

# Performance Monitoring

**12th TF-NGN meeting,  
Cambridge (UK), 15-16/09/03**

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DANTE**

# Where does the project come from?

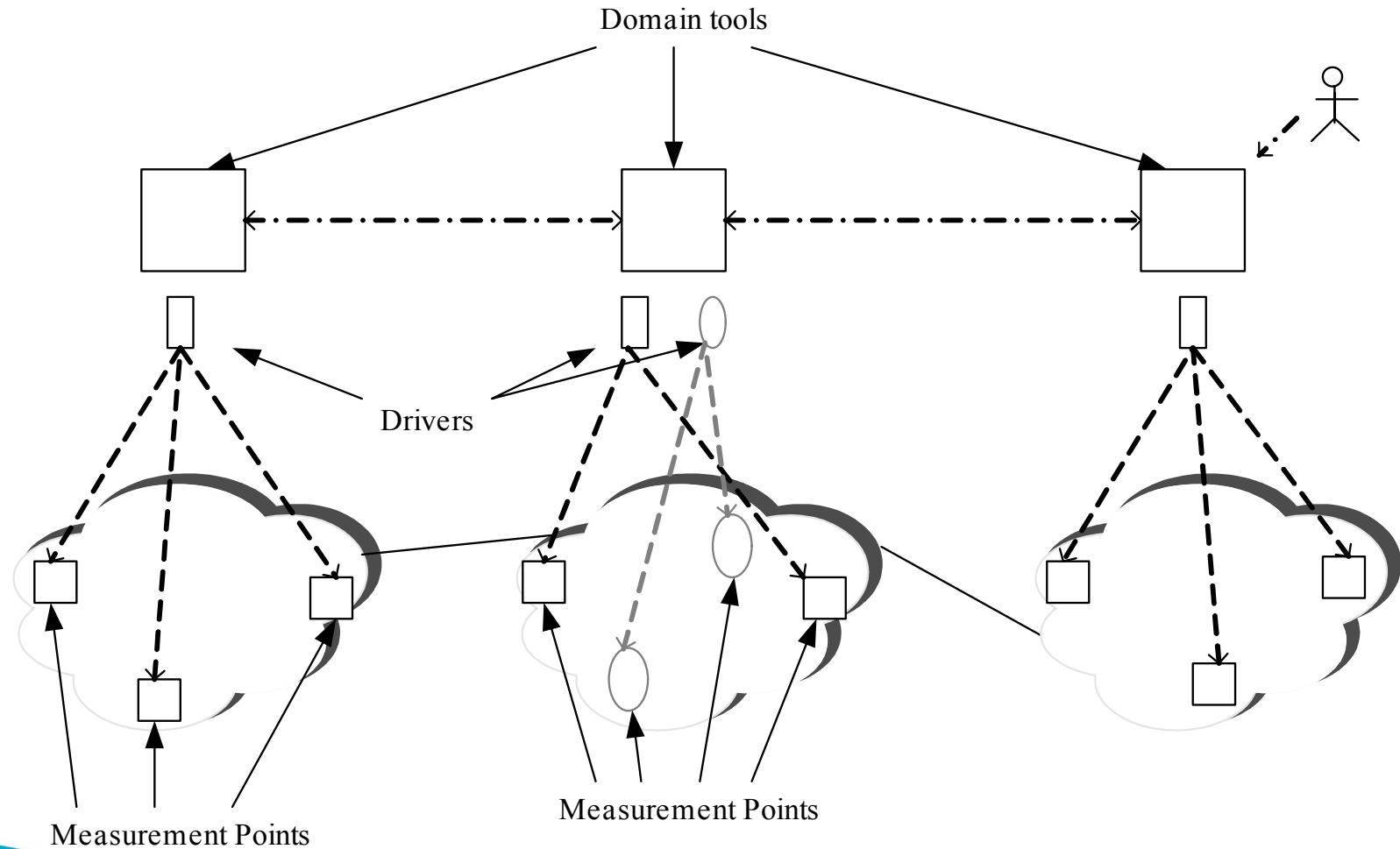
- **PERT/PRT and the need of addressing the end-to-end problem and provide for the network side a tools for the PERT group.**
- **Users and users' users are requesting more and more networks statistics.**

# Overview

- **Objectives**

- Exchange monitored data between domains to
  - Ease the troubleshooting
  - Give to the network users some views of the networks-edge to network-edge performances (later on end-to-end if software developed for end-users, not primary objective of the performance monitoring).
  - Network/service health verification.
  - SLA verification
- Re-usable parts (as much as possible).
- Extendable to new type of tests.

