



034115

PHOSPHORUS

Lambda User Controlled Infrastructure for European Research

Integrated Project

Strategic objective:
Research Networking Testbeds



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Demonstration and training event at iGrid'08 or SC2008

Abstract

This deliverable describes the general demonstration plans for SuperComputing 2008 conference. The SC2008 will take place on 15th-21st November 2008 in Austin Convention Center. This conference is the biggest international conference for High Performance Computing, Networking, Storage and Analysis.

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1 SuperComputing conference overview

Supercomputing Conference is expanding the frontiers of HPC by challenging the combination of computation, networking, storage, and analysis and hosting an exceptional technical program, an expanded exhibits area, an exciting education program and much more. This event is a great chance to share Phosphorus ideas in the large world-wide Grid community and to establish new cooperation agreements.

Phosphorus partners participated in SC'06 and SC'07 and were showing a demonstration of the project's practical achievements. The demonstrations showed the usability of the Network Service Plane, developed by the members of the PHOSPHORUS consortium. The Network Service Plane, which allows interoperability in a seamless environment between different NRPSs (Network Resource Provisioning Systems), was verified in an environment composed of UCLP (User Controlled Light Paths), DRAC (Dynamic Resource Allocation Controller) and ARGON (Allocation and Reservation in Grid-enabled Optic Networks). Moreover, University of Essex organised and chaired a BOF session during SC06 between the OGF Grid High Performance Networking Research Group (GHPN) and the GLIF Control Plane Working Group focused on "*Delivery of Network Services across Heterogeneous Optical Domains*". The BOF discussed solutions provided by the three research projects: PHOSPHORUS (EU), EnLIGHTened (US) and G-Lambda (JPN). All three projects are concerned with interoperability issues between heterogeneous network domains. The BOF targeted wider community awareness and participation in the main common technical challenges concerning these projects.



2 Phosphorus project plans for SC'08

During project Y2, the Phosphorus partners are also very interested in participation in SuperComputing'08 conference. It will be a great opportunity to show Phosphorus involvement and the project results for/to the Grid community.

The Phosphorus workpackages which are preparing for SC'08 participation are: WP1, WP2, WP3, WP4, WP6 and WP7:

- WP1 will present Network Service Plane (PSNC booth),
- WP2 will present G²MPLS Control Plane (PSNC booth),
- WP3 will be participating in NSP and G²MPLS demonstrations,
- WP4 will present GAAA toolkit with Internet2 cooperation (University of Amsterdam booth),
- WP6 will configure and maintain testbed resources taking part in demonstrations,
- WP7 will organize PSNC (PIONIER) booth and provide Phosphorus promotion materials: NSP and G²MPLS demonstrators will be placed. in the PSNC booth.

Currently (8 month before the event), Phosphorus project has prepared the first round of plans for SC'08. These plans are rather general, refer to functionalities currently under current development and, thus, contain a set of potential demonstration scenarios. We should expect these plans to be clarified around September/October 2008 when many developments will finished.



2.1 Network Service Plane (NSP) demo

2.1.1 General considerations

Work package 1 will perform a demonstration during SC08 where interoperability will be the main feature to be shown. Interoperability will be achieved and demonstrated in different dimensions:

- Among domains controlled by different Network Resource Provisioning Systems (NRPSs) such as ARGON, DRAC, UCLP/ARGIA and a GMPLS domain controlled by a “Thin NRPS” by means of the Network Service Plane (NSP).
- Among the NSP and the Grid Applications by means of the Middleware (using its Metascheduler System, MSS) developed within WP3.
- Among different NSPs, either in a hierarchical or in a peer-to-peer architecture.
- Among the whole Middleware-NSP-NRPSs architecture and other systems, such as G²MPLS from WP2, Autobahn from Géant2 JRA3 or even IDC from Internet2.

The first two items in the list above have already been achieved by the elaboration of this document. The third item has partially been achieved, since different NSPs can currently interoperate in a hierarchical architecture. The distributed interoperation among different NSPs is under development and will be delivered by M24, although a working prototype is planned to be working before the official delivery date.

The last item of the list is planned to be delivered officially by M30. However, a joint demonstration will be considered if the G²MPLS prototype provided by WP2 is available and enough stable for testing before SC'08 event. In parallel, interoperability work with Géant2 JRA3 and Internet2 will be carried out. If feasible, joint demonstrations with these external projects will also be considered.

