



034115

PHOSPHORUS

Lambda User Controlled Infrastructure for European Research

Integrated Project

Strategic objective:
Research Networking Testbeds



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Plan of demonstrations of project results

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Abstract

Phosphorus addresses some of the key technical challenges to enable on-demand e2e network services across multiple domains. The Phosphorus network concept will make applications aware of their complete Grid resources (computational and networking) environment and capabilities, and able to make dynamic, adaptive and optimized use of heterogeneous network infrastructures connecting various high-end resources. Phosphorus will enhance and demonstrate solutions that facilitate vertical and horizontal communication among applications middleware, existing Network Resource Provisioning Systems, and the proposed Grid-GMPLS Control Plane (G²MPLS).

One of the main assumptions of Phosphorus is that the project propositions and developments should be validated and demonstrated in a real advanced optical network. To achieve this, the project has built a distributed test-bed in which the project outcome will be demonstrated with a set of real scientific applications in a set of real-life scenarios..

This document summarises the plan of demonstrations of the project results. The demonstrations will show a real optical network which supports GRIDs and applications with advanced service delivery mechanisms dedicated for bandwidth-consuming and QoS-demanding applications.

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0 Executive Summary

Phosphorus addresses some of the key technical challenges to enable on-demand e2e network services across multiple domains. The Phosphorus network concept will make applications aware of their complete Grid resources (computational and networking) environment and capabilities, and able to make dynamic, adaptive and optimized use of heterogeneous network infrastructures connecting various high-end resources. Phosphorus will enhance and demonstrate solutions that facilitate vertical and horizontal communication among applications middleware, existing Network Resource Provisioning Systems, and the proposed Grid-GMPLS Control Plane (G²MPLS).

One of the main assumptions of Phosphorus is that the project propositions and developments should be validated and demonstrated in a real advanced optical network. To achieve this, the project has built a distributed testbed in which the project outcome will be demonstrated with a set of real scientific applications in a set of real-life scenarios..

This document summarises the plan of demonstrations of the project results. The demonstrations will show a real optical network which supports GRIDs and applications with advanced service delivery mechanisms dedicated for bandwidth-consuming and QoS-demanding applications.

The demonstrations will use the distributed test-bed built by the project, in which the project results are gradually deployed. The testbed infrastructure consists of a transport network which interconnects the various local testbeds, switching layer which will be controlled by the control and provisioning plane mechanisms developed by the project, GRID resources used by applications, GRID middleware and a set of modern scientific applications so it has all the resources needed to demonstrate a real optical network which supports GRIDs with new inter-layer communication mechanisms.

Interconnection of the local test-beds via dedicated channels in GÉANT2, GLIF, and other networks, creates a unique possibility of demonstrating Phosphorus achievements on a European and global scale.

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Plan of demonstrations of project results

Chapter 1 of this document gives information about the events on which demonstrations to external audience has been planned. The next chapters show the demonstration scenarios in which the ideas and developments of the project will be demonstrated. The scenarios are divided into four chapters, each of them describes the demonstrations of the developments of one PHOSPHORUS workpackage. As most efforts on integration of the developments of the different workpackages are planned in the last months of the project, the first demonstrations are planned separately for each workpackage while the integration of the outcome of all the PHOSPHORUS workpackages can be demonstrated in the last months of the project.

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1 Planned demonstration events

Demonstration of the results of the project to external audience is part of the project dissemination, which is covered by Workpackage 7. As Workpackage 6 is responsible for 'live' demonstrations – demonstrations in the testbed with real transport network infrastructure, GRID middleware and applications – it must synchronise its efforts with Workpackage 7 and plan common activities which will combine demonstrations and other forms of project dissemination (presentations, posters etc).

Workpackage 7 is planning two events on which live demonstrations can be used to show the project outcome in a real network. The two events are Open Grid Forum 23 and SC 08.

The 23rd Open Grid Forum will be held in June 2008 in Barcelona. The Open Grid Forum (OGF) is a community of users, developers, and vendors leading the global standardization effort for grid computing. The OGF community consists of thousands of individuals in industry and research, representing over 400 organizations in more than 50 countries. (source: www.ogf.org)

The SC 08 Conference (Supercomputing conference) will be held in November 2008 in Austin (United States). The conference will feature the latest scientific and technical innovations from around the world. Bringing together scientists, engineers, researchers, educators, programmers, system administrators and managers, SC08 will be the forum for demonstrating how these developments are driving new ideas, new discoveries and new industries. (source: sc08.supercomputing.org)

Having demonstration at the two events listed above will let the Phosphorus consortium address two groups of the potential users of the project developments: the GRID community and the NREN community. Having demonstrations in Europe and the United States will also help raise awareness of the project and its results in both Europe and North America.

