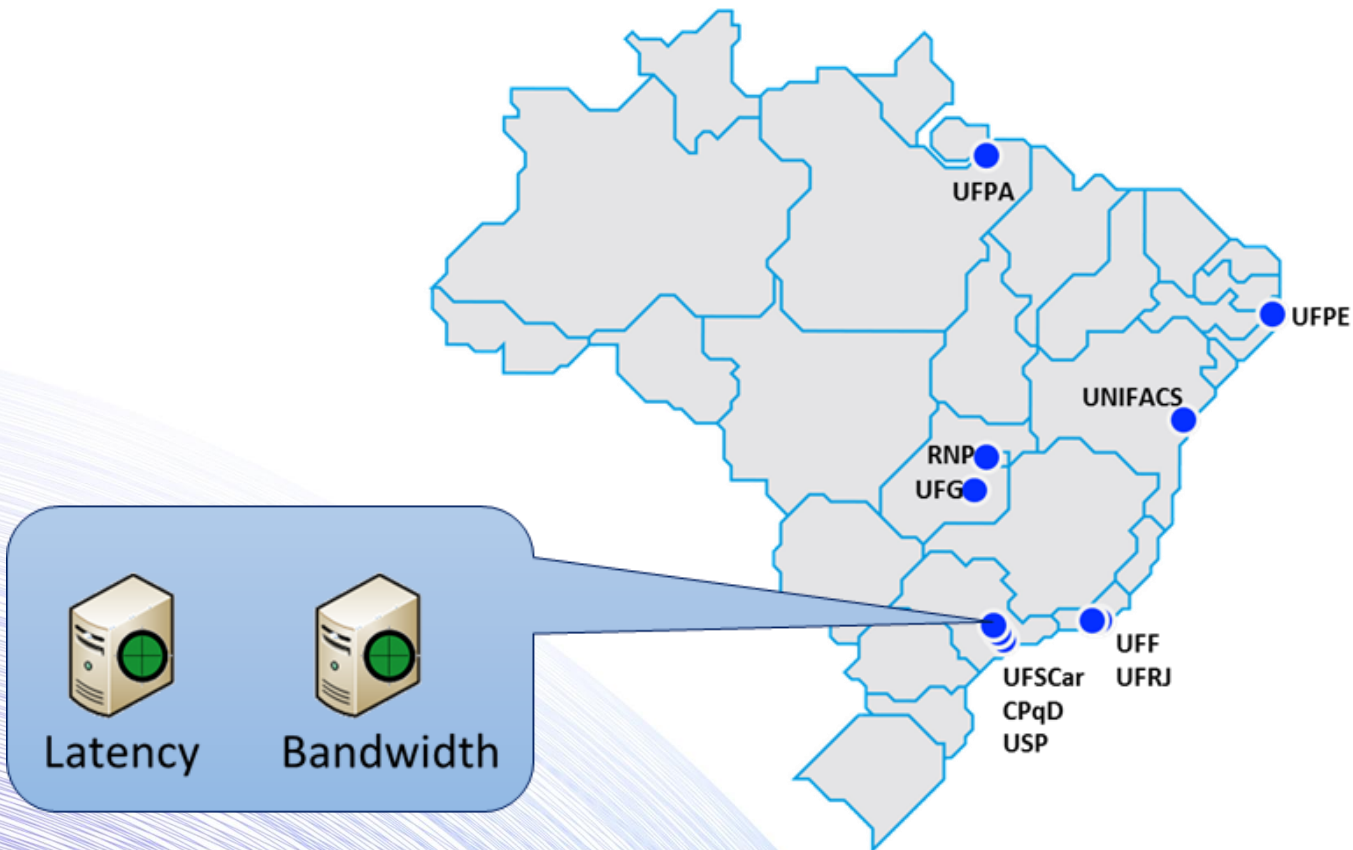
- “Intra” and “Inter”- CMF measurements



# Monitoring Federation Use Cases

## Infrastructure Measurements

- UC 1: Infrastructure **active** measurements





# Monitoring Federation Use Cases

## Infrastructure Measurements

### UC 1: Infrastructure **active** measurements

- Proposal
  - Install perfSONAR PS Toolkit nodes at each FIBRE island
  - Provide a Dashboard at NOC with global view of the testbed's performance
  - Develop a gateway to translate perfSONAR data to TopHat standard (in progress)