The demonstration to be carried out by WP1 at SC'08 will follow the main workflow used up to date with any necessary modification if other systems considered. It must be considered that connectivity facility at the venue is highly critical. First of all, the feasibility of extending the Phosphorus test-bed up to the venue has to be determined. As WP6 is in charge of these tasks, WP1 will contact WP6 in order to sort it out. At this point, there are two options for the WP1 demonstration:

1. If the test-bed can be extended to the venue, a joint WP1-WP3 demonstration can be performed live. Thus, any Grid application client can be located at the venue and directly connected to the test-bed. In this situation, visitors will experience themselves the interoperability by being able to request an advanced reservation of Grid and network resources directly from the client. Additionally, a computer with the WP1 Administration GUI can be used to show the effects of the client's action inside the MW-NSP-NRPS architecture.



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2. If the test-bed cannot be extended to the venue, remote connections to Grid clients or to user hosts will be performed. This option will degrade visitors' experience in the site of the event, but will demonstrate interoperability just as the aforementioned option.

In the second option, depending on the dedicated bandwidth available at the site of the event, different remote connections can be considered. Remote desktop connections can be done using either RDP protocol from Microsoft or NX Server/client architecture from NoMachine, if the available bandwidth is high (over 20 Mbps). These two protocols allow easy video visualisation in the remote client but are very bandwidth consuming when showing a video from the server. If the bandwidth is too low for RDP/NX, VNC can be used as it is less bandwidth consuming. However, VNC sometimes fails to provide a remote reproduction of the video playing in the server, due to the different implementations of servers and clients that co-exist. In the worst case, when the available bandwidth is very low, an SSH connection to any client can be performed. In this situation, only ping, traceroute, and iperf tests can be shown.

The following table resumes the different demonstration options depending on the connectivity at the event venue:

Connection facility	Feasible tests	Visitor Experience
Direct connection to the test-bed	Grid application running in the venue + Web access to WP1 Administrator GUI	Excellent
Remote connection: high bandwidth (over 20Mbps)	High quality remote desktop to user computer + Web access to WP1 Administrator GUI	Very good
Remote connection: medium bandwidth	Low quality remote desktop to user computer + Web access to WP1 Administrator GUI	Good
Remote connection: poor bandwidth or high delay	Shell connection to user computer + Web access to WP1 Administrator GUI	Normal

Table 2.1: Feasible tests depending on connection facility on the venue

2.1.2 Demo workflow

In the following subsections describe the components of a typical WP1 demo workflow.

2.1.2.1 Testbed initialization

The initialization of the testbeds has been implemented in a way that makes it easy for a domain to be part of the controlled resources. Using an automatic registration process and several simple configuration files, a



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traceroute utility, it is verified that the connectivity is established on layer 2, i.e. that the hosts are connected via a single IP hop.

Depending on the connectivity at the demonstration venue, applications such as HD video streaming can be shown. Furthermore, the connections can be used by any application provided by WP3.