# Performance Monitoring Overview

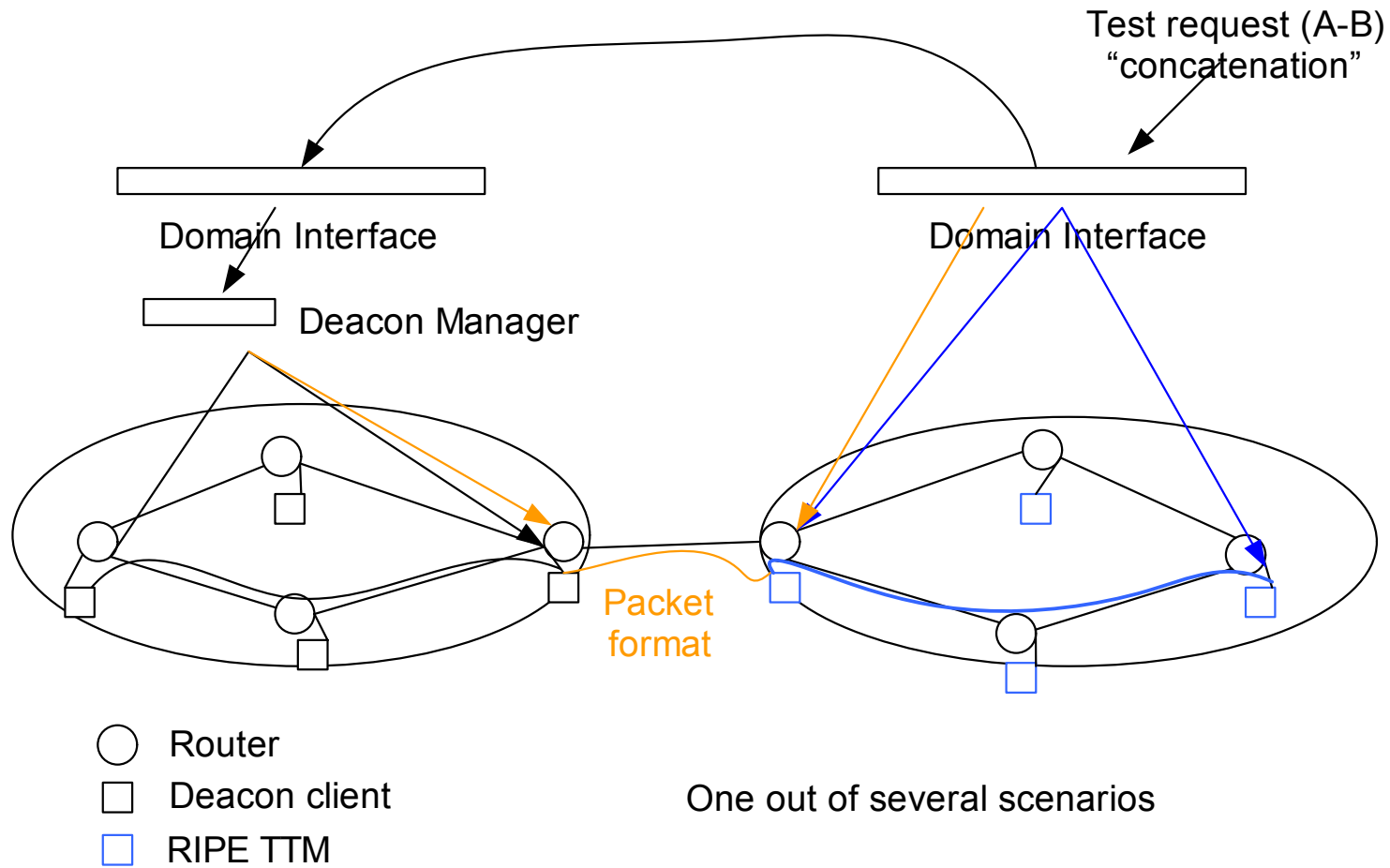


# Performance Monitoring Overview

- **Measurement Point (MP)**
  - “something” (router, piece of software, etc) capable of providing information about a network characteristics (delay, routing info, interface status, etc)
- **Interface**
  - presents network information from a domain, under a pre-defined format, to the outside world.
    - The interface can also presents concatenated information coming from several domains.
  - Allows to start measurements from/to MPs not under our administrative authority.

## Assumptions

- **Different networks have different monitoring architecture (tools, measurement methodologies). This has implications on our tasks:**
  - a) investigate if there is no “minimum requirement” to be fulfilled to run one type of test in different domain
    - test methodology, statistics to aggregate/concatenate measurements.
  - b) for active monitoring, packet format should be standardised (different domains used different type of boxes)
  - c) request to start a test, reserve resource for a test between two domains



# Assumptions

- **Currently, inter-domain not very well monitored.**
- **Every domain must stay in control of their monitoring infrastructure**
  - do not want to depend on a central tool
  - want to decide who can retrieve data from the domain and which data
  - they are in control of who can access the resources, how much and how often
    - need of AA between domains and rules to authenticate users from other domains, find out their privileges
    - domainX.userX -> domainX.groupX(.userX) -> privilegesX
    - bilateral agreements between the domains involved or bilateral agreement between “peer” networks (and customers of peer networks included in the agreement as one or several specific classes).

# Working areas

- **The work has been subdivided into several working areas**
  - Tests/metric definition. -> *news*
  - Domain interface (was Inter-domain measurement request).  
-> *news*
  - Path finder. -> *news*
  - Measurement protocol.
  - User representation and statistics.
  - Data storage, retrieval and analyses.