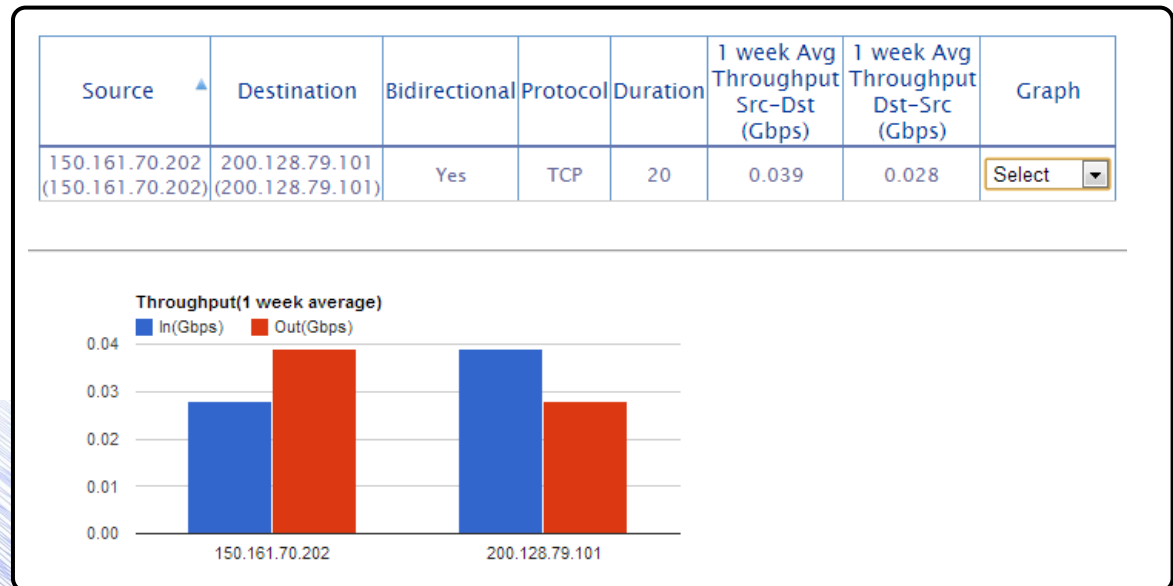
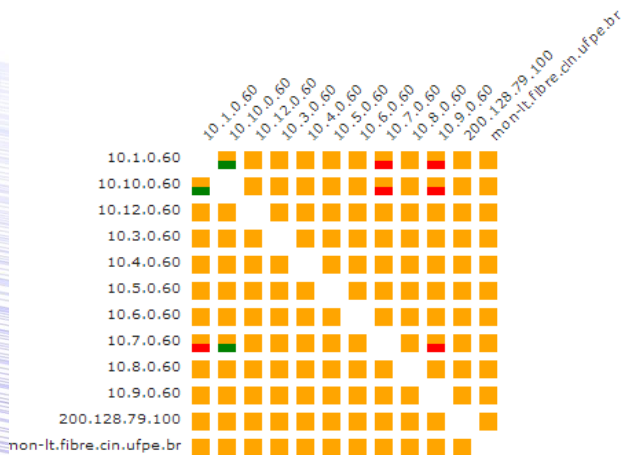
# Monitoring Federation Use Cases Infrastructure Measurements

- perfSONAR Dashboard prototype implementation

## FIBRE-BR Dashboard

OWAMP

■ Loss is 0
 ■ Loss is greater than 0
 ■ Unable to retrieve data
 ■ Check has not yet run

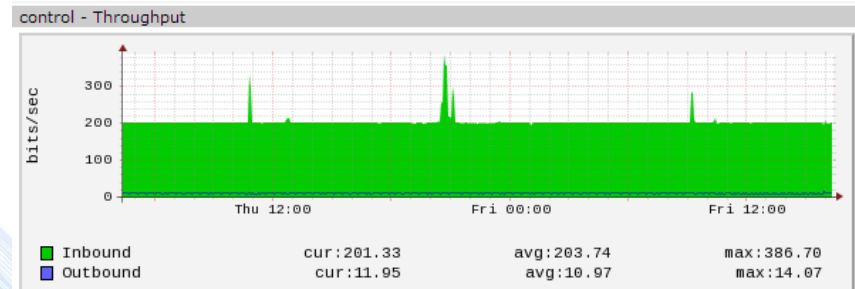
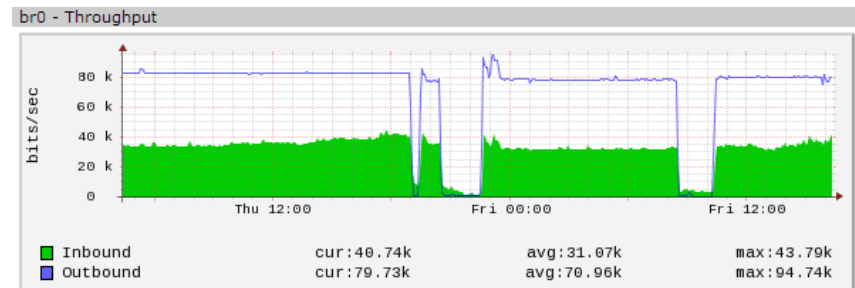
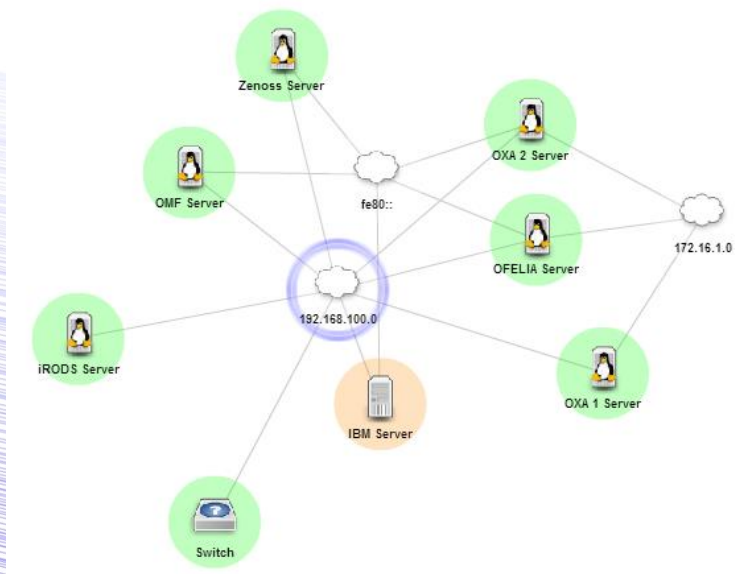