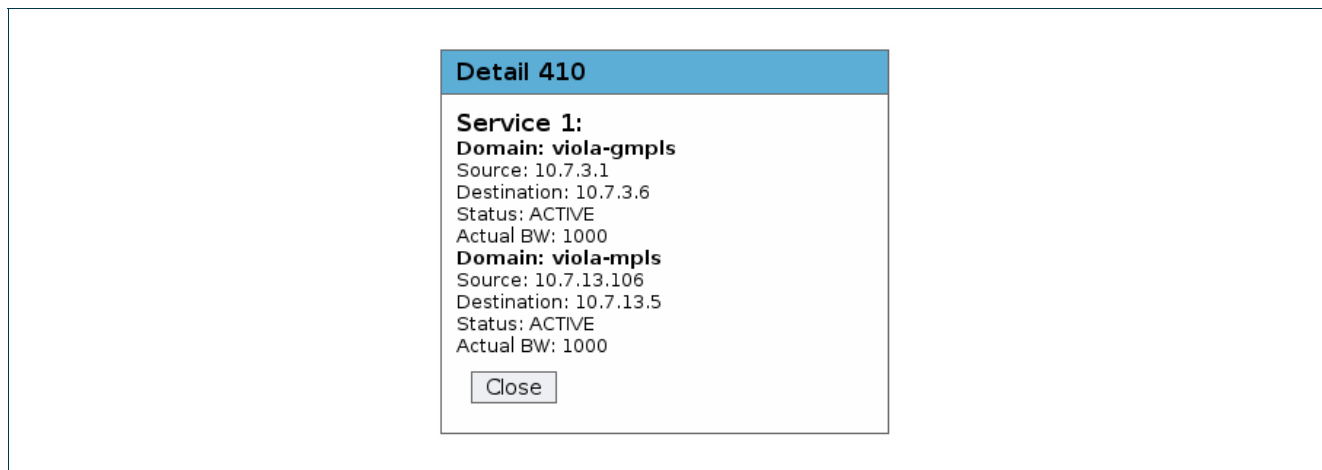


Figure 2.2: Window showing the status of an interdomain reservation

To retrieve the status of a connection with the administrative GUI, the user selects a reservation ID from the list of reservation in the Admin tab of a domain in the Reservation section. A `GetStatusRequest` with this ID is then sent to the domain's Reservation-WS. When the corresponding response is received, a window summarizing the status data is displayed (cf. Figure 2.2).

2.1.2.4 Path teardown

The teardown of a running connection is performed by calling the `cancelReservation` operation of the Reservation-WS. Within the NSP, the reservation ID provided as input parameter is mapped to the reservation IDs used locally inside the participating subdomains. A `cancelReservation` with the appropriate ID is then performed within each of these domains.

During demonstration activities, a connection teardown is performed while the data plane is being used by an application (either “ping” or a video stream). It can then be seen that shortly after `cancelReservation` has been called, the connection “freezes”.

To cancel one or more reservations with the administrative GUI, the reservations are checked in the Admin tab of a domain in the Reservation section, Cancel is chosen from the pull-down menu and the Execute button is pressed. Then, `CancelReservationRequests` are sent to the Reservation-WS of this domain. Afterwards, a window with all results pops up.

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2.2 G²MPLS demo with WISDOM and MSS

During SC'08 conference, there will be the first G²MPLS architecture public demonstration. In the demonstration, the visitors may experience the performance of a seamless integrated and single-step approach for the on-demand provisioning of Grid and network resources. The G²MPLS architecture is the innovative PHOPHORUS solution for the Network Control Plane. It is used to implement the Grid Network Services, i.e. the provisioning of network and Grid resources in a single-step, through a set of seamlessly integrated procedures. G²MPLS derives from the standard ASON/GMPLS and integrates Grids and automatic Control Plane technologies towards real operational and commercial networks. Key factor to achieve this objective is the use of a unified interface for the Grid-user to trigger both Grid and network transactions. G²MPLS enables a real node-to-node deployment of Bandwidth On Demand services tight with on-demand Grid services.

The major goal of WP2 demo is to demonstrate both the Phosphorus Overlay and the Phosphorus Integrated deployment models [ref. deliverable D2.1 for major details] in support of grid middleware and applications. Through these demonstrations most of the innovative G²MPLS features will be showed for their evaluation and discussion with experts. An intensive and well-known Grid computing application, WISDOM, has been chosen at the time of writing of this document to demonstrate G²MPLS operations with Grid Network Services. However, the possible use of other application(s) that could emphasize and strengthen the demonstration of functionalities is under evaluation.

At the demo site, Grid user will have access to a UNICORE client connected to the middleware with MetaScheduling Service (MSS). A G²MPLS Control Plane visualisation tool will be available as well. Two remote G²MPLS Control Plane domains with Optical Transport Plane capabilities are planned – the first in UESSEX laboratories (UK), the latter in PSNC, laboratories (PL) – interconnected by inter-domains links through GÉANT2. Each domain will connect some local Grid sites with a bunch of computing and storage resources. There will be a third site hosting the UNICORE MSS that will provide jobs broker functionality. This service will be statically located in FZJ laboratories (DK), and will be bridged to the G²MPLS Control Plane through a G.UNI Gateway (G.UNI-GW) and a dummy G²MPLS CP instance, in order to issue GNS call requests and gather responses via G²MPLS protocols, but without any Transport Plane configuration.