Further demonstrations will be planned in cooperation with Workpackage 7.

2 WP1 demonstrations

The first part of chapter 2 focuses on demonstrations which was shown on review meeting in Poznan, and ONDM conference. The second part describes plan of demonstration on future events like SC08 base on experiences from earlier demonstrations.

2.1 Description of the review meeting demonstration, December 13th 2007 in Poznan

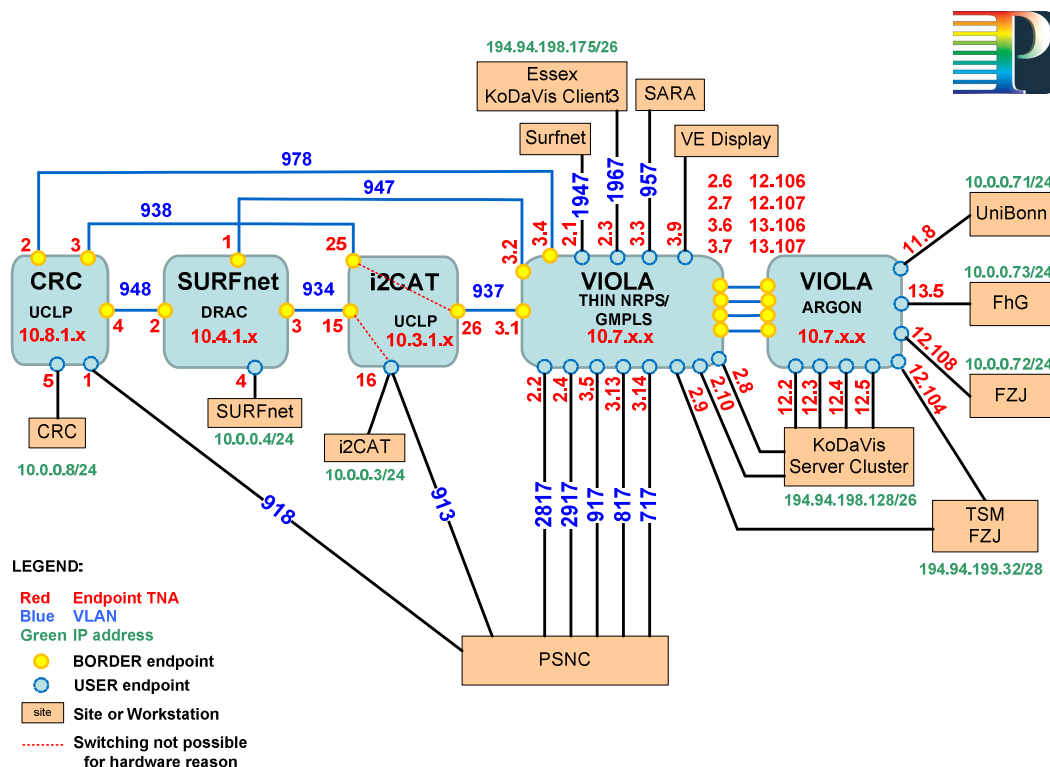


Figure 2.1: WP1 testbed for demonstrations



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The first reservation made during the demonstration at the review meeting was a connection between the TNAs 10.8.1.5 (connected to a host at CRC) and 10.3.1.16 (connected to a host at the site in Poznan via the i2CAT domain). Prior to the reservation, the interdomain links with the VLANs 934 and 978 were removed (cf. Figure 2.1).

Figure 2.2 shows a protocol of the operations concerning this reservation. The connections spans all four domains CRC, SURFnet, VIOLA, and i2CAT. This is due to the fact that the direct connection between the CRC and i2CAT domains via VLAN 938, which is checked first, is reported to be unavailable by the i2CAT domain that cannot connect the according endpoints for internal reasons. Within the VIOLA domain, the connection is local to the FhG site (third octet of both TNAs is “3”), since both interdomain links, the one to SURFnet as well as the one to i2CAT, terminate there.