# Monitoring Federation Use Cases

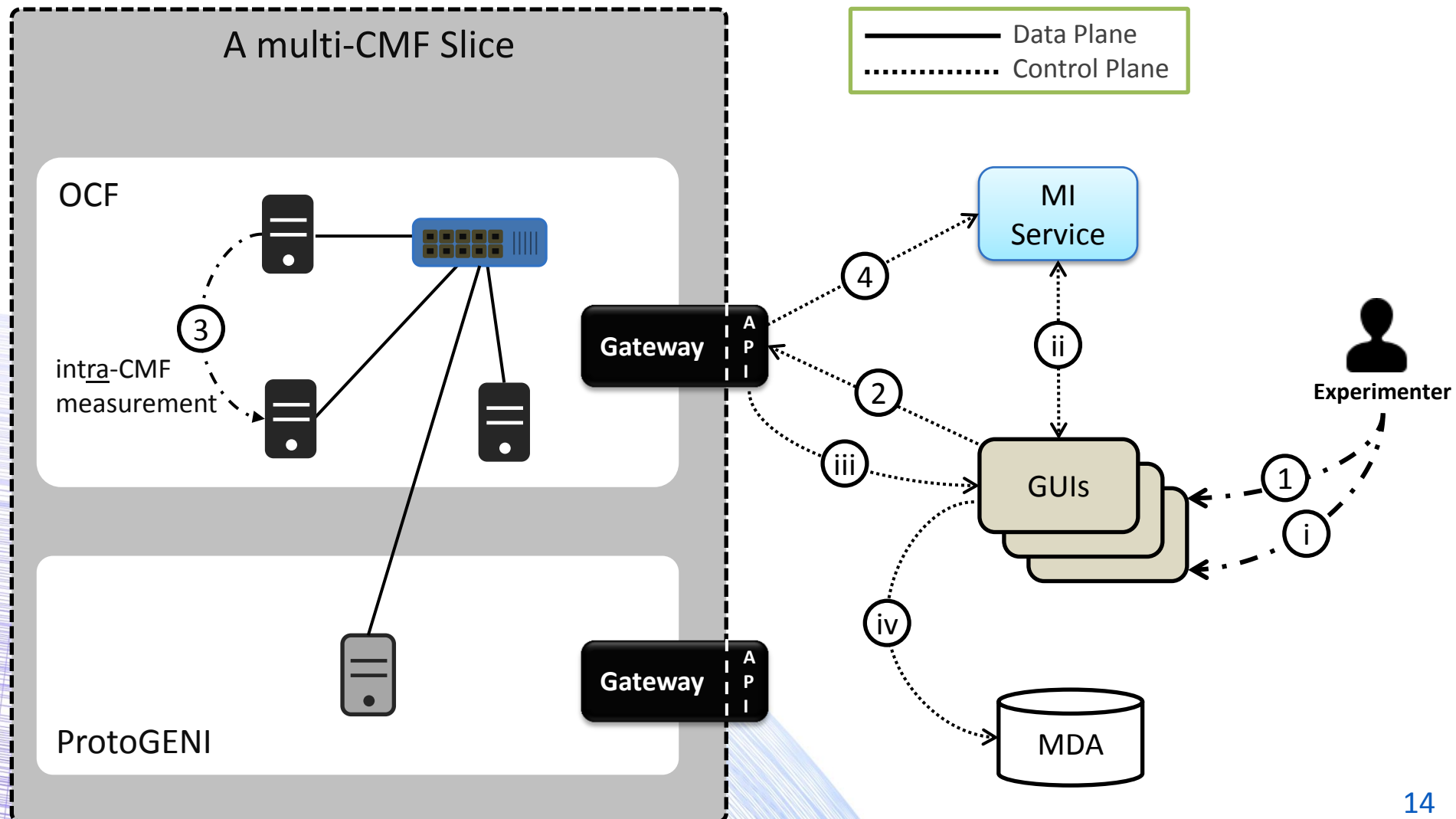
## Infrastructure Measurements

- UC 2: Infrastructure **passive** measurements
  - Monitoring a variety of metrics (CPU, memory, NIC utilization, etc.)