The main set of G²MPLS functionality will be shown during Phosphorus Overlay and Integrated deployment demonstration (Figure 2-3), in which a Grid user selects stage-in resources located in Grid Site 1.1 and stage-out resources located in Grid Site 2.1. These resources will be used as data source and data destination in the WISDOM workflow. For success of the WISDOM workflow there is a need of processing resource allocation. The scenario of finding and choosing a processing resource is crucial aspect of Phosphorus Overlay or Integrated model. The first scenario (Phosphorus Overlay demo) assumes that MSS selects processing resources (Grid site and computing host) according to its scheduling algorithm. In the second more advanced scenario (Phosphorus Integrated demo), MSS only checks for availability of processing resources according to its scheduling algorithm and G²MPLS Control Plane is responsible for choosing and allocating the candidate computing host. The chosen computing resource will be placed in Grid Site 2.1. In both scenarios, MSS

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performs the workflow decomposition in jobs and issues through G.UNI-GW two indirect GNS calls (ref. deliverable D2.1 for details of this use-case). The first call will be unicast (in case of Ph. Overlay) or anycast (in case of Ph. Integrated) and it will setup a network path between GS-1.1 and GS-2.1 (or GS-1.2 in case of anycast), configure processing resource in GS-2.1 and issues the start of the first job (data transmission and data processing). The second call will be unicast. It will use advance reservation of the network path between GS-2.1 and GS-2.2, and allocate in advance the amount of free space in storage resource located in GS-2.2. This demonstration will present different G²MPLS call types in multi-domain environment and show cooperation with Grid middleware. In Phosphorus Overlay scenario, G²MPLS will implement just the inter-domain Network Service. In Phosphorus Integrated scenario, G²MPLS will implement the inter-domain Grid Network Service. The most interesting G²MPLS feature that will be presented during the demonstration is the anycast call service, which will occur when G²MPLS CP will find, choose and allocate the appropriate computing resources for the Grid job.