# Working areas

- **Working areas [cont.]**
  - Domain tool architecture. -> *news*
  - Domain tool implementation. -> *news*
  - Measurement box guidelines.
  - Trial. -> *news*

# Working areas

- **Tests/metric definition.**
- Domain interface.
- Path finder.
- Measurement protocol.
- User representation and statistics.
- Data storage, retrieval and analyses.
- Domain tool architecture.
- Domain tool implementation.
- Measurement box guidelines.
- Trial.

## Tests/Metrics Definition

- **Need agreement on which tests/metrics/parameters we are willing to develop.**
- **So far have been working on one-way test**
  - Metric from IPPM (OWD, IPDV, OWPL, re-ordering, RTT) and traceroute.
  - Will be used for trial as an infrastructure already exists (RIPE TTM boxes).
  - No generic traffic pattern to be used have been defined yet to get the best representation of the network performances.  
*Looking for people having work on the topic or able to provide some help/advices.*

## Tests/Metric Definition [Cont.]

- **Are investigating the needs**
  - Need input from NRENs, TF-NGN, APM, group of users to know what they need, in which direction we have to go later on. **Feedback needed and very much appreciated.**
- **To evaluate these needs two documents are drafted**
  - list the existing monitoring tools deployed within the different NRENs, their characteristics and to who they are addressed.
    - The goal is to find out the different groups using the monitoring infrastructure and isolate some common characteristics for each groups.

## Tests/Metric Definition [Cont.]

- **To evaluate these needs two documents are drafted [cont.]**
  - The second one presents a different approach which is to list the different groups of users and their needs/dreams (or the ones extrapolated by us) in term of monitoring.
- **Notes**
  - The goal is to have an infrastructure as widespread as possible amongst the research community.
  - Test can be active or passive, information taken from a router or a PC, etc
  - Need also to take into account what is currently done by the various network involved.

# Working areas

- Tests/metric definition.
- **Domain interface**
- Path finder.
- Measurement protocol.
- User representation and statistics.
- Data storage, retrieval and analyses.
- Domain tool architecture.
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# Domain Interface

|                |                           |                       |    |
|----------------|---------------------------|-----------------------|----|
| Path<br>Finder | Performance<br>monitoring | Looking<br>glass data | AA |
|----------------|---------------------------|-----------------------|----|

- **Interface with pre-defined message format (XML -> easily extensible)**
- **Broader than just performance monitoring.**
- **Most important part of all, allow the domain to implement their monitoring architecture “below” the interface as they want. That’s the only bit really mandatory.**

# Domain Interface

- **Path finder**

- for a given traceroute, provides the domains and the MPs which have to be contacted along the path
  - provides the MPs within the domain and the adjacent domains which need to be contacted (discovery)
  - can also be extended to provide all the MPs and all the domains along the path
- Provides the domain capability (in term of MPs and parameter they can deal with -e.g. ipv4, ipv6, port number, tos value, etc) to the outside world.

# Domain Interface

- **Performance Monitoring**

- receive request about the metric related to the performance monitoring (delay, packet loss, available bandwidth, etc) and send result of the request to the requester .
  - Messages have a predefined format.
  - The request can concern simple network characteristics information measured and stored in the domain or which can be directly retrieved from a MP (e.g. 5 min average delay between two MPs between t1 and t2).
  - They can concern more complex requests as the concatenation of delays along the path to provide a single value or provide a per domain view of the end-to-end delay

## Domain Interface [Cont.]

- **Performance Monitoring [Cont.]**

- receive request to start a test involving MPs (within the domain or not). This allow to run tests between MPs located under different administrative authorities.
  - NOC would ask e.g. for 5min averages over the last 4 weeks per link along the path, or last 5 min - min, avg, max values for all the link following the path.
  - an end-user would need “pre-digested” data between the edge of the network to the other edge.

## Domain Interface [Cont.]

- **Looking glass**
  - very much the same as performance monitoring, it provides “looking glass” type of information under a pre-defined format (covers what the existing looking glasses do).
    - Powerful in combination with the path finder to allow recursive operations across several routers/domains.

## Domain Interface [Cont.]

- **AA (suggestion)**
  - only if AA distributed between different domains
  - receive request to authenticate a user from its own domain and to associate him with an defined group
    - e.g. domainX.NOC or domainX.user\_type
  - the mapping to a group allows the people mapped to it to access the data and resources for the scheduling they are allowed to.
  - send request to authenticate a user from another domain and map it to a group
- **Other group working on the interface**
  - <http://www.hep.ucl.ac.uk/~pdm/e2epipes/domain.html>

# Working areas

- Tests/metric definition.
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- **Path finder.**
- Measurement protocol.
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# Path Finder

- **Goal: locate the measurement nodes along a end-to-end path. (could also provide the domain and domain measurement nodes capabilities).**
  - Two cases
    - the full path is given
    - only end points are given
      - trickier
  - historical path variation difficult to provide (implies limitation concerning the end-to-end information which can be provided).
- **Work lead by SWITCH (Chris Welti).**

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# Measurement Protocol

- **Mainly needed for active tests between different type of equipments.**
  - Specify the packet payload format to be understandable by different measurement boxes type.
  - E.G. for OW test, Internet2 is developing OWAMP.