# Monitoring Federation Use Cases

## UC 3: Intra-CMF measurements





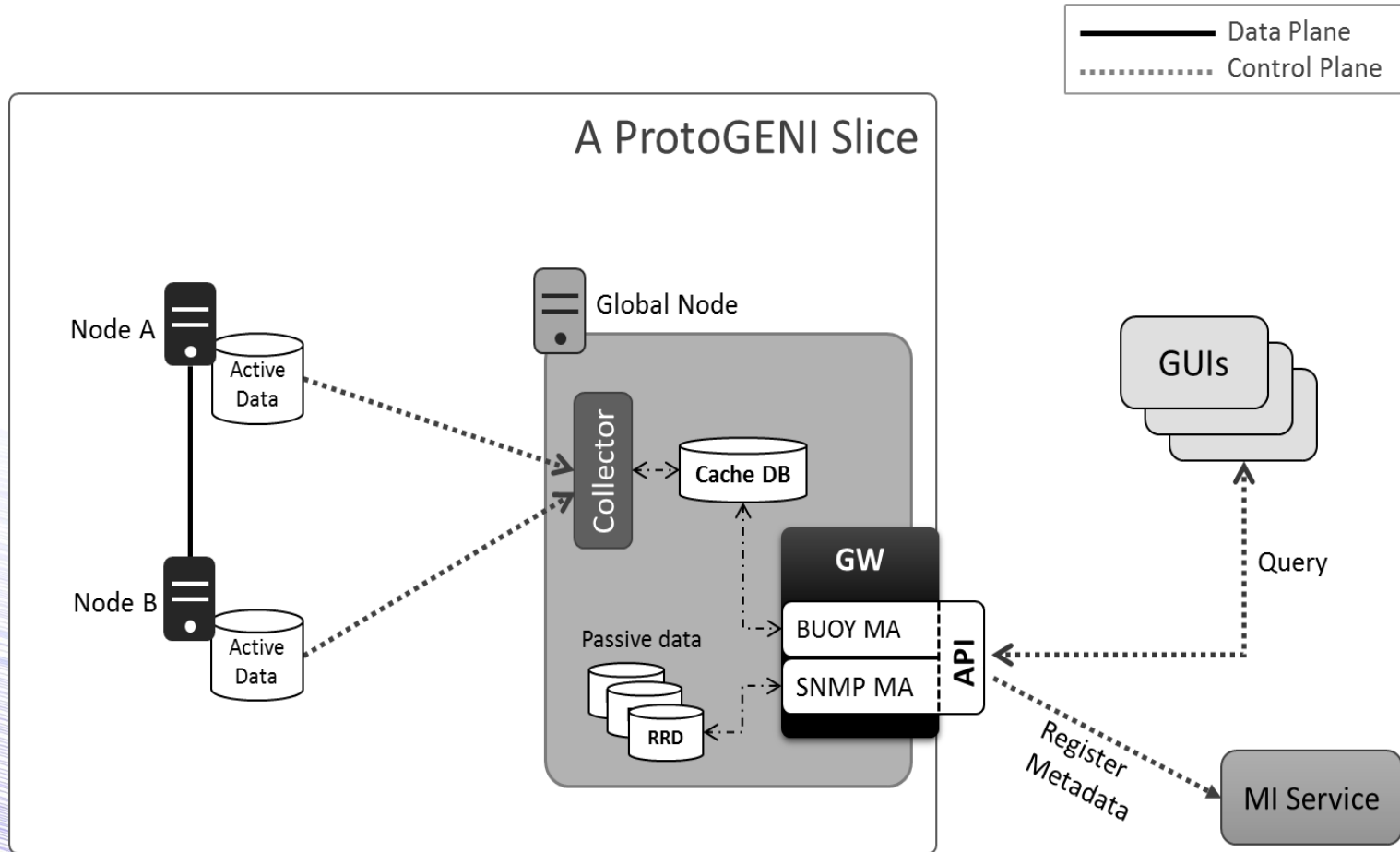
# Monitoring Federation Use Cases

## Experiment/Slice Measurements

- UC 3: **Intra**-CMF measurements
- Proposal:
  - CMF's native I&M software (e.g.: GEMINI on ProtoGENI) is responsible for the measurement management and configuration (the experimenter will use the CMF's I&M Portal)
  - Gateways (such as MDIPs) are responsible for exposing the measurement data collected by the CMF's I&M software in a standardized format