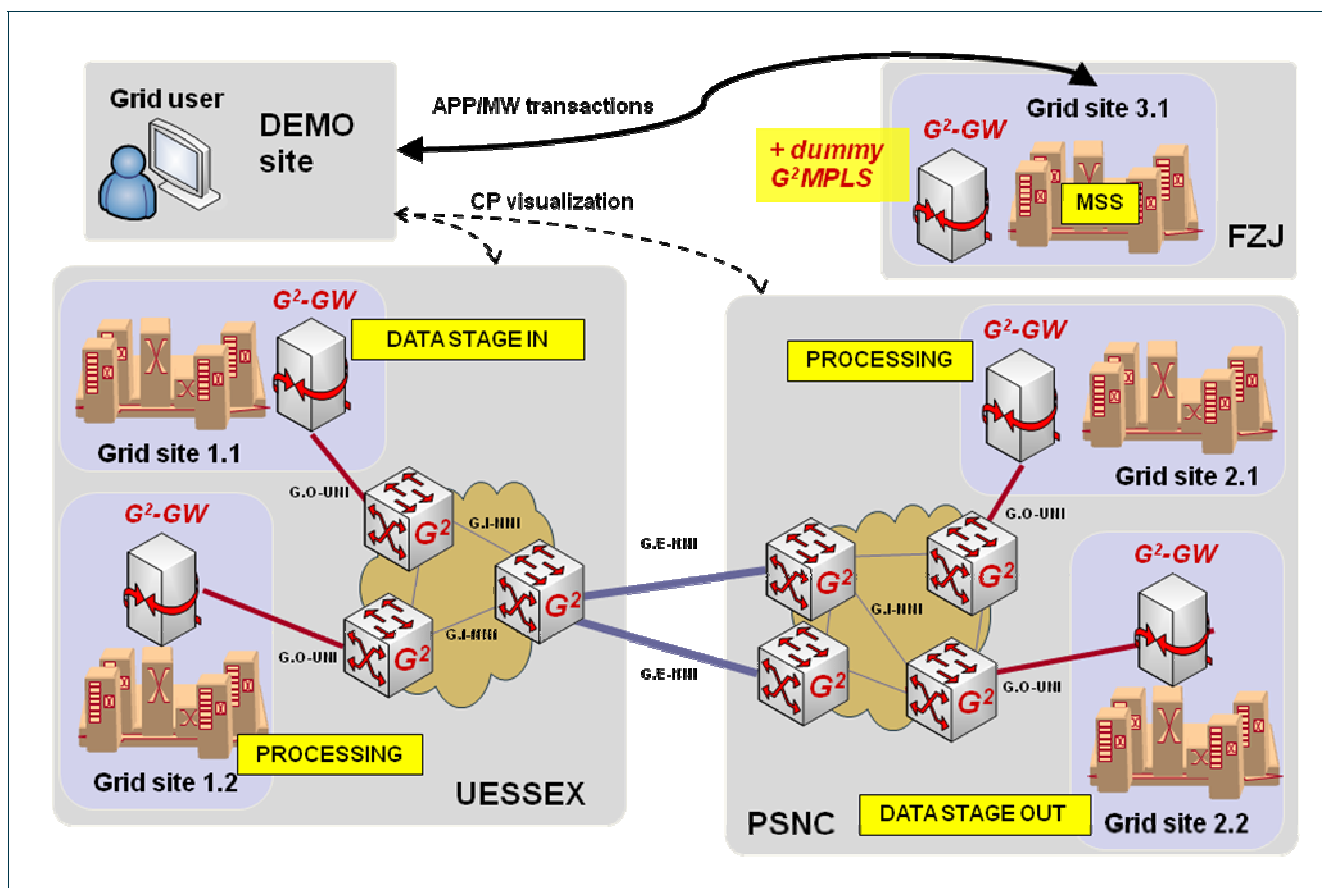


Figure 2-3: G²MPLS multi-domain demo testbed for WISDOM workflows.

Optionally and depending on the availability of international connectivity among the different sites, it will be possible to show G²MPLS and NSP interoperability scenario (Figure 2-4). In this scenario, some set of Grid resources (GS-1.1 and GS-1.2) will be connected to NRPS-es/ NSP and Grid user will select stage-in resources located in GS-1.1. MSS will choose the processing resource in GS-2.1 and will decompose the

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workflow into two calls. The first call will be send as Network Service (NS) immediate request to NSP. NSP will setup the network path to NSP border and forward the NS request to G²MPLS domain. G²MPLS domain will setup the rest of the path. MSS will issue the second call through G.UNI-GW to G²MPLS CP. It will be indirect, unicast, advanced NS call. It will provide advance reservation of the network path between GS-2.1 and GS-2.2. The added-value of this demonstration is to show the interoperation of different control technologies for network resource, even though the scope of the deployment scenario is limited to Phosphorus Overlay only.

