

# Simplified NIF for GN4 Input

**Purpose:** This NIF form is to be used for the submission of New Ideas suggested for inclusion in the GN4 Phase1 and beyond proposals. Budget estimates, information about objectives, impact, benefits, etc. as well as scope must all be supplied.

**Submit to:** pmo@GÉANT.net by January 31st, 2014 with the subject label starting: GN4Input

## Overview

<b>Project Name:</b>	Performance Architecture	Verification and End-to-End Performance Analysis	<b>Project Proposer:</b>	Jerry Sobieski
<b>Project Type:</b> GN4 Phase1 or longer term	Performance Architecture	Verification and End-to-End Performance Analysis	<b>Estimated Project Costs (best effort!)</b>	
<b>Duration proposed</b>	Phase 1: 1 yr GN4 Phase 2: TBD		Manpower in person-months also identifying specific expertise required	.5 FTE for 1 yr Network Performance SME, Network Architect, Protocol SME – Develop and document the architectural requirements and approach.  2 FTE for 1 yr: Systems software developers – One FTE to write the flow correlation and analysis system, one FTE to develop the active flow scheduling firmware and high precision time stamping capture system.  2.5 FTE @160K EUR/FTE= 400K EUR personnel
<b>Deliverables proposed (If any can be defined at this stage)</b>	1. A document describing a multi-domain network architecture that enables <i>deterministic fine-grained</i> end-to-end performance analysis of performance guaranteed virtual circuits. 2. A proof of concept demo		Hardware and equipment:	8 PC Server platforms. Sustained 10Gbps capable, with 10G NICs, 32GB memory, and high speed nic-mem-disk spooling. 8-12 TB high speed disk per server. Plus micro-programmable 10Gbps NIC(s). ~ 100K

<p>Milestones proposed (If any can be defined at this stage)</p>	<p>using automated agents to measure and analyse the performance of a 10Gbps flow across multiple autonomous domains to characterize jitter dynamics, data rate, error rate. The demo will perform fault detection, localization, and notification.</p> <p>3. Bonus Points: If possible, incorporate the high accuracy timing service (ICOF Opencall) to provide the jitter characterization timing.</p> <p>This project is intended to demonstrate the need and advantage of advanced performance verification architectures and tools that automate the process of performance verification and fault analysis in emerging advanced network services.</p>	<p>Other costs</p>	<p>Various insundry patch fibers, optical splitterscombiners, and optical amplifiers, etc. patch panel rack, etc, ~25K EUR</p> <p>Travel = 8 trips @2500 EUR = 20K EUR.</p> <p>Total= 545K EUR</p>
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## 1 Background and Reasoning

*Provide background information and the context of the project. Explain the reason for the project. What do you want to be different? What do you hope to improve? Why is the project needed? This should be the reason for the project, not the solution.*

As the R&E community deploys performance guaranteed services (e.g NSI based BoD service), and the user community begins to rely upon – and ultimately pay for – these services, it becomes imperative that both the user and the provider have the tools to verify the provisioning of these circuits. Further, if the circuit service is determined to be sub-par, there should be a deterministic process for analysing the circuit performance to determine where the failure has occurred. In order to scale and to rapidly detect and react to faults, the process must be automated.

Existing performance analysis tools such as perfSonar were developed as monitoring tools for conventional IP network service. These tools lack an underlying architectural expectation necessary for deterministic independent analysis. And so they ultimately rely upon human intervention and analysis, require active measurement (which takes the circuit out of service) and typically can only provide long term statistical characterization of traffic if/when an error occurs.

This NIF proposes to define a set of architectural network features that if incorporated into the design process will enable automated agents to detect transient events or errant behaviour that may result in subpar performance, determine where those errors are occurring, and provide fault characterization that can identify the problem and speed the mitigation and recovery process.

Key concepts in this NIF are:

1. A passive flow correlation process by which an agent can initiate the high accuracy capture of packet arrival/departure time at specific locations along a path. These captured streams are correlated to one another to determine the jitter characteristics of each packet as it passes along the path end to end.
2. Development of 10Gbps packet capture process. This capture process must timestamp each packet with a time sufficient to resolve each packet's arrival time to an accuracy one byte (thus for a 10Gbps circuit, the clock must have a nominal average frequency of  $2 \times 10^9$  hz. Further, this capture process must be able to spool the captured stream to disk for later analysis.
3. Development of an active test process. This active source will transmit traffic as required by the analysis agent. This process must be able to schedule each packet according to a desired pattern in order to provide a very well behaved source stream.
4. Development of the analysis process and protocol for communicating with the Performance Verification servers to characterize all sections of a service instance.
5. Possible packet check sum to reduce the amount of data captured for correlation.
- 6.

## 2 Objectives, Impact and Benefits

*Provide one or more bullet points to briefly describe the primary objective(s) of the project in terms of the desired outcomes. This should be expressed in the form: 'To ensure...', 'To implement...', 'To service...', 'To improve...', 'To innovate...', 'To optimize...', 'To save...', etc. For each objective mention the benefits to identified stakeholders (e.g. end-users, NRENs, large international research projects, industrial research partners, high level education, etc.) should be mentioned. A description of the expected overall impact must also be provided.*

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## 3 Scope

*Describe the areas expected to be covered or impacted by the proposed activity, such as organisational areas, systems, processes, resources.. i.e. what is 'in scope'. This is not a list of what will be done but identifying the services, areas or what, will be affected.*

*Also please enumerate specific items which although they could perhaps be related are intentionally not addressed by your proposal ("Out of Scope").*

### 1. In Scope

Performance Verification protocol development.

Software tool development for sourcing streams, capture of streams, sending captured streams to a correlation service.

Architecture specification.

Analysis sequence.

While integration of the PVA with existing perfSonar tools is not in scope, recommendations on how the PVA could be adapted to provide a comprehensive network service verification model **is** in scope.

### Out of Scope

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It is not required (or recommended) that this effort leverage existing perfonar environments.

It is not required that this effort construct a proof of concept for other service – just the NSI based Connection Service.

## 4 General Information

*Outline any potential issues, risks, dependencies, assumptions, constraints and limitations or any other points that may be useful to help assess the proposal.*

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This automated fault localization has been a long time coming. Existing tools do not adequately address this issue. The emerging NSI Framework stipulates domain boundaries that would nicely lend themselves to the divide and conquerer fault localization process. And the protocol for recursively notifying a provider of a faulty connection should map faulty segments to the provider that

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