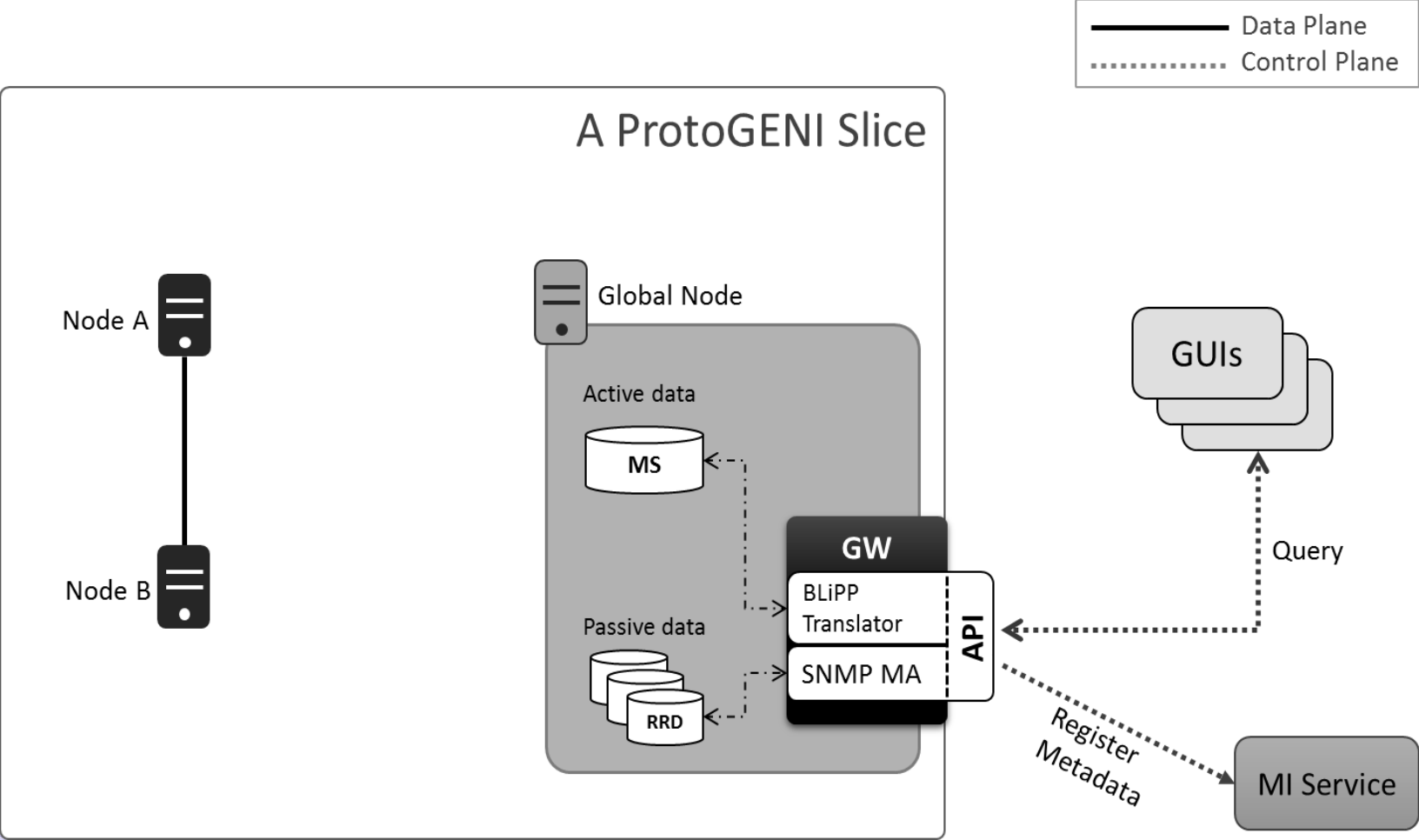
# Monitoring Federation Use Cases

## UC3: ProtoGENI MDIP (Implemented)



# Monitoring Federation Use Cases

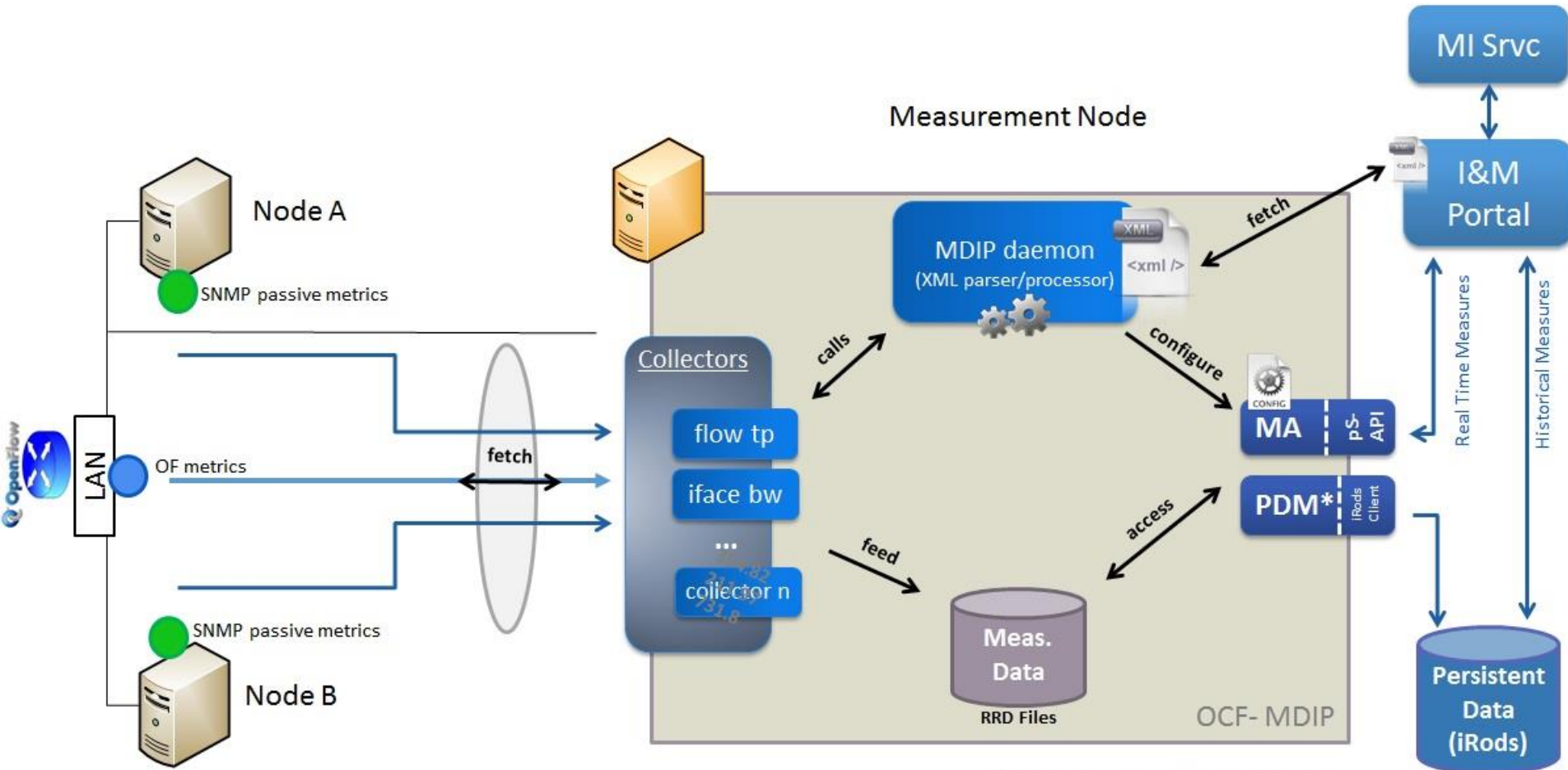
## UC3: ProtoGENI MDIP (Proposed)