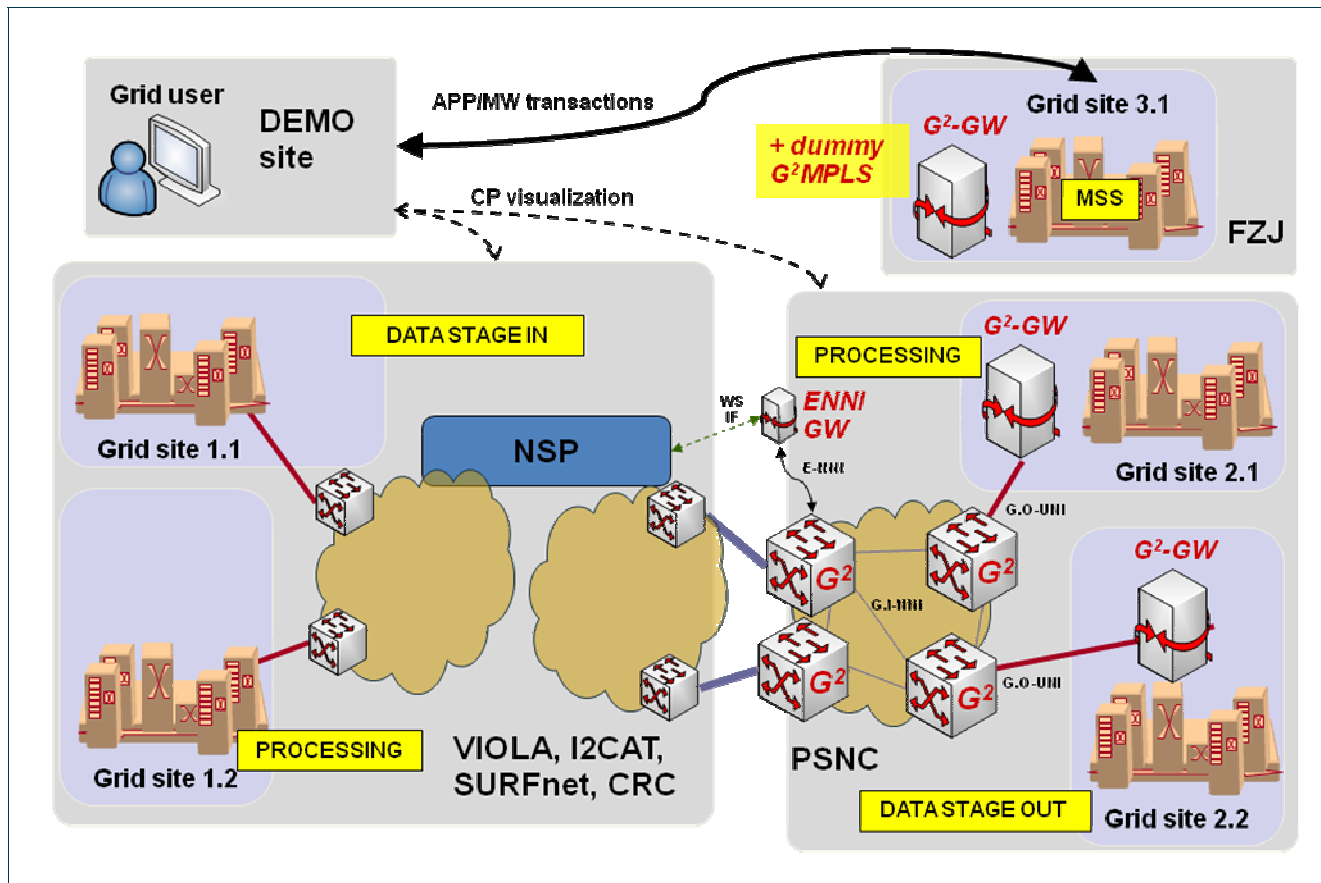


Figure 2-4: G2MPLS and NSP interoperability demo testbed for WISDOM workflows.

2.3 GAAA Toolkit demo

The major goal of the planned UvA demonstration for SC08 is test the proposed AAA/AuthZ architecture to support multidomain Optical Network Resource Provisioning (ONRP) as a specific use case of the general Complex Resource Provisioning (CRP) model.



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In particular, SC'08 demo will demonstrate two advance reservation and signalling models using Token Based Networking (TBN) concept and access tokens that allows separate reservation and access stages and use access token for signalling and access control at the access stage.

Figure 2-5 illustrates the general interaction between network domains when doing tree or chain reservation of lightpath between two applications A and B that may cross few administrative domains. At the reservation stage the service or connectivity request is sent to the first domain or interdomain controller (IDC) next to user application domain. This IDC that has also AAA/AuthZ functionality can either relay the request to the next domain IDC for the chain model or request all other domains and obtain reservation confirmation from them for the tree model. As a reservation is confirmed by all IDC/domains, it is assigned a common Global Reservation ID (GRI) and related deployment/setup information is forwarded to all participating domains. It is the responsibility of each domain to keep reservation information that corresponds to the specific GRI.