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# User-representation and Statistics

- **Metric Concatenation**

- A statistical work has to be done to provide guidelines on how to concatenate measurement taken from different domains.
  - This concern mainly the end-user representation.

- **Statistics**

- Will start with simple function as averages, percentiles.
  - Agree on a minimum common set of statistics which are meaningful and which can be used for a type of measurement

# User-representation and Statistics

- **User Representation**
  - What is the best way to represent the information to the user?
  - How to have this information understandable for a non-technical user?
  - How to represent on a screen the behavior of a network? (a bit as a plane cockpit)

# Working areas

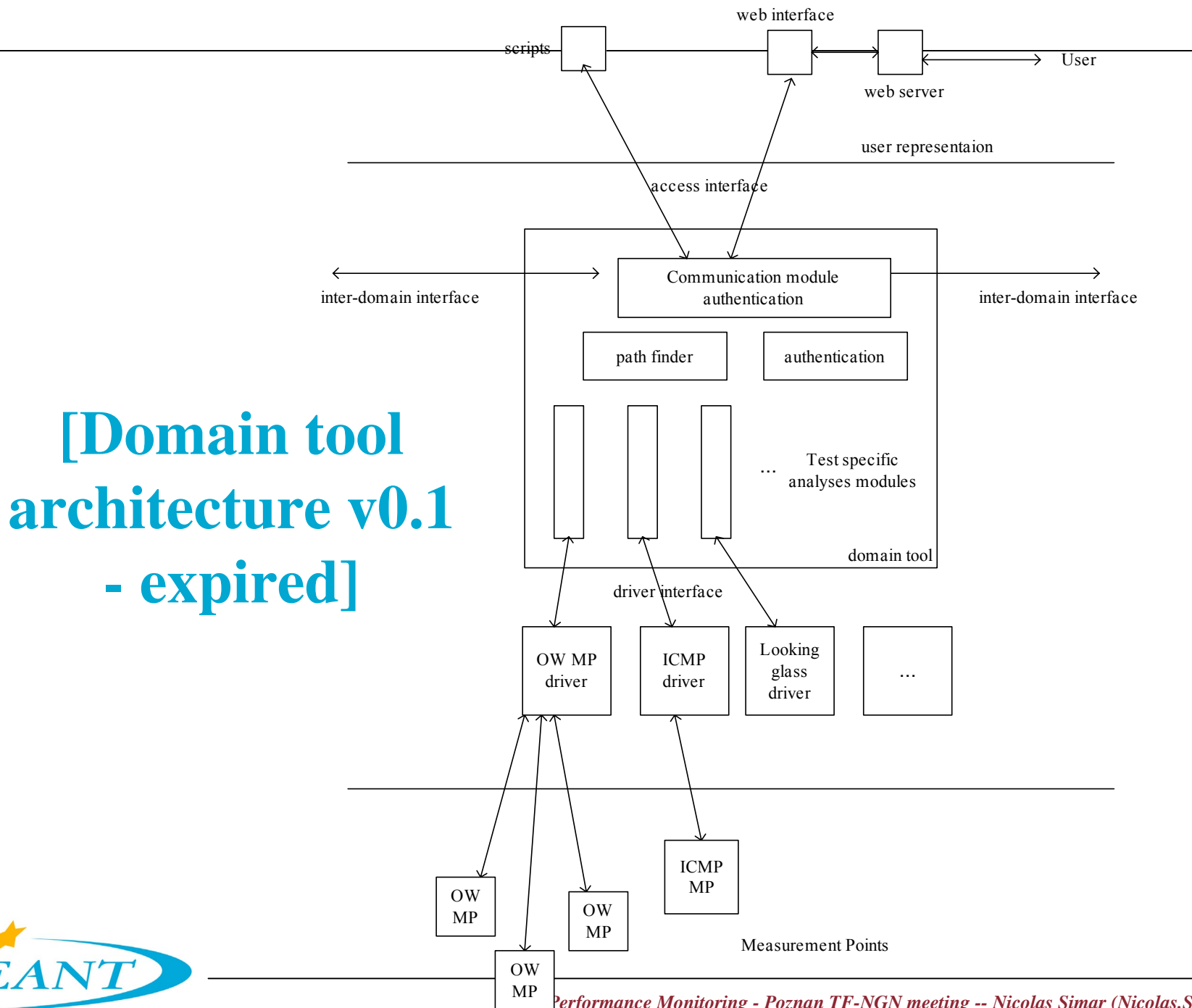
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# Data Storage, Retrieval and Analyses

- **Data storage**
  - a database to store the measurement information seems to be needed (according to the first experiments done).
    - Internet2 is using one. They feel there is a strong need to improve the population of the database (tuning needed).
  - Minimum requirement: storage of the raw data for 4 weeks.
    - To allow post analyses, for larger period of time aggregation is most likely sufficient.