# Monitoring Federation Use Cases

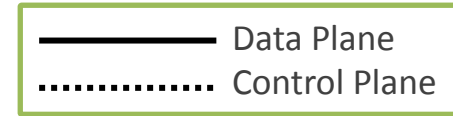
## UC3: OCF MDIP



\*PDM: Persistent Data Module

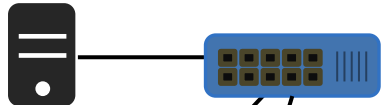
# Monitoring Federation Use Cases

## UC 4: **Inter-CMF** measurements



A multi-CMF Slice

OCF



M. Tool



③ inter-CMF measurement

M. Tool



ProtoGENI

Gateway

A  
P  
I

Gateway

A  
P  
I

④

MI Service

②

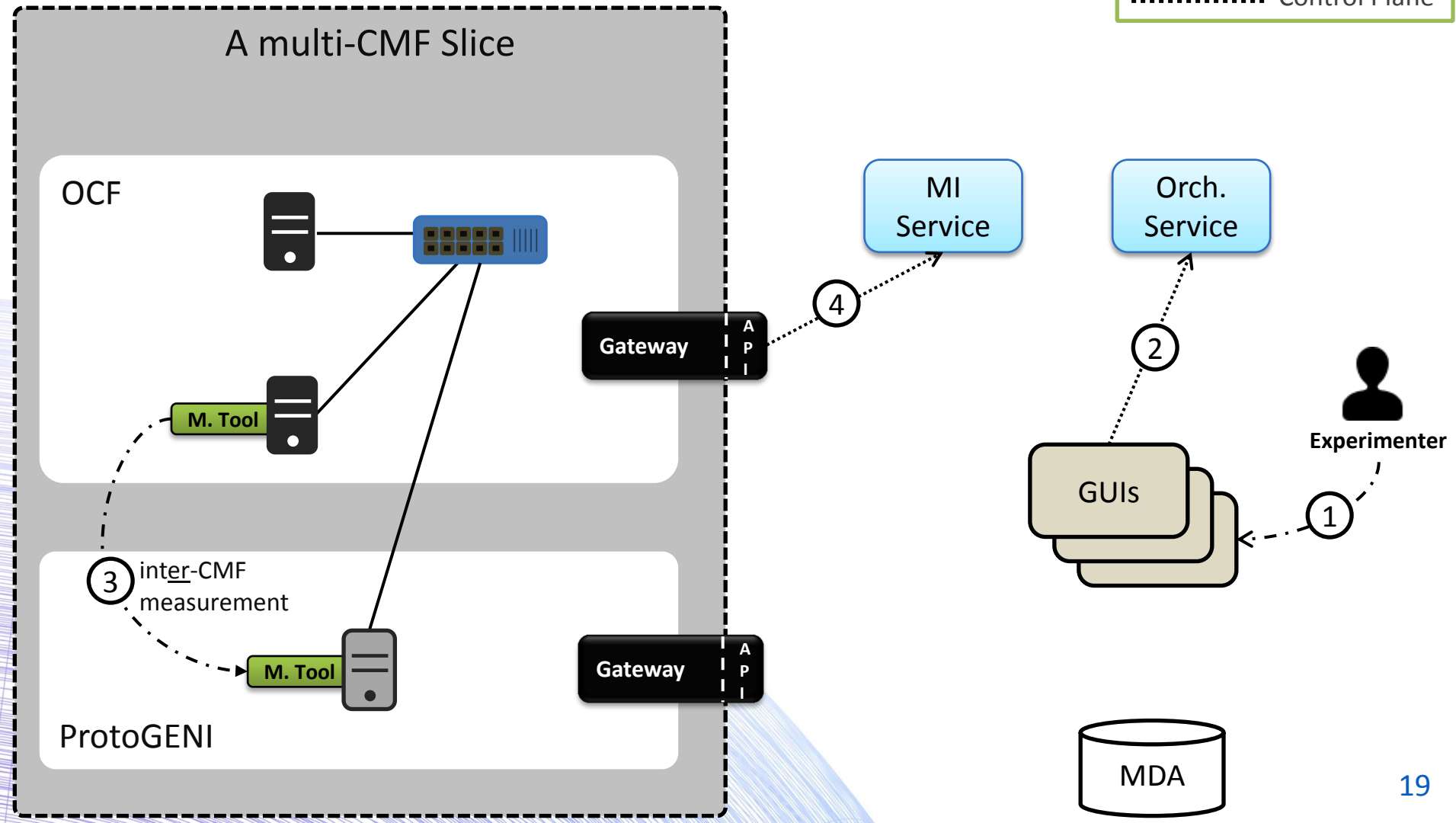
Orch. Service

Experimenter

①

GUIs

MDA



# Monitoring Federation Use Cases

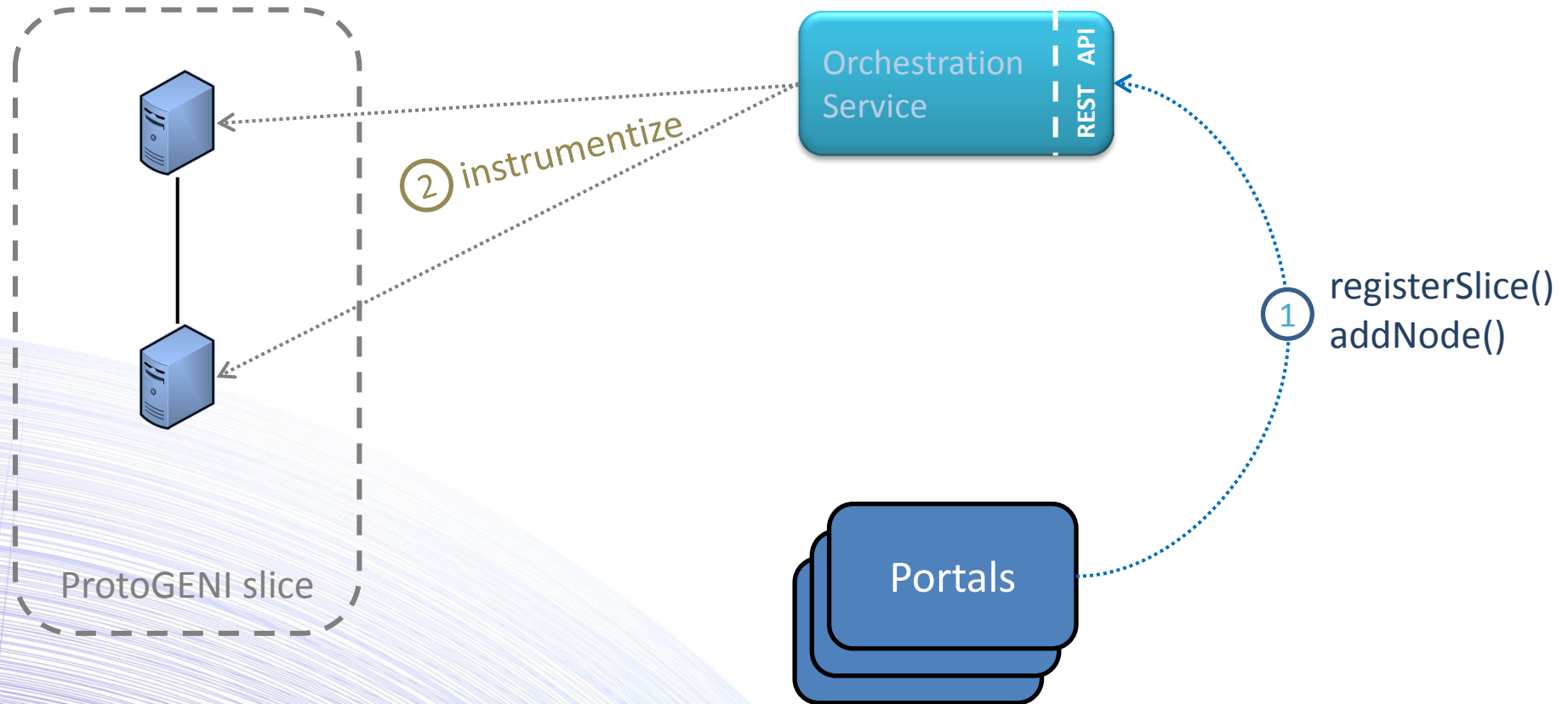
## Experiment/Slice Measurements

- UC 4: **Inter**-CMF measurements
- Proposal:
  - Each node, regardless of “its CMF”, comes with a common measurement tool pre-installed. This way, measurements become possible between any node pair
  - A gateway abstracts the configuration and data exposal complexities of the common tool through a standard API, so:
  - The experimenter can use **ANY Portal** to configure measurements and retrieve data
- Alternatives:
  - perfSONAR BUOY
  - OML