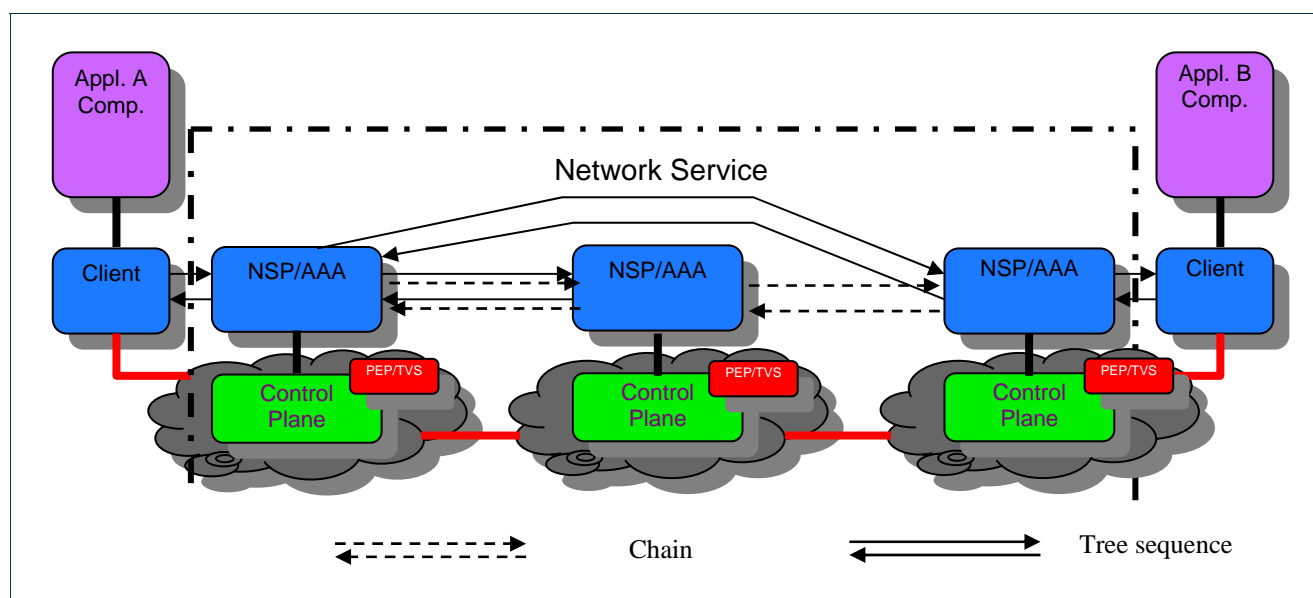


Figure 2-5: Interaction between network domains and related services during tree/chain reservation and signalling.

The demo setup will use the UvA local testbed as one end and SC08 UvA booth installation as another end point. Intermediate transit networks will be defined later and presumably will include project partner network and Internet2 network following former successful cooperation with Internet2. At the later stage it will be discussed how the proposed basic setup can be connected to the WP1 NSP infrastructure and common project testbed.

Błąd! Nie można odnaleźć źródła odwołania. provides more details what components of the GAAA Toolkit (GAAA-TK) will be used in the planned demo and their interaction. Current suggestions that chain/provider model can be implemented using in Internet2 OSCARS based DCN infrastructure, and tree/centralised model can easy be implemented with the Phosphorus WP1 NSP infrastructure but this will depend on the easy solution to create NSP adapter to UvA IDC that can be either OSCARS or AAA based. It is also anticipated that

The diagram illustrates a network architecture with three main planes: Service (AAA) plane, Control plane, and Network plane.

- Service (AAA) plane:** Contains the AAA (Authentication, Authorization, and Accounting) components. It includes three NSP/AAA blocks (each containing PAP and PDP) and one INSP/AAA block (containing PAP and PDP). A separate AAA block is part of the Dest Host. IBC KGS (Inter-Block Key Generation Service) is shown as a dashed blue line connecting the NSP/AAA blocks.
- Control plane:** Contains the DC/NRPS (Domain Controller / Network Resource Provisioning System) blocks. Each DC/NRPS block contains a PEP (Policy Enforcement Point) and a TVS (Token Validation Service). A User Client (containing a T token) sends a ServReq (Service Request) to the first DC/NRPS. The DC/NRPS blocks are interconnected with each other and with the NE (Network Element) blocks.
- Network plane:** Contains the NE (Network Element) blocks. These are connected to the DC/NRPS blocks and the Dest Host.
- Dest Host:** A vertical blue bar on the right representing the destination. It contains an AAA block in the Service plane and an Application block in the Network plane.

Legend:

- NRPS – Network Resource Provisioning System
- DC – Domain Controller
- NSP – Network Service Plane Controller
- AAA – AuthN, AuthZ, Accounting Server
- PDP – Policy Decision Point
- PEP – Policy Enforcement Point
- TVS – Token Validation Service
- KGS – Key Generation Service

The following ideas and solutions are planned to be demonstrated in the UvA SC08 demo, however their final implementation will depend on available resources:

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