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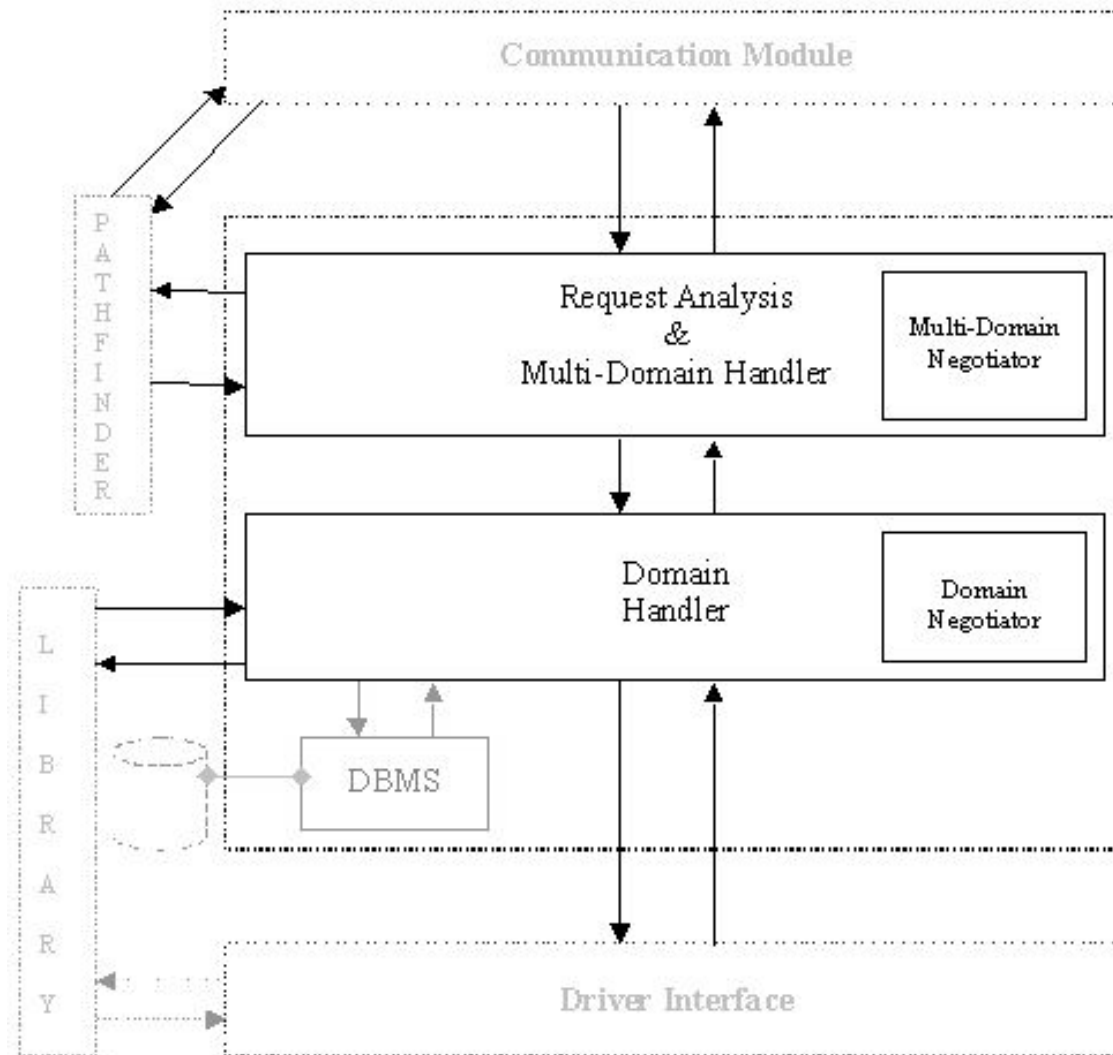


**[Domain tool architecture v0.1 - expired]**

# Domain Tool

- **Loukik has refined the domain tool model and implemented some parts of it.**
  - It has allowed us to find out some issues which need to be addressed such as
    - the need of a a proper database to store the data rather than retrieving them from the RIPE (particular to the way RIPE is storing the data).
    - The user requesting raw data will have to be patient.
  - The tool hasn't yet been used in a multi-domain environment.

# Analyser module v0.3



# Analyser Module

- **The analyse module is splitted in two (new, following UCL workshop)**
  - the multi-domain part
    - based on user request, ask the path finder about the MPs and the domains which need to be contacted.
    - Request the data to the domain layer and to the other domain multi-domain layer (via the domain interface).
    - Negotiate the test with other domains (when data not existing)
    - aggregate and concatenate data
    - format the data according to domain interface and the request needs (single values, one value per domain, one per link)

# Analyser Module

- the domain part
  - receive request from multi-domain part (request including MPs)
  - request data for a single measurement to the driver module
  - concatenate/aggregate the measurement for the domain
  - send the data to the multi-domain layer
  - can negotiate the test with the domain's MPs
  - can check the allow or not a test (
  - used MNGW hierarchy for the metrics
  - Has access to the database (or the driver has access to it)