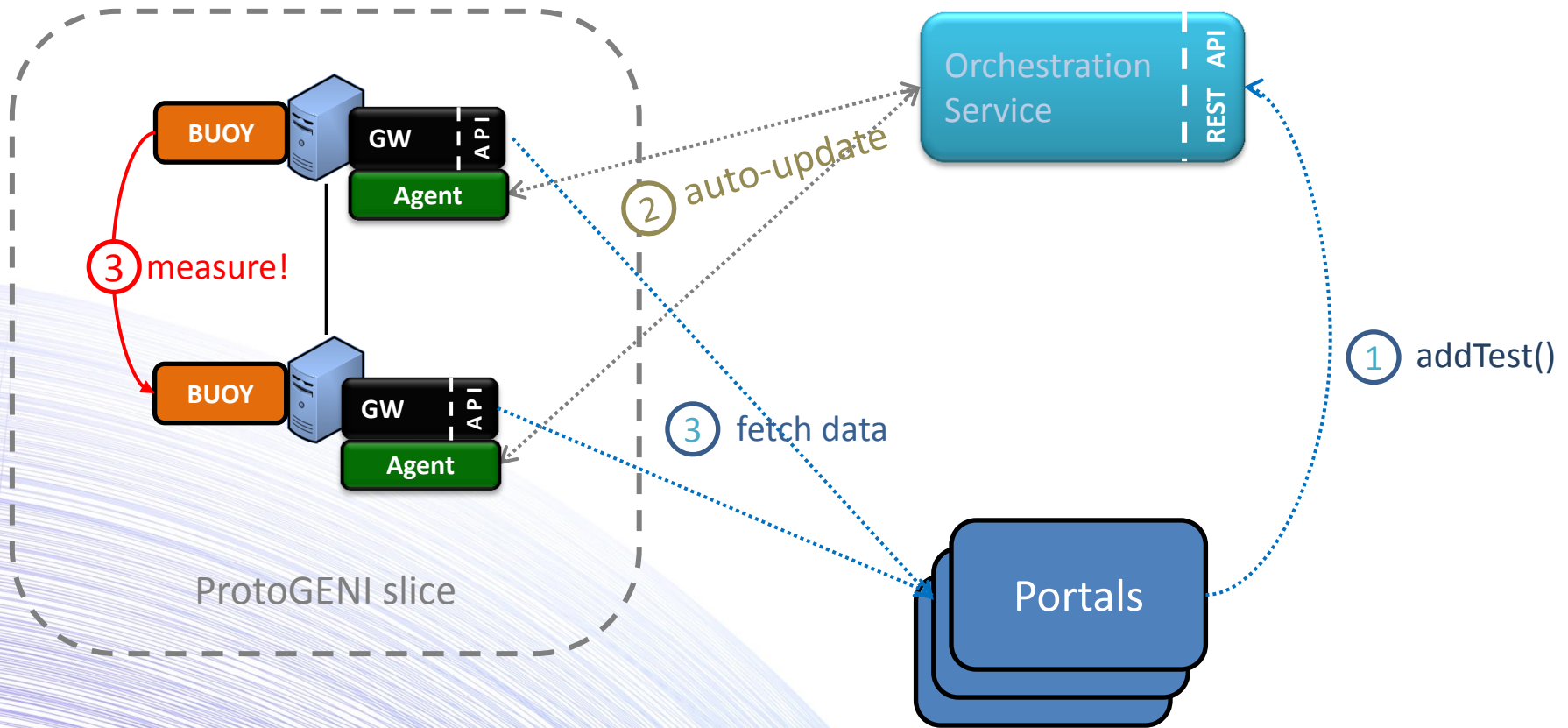
# Monitoring Federation Use Cases

## UC4: Instrumentation Phase



# Monitoring Federation Use Cases

## UC4: Measurement Configuration Phase



# Monitoring Federation Use Cases

## UC4: OML MDIP

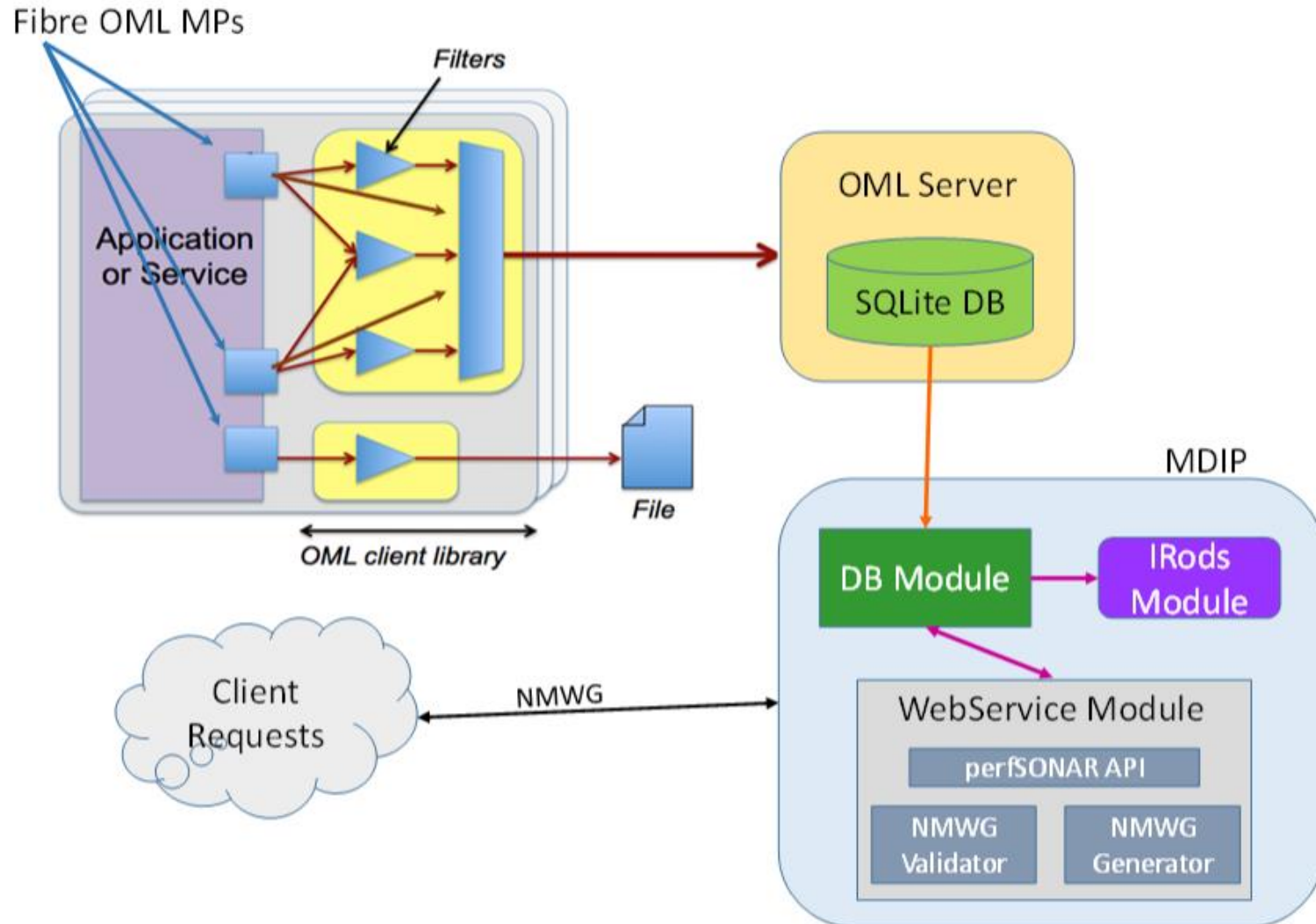
### Goal:

- Turn OML into a perfSONAR-enabled solution
  - PS-like query for experiment data:
    - NMWG measurement data format
- All communication will be made through Web Services to receive and retrieve data



# Monitoring Federation Use Cases

## UC4: OML MDIP



# Monitoring Federation in FI Testbeds

## Challenges/Issues

- Testbeds Federation x Multi-Domain
  - Specially for Infrastructure measurements (each testbed uses its own tools)
- Need for a common data measurement report format and protocol
  - Webservices, NMWG (XML x JSON), NML, extended with other resources (servers, VMs, etc.) measurement report formats
- Need for measurement tool gateway in case of similar but heterogeneous tools
  - E.g., Owamp x ETOMIC
- Extend SFA with a sort of MSpec (Measurement Specification)
  - To retrieve, reserve (if necessary), schedule tests, and fetch data from available infrastructure measurement resources

# Monitoring Federation in FI Testbeds

## Challenges/Issues

- Universal Measurement Information?
- Measurement software tools deployed as experimenter own software:
  - Hopefully without requiring that the experimenter be a measurement expert
  - Avoids heterogeneity problems
- Specialized Hardware Measurement Tools:
  - E.g., DAG cards, wireless band interference monitors, etc.
  - Availability and heterogeneity issues
- Persistent data archiving (format and location issues)
- Experiment repeatability issues:
  - Specialized resources may not be always available



# Monitoring Federation in FI Testbeds

## Challenges/Issues

- Constraint based resource orchestration:
  - Orchestration agent for each CMF and one summary agent for the island



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# Thank you

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