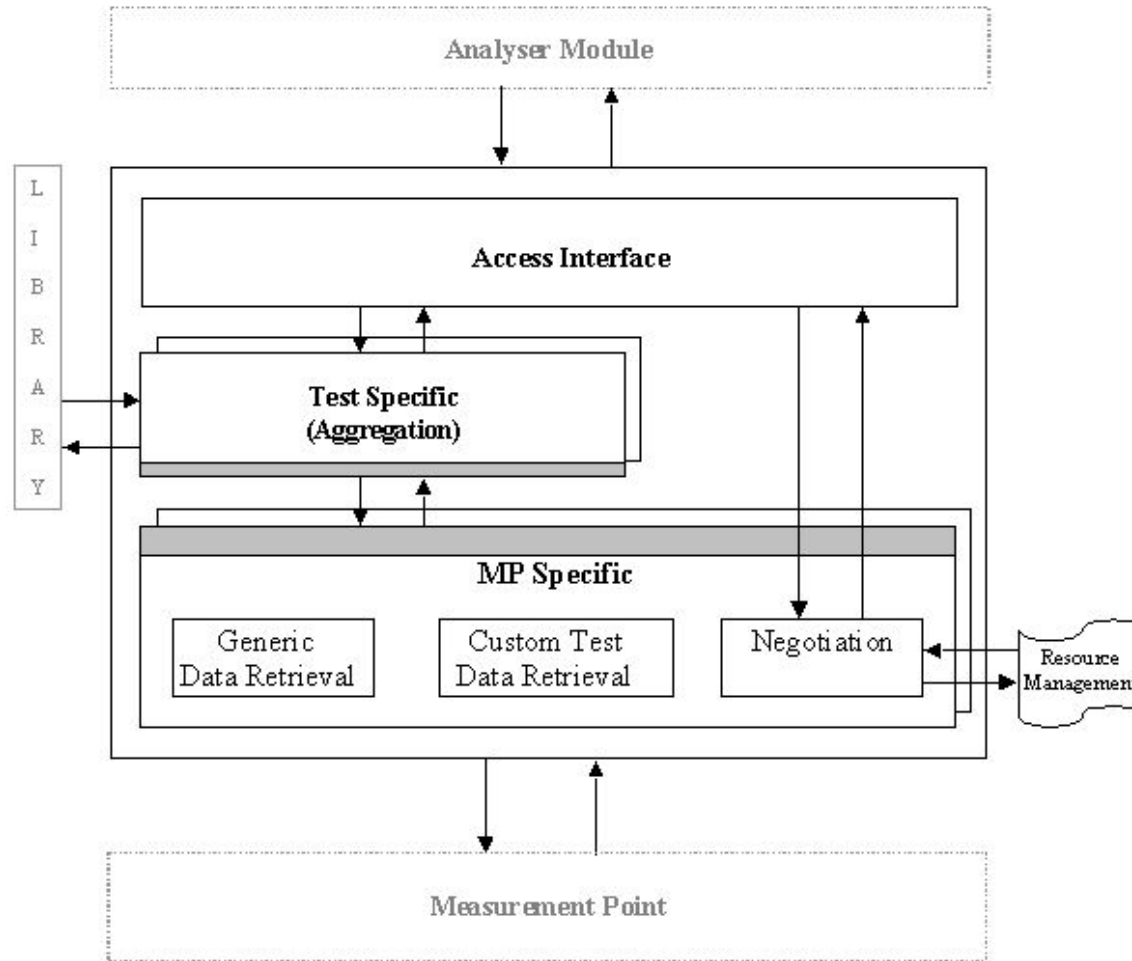
# Driver Module

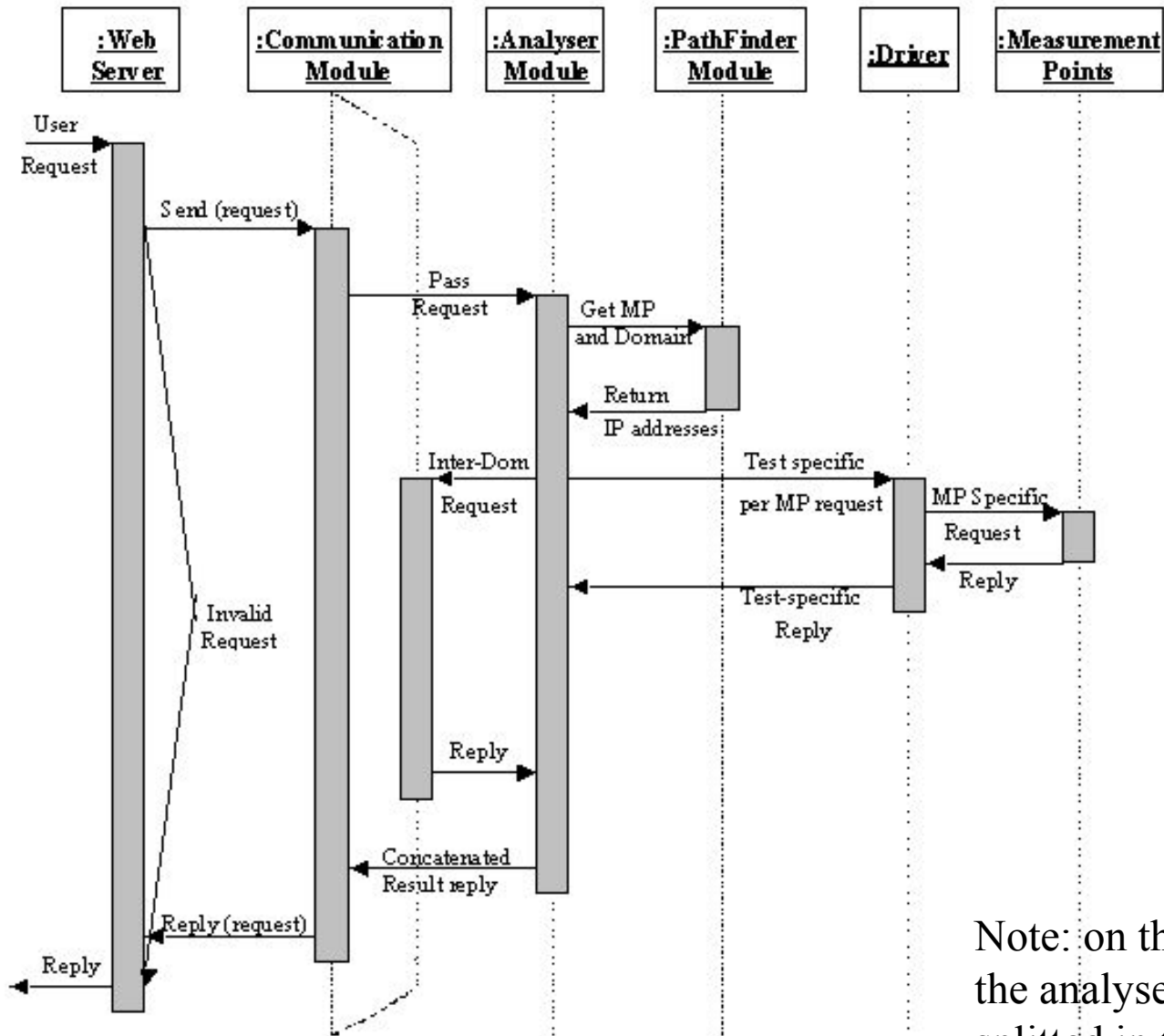
- **Responsible to provide the monitored information to the analyser module.**
  - Make the type of measurement point transparent to the analyser module.
    - Specific for a type of test
    - Receive notification from the analyser module to retrieve monitored information (corresponding to set of parameters) from a measurement point.
    - Connect to the MP (or database?) and extract the information (it does all the MP type specific actions)
    - capable of test scheduling and test negotiation
    - capable of aggregating the data

## Driver Module [cont.]

- send the information to the analyser modules via a specific interface (idea: could use this specific interface right below the domain interface in such way that when a request for “basic” information is coming, no need to go through the analyser interface, it provides the metric values)

# Slide Title





Note: on this representation, the analyser module not splitted in two

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- **Measurement box guidelines.**
- Trial.

# Measurement Box Guideline

- **Which goals?**
  - At least provide hardware and functionality recommendation list (and motivations for them).
  - Liase with tools/box developers
- **Provide guidelines about what equipment, what is needed to provide good measurement.**
  - HEANET, GARR and DANTE contribution -> more needed.
- **Need to have the community to agree on what is suitable to use for the long run.**

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- **Trial.**

# Trial

- One-way type of tests (use of RIPE TTM boxes)
- GARR, GÉANT, HEANET and SWITCH
  - GARR, SWITCH and HEANET already have some RIPE TTM boxes. Three RIPE TTM boxes will be installed on GÉANT.
    - One has been ordered for Geneva
    - For Milan and Dublin, distance between existing boxes in the building and the GÉANT one missing, waiting for technical information from RIPE about cat5 splitting.
- Analyser module (v0.3) and interface not completely implemented.
  - Interface still requires some specification.
- Need to add a security section to the performance monitoring proposal.

# Future

## GN2

- **In the GN2 proposal, the performance activity is foreseen as being a Service Activity -SA- (and the PERT a Joint Research Activity - JRA)**
  - GN2 starting Q3 2004
  - For SA and JRA, there is some budget for the NREN to work on (11 FTE)
  - budget to deploy few boxes within NRENs.

# Future Collaborations

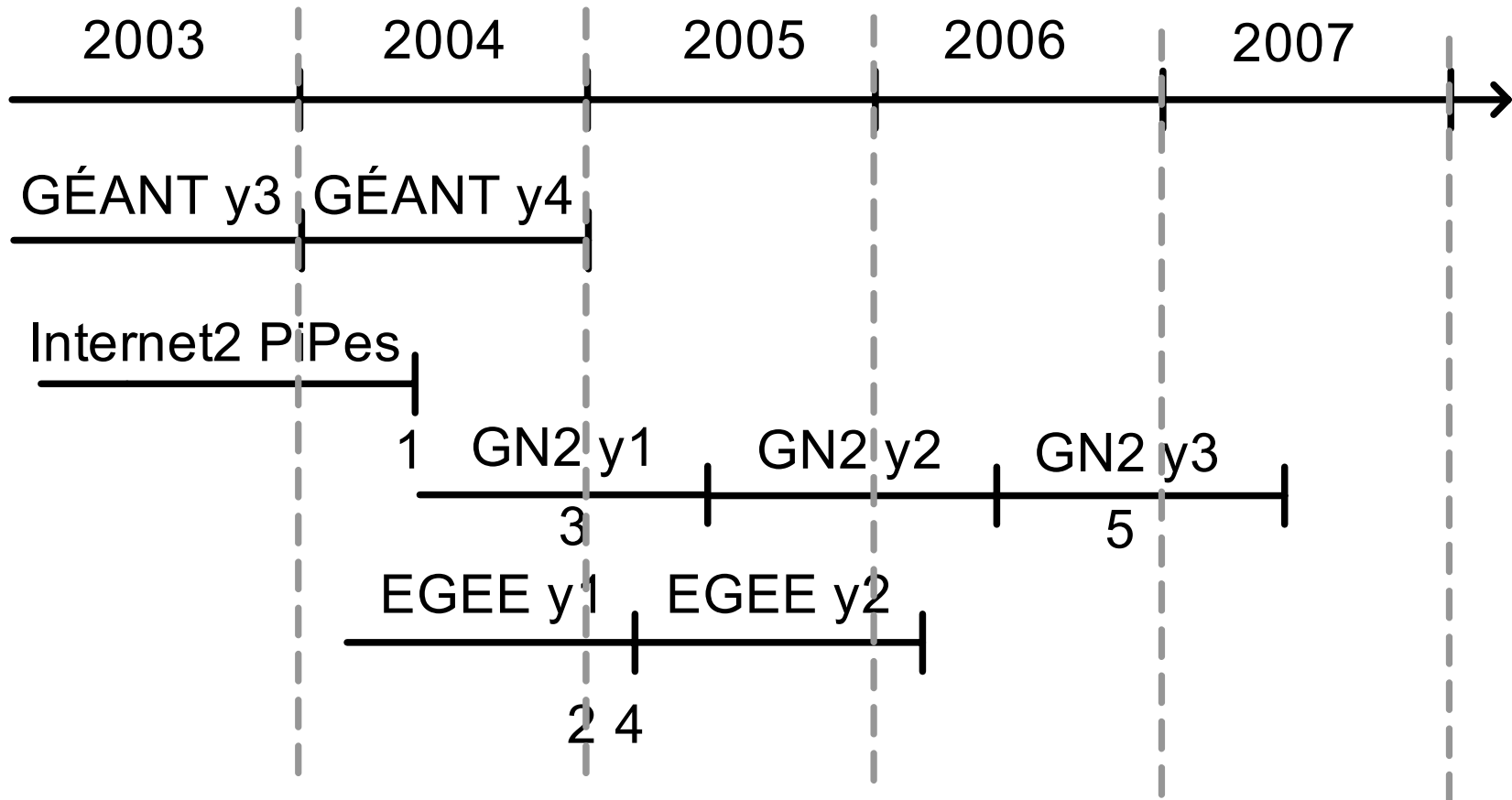
- **Other group working on the topic**
  - Internet2 PiPes initiative (<http://e2epi.internet2.edu/>)
    - already have some meeting with them
    - insist heavily to collaborate (three different levels)
      - exchange of information
      - systems inter-operable (minimum)
      - merge the projects (pro: more resources available/ideas, have already done some work; cons: timescale)
  - IST Intermon (<http://www.ist-intermon.org/>)
    - have had some contact, they suggested a collaboration, need to be investigated.

# Future

## Collaborations [cont]

- **Other group working on the topic**
  - APAN (?)
  - MBNG
    - can use their tests definition/structuration, message format a bit heavy (but maybe not understand it properly)
    - <http://www-didc.lbl.gov/NMWG/>
    - <http://www.hep.ucl.ac.uk/~pdm/e2epipes/domain.html>

# Future



## Future

- (1) Internet2 activity finished in Q2 2004, GN2 starting in Q3 2004
- (2) EGEE specifies interface in their month 9, January 2005, (3)GN2 specified at the same time
- (4) EGEE in pilot phase to use the interface in April 2005, whilst GN2 in pilot phase in 2006 (5) Need to start early and provide an interface (no need to have the full solution)

# GÉANT y4

- **Tasks which need to be done before GN2 (or early in GN2).**
  - Domain interface definition with Internet2 and measurement protocol agreement. (1) Need people to have a look at it.
  - Need advice on what to answer to Internet2. (and for evaluation).
  - Provide an interface and few measurement points for EGEE y1 to test their interface.
- **We are also interested in the following**
  - Need feedback on work already done (always welcome) to raised issues we haven't addresses yet (if any ;o)

# GÉANT y4

- **Need people to start help for the completion of the tests/metrics documents**
  - existing tools in NRENs, characteristics and users
  - users and wishes
- **Need feedback from NREN to tell in which direction to go.**
- **Trial go ahead when Loukik back at DANTE.**

# Information

- **URLs**
  - <http://www.dante.net/tf-ngn/perfmonit/>
  - <http://chx400.switch.ch/mailman/listinfo/perfmonit>

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