The first status requests show the connections to be “active” in all participating domains. However, a “ping” performed between the two hosts showed that there was no connectivity. A subsequent status request (performed at 18:29:56) reveals a failure within the SURFnet domain (reported status was “cancelled_by_system”). The reservation was then cancelled. Now, the other domains report the status of the reservation as “cancelled_by_user”.

```
18:27:25 createReservation[b606aaf]: 10.8.1.5-10.3.1.16
18:28:03 createReservationResponse[b606aaf]: 1520 (10.4.1.2-10.4.1.1 /
10.3.1.26-10.3.1.16 / 10.7.3.2-10.7.3.1 / 10.8.1.5-10.8.1.4)
18:28:05 getStatus[5e6b1c78]: 1520
18:28:11 getStatus[65c0bf21]: 1520
18:28:27 getStatusResponse[5e6b1c78]:
active:surfnet=testbed,i2CAT,viola-gmpls,CRC
18:29:31 getStatusResponse[65c0bf21]:
active:surfnet=testbed,i2CAT,viola-gmpls,CRC
18:28:56 getStatus[3bec9b56]: 1520
18:30:12 getStatusResponse[3bec9b56]:
cancelled_by_system:surfnet-testbed /
active:i2CAT,viola-gmpls,CRC
18:30:57 cancelReservation[34115b7c]: 1520
18:31:25 cancelReservationResponse[34115b7c]: true
18:31:31 getStatus[d69bela4]: 1520
18:31:44 getStatusResponse[d69bela4]:
cancelled_by_system:surfnet-testbed /
cancelled_by_user:i2CAT,viola-gmpls,CRC
```

Figure 2.2: Poznan-Demo, Reservation #1520

As a result of the failure of the SURFnet domain, the interdomain link table in the NSP database was modified: VLAN 978 was added to the interdomain topology and VLAN 948 was removed. Now, the shortest available connection connects the CRC and the i2CAT domains directly via the VIOLA GMPLS domain (cf. Figure 2.3). Within the VIOLA domain, the connection crosses the FhG and the Uni Bonn sites, since the CRC connection (which physically uses the Uni Bonn – PSNC link) terminates at Uni Bonn.

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The connections are reported to be “active” by all domains, and this time, connectivity was shown by running “ping” between the two hosts. A “traceroute” reveals that the hosts are connect on OSI layer 2 on a single IP subnetwork. A live HD video is streamed by the CRC team in Canada to the venue in Poznan.

```
18:32:26 createReservation[7a19579]: 10.8.1.5-10.3.1.16
18:32:55 createReservationResponse[7a19579]: 1521
      (10.3.1.26-10.3.1.16 / 10.7.3.2-10.7.3.1 / 10.8.1.5-10.8.1.2)
18:32:56 getStatus[247a526a]: 1520
18:33:12 getStatus[bee506e7]: 1521
18:33:12 getStatusResponse[247a526a]:
      cancelled_by_system:surfnet-testbed /
      cancelled_by_user:i2CAT,viola-gmpls,CRC
18:33:12 getStatus[fbaa3e45]: 1521
18:33:33 getStatusResponse[fbaa3e45]: active:i2CAT,viola-gmpls,CRC
18:33:33 getStatusResponse[bee506e7]: active:i2CAT,viola-gmpls,CRC
18:40:46 cancelReservation[9c96440b]: 1521
18:41:13 cancelReservationResponse[9c96440b]: true
18:41:14 getStatus[6d89df4d]: 1521
18:41:16 getStatus[906f1d27]: 1521
18:41:34 getStatusResponse[6d89df4d]:
      cancelled_by_user:i2CAT,viola-gmpls,CRC
18:41:35 getStatusResponse[906f1d27]:
      cancelled_by_user:i2CAT,viola-gmpls,CRC
```

Figure 2.3: Poznan-Demo, Reservation #1521

The second part of the review demonstration was performed by work package 3. Their meta-scheduler accessed the central NSP instance through its northbound interface to make the reservations. The requested connections spanned endpoints in the VIOLA GMPLS domain (to which hosts located at the venue were connected) and the VIOLA MPLS domain (to which hosts located in Germany were connected). The middleware was extended to send getStatus requests to the NSP every 15 seconds to become aware of changes in the connections’ status. Figure 2.4 shows the first two reservations made by WP3 software during the review meeting demonstration.

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```
18:49:39 createReservation[7065eb5a]: 10.7.1.5-10.7.12.3
18:49:46 createReservationResponse[7065eb5a]: 1522
      (10.7.1.5-10.7.3.6 / 10.7.13.106-10.7.12.3)
18:49:46 getStatus[9a71425f]: 1522
18:49:47 getStatusResponse[9a71425f]: active:viola-gmpls /
      setup_in_progress:viola-mpls
18:50:02 getStatus[aabf0f00]: 1522
18:50:05 getStatusResponse[aabf0f00]: active:viola-gmpls /
      setup_in_progress:viola-mpls
18:50:20 getStatus[106b518b]: 1522
18:50:21 getStatusResponse[106b518b]: active:viola-gmpls /
      setup_in_progress:viola-mpls
18:50:36 getStatus[a3c3d266]: 1522
18:50:38 getStatusResponse[a3c3d266]: active:viola-gmpls,viola-mpls
18:50:53 getStatus[2759b1e0]: 1522
18:50:54 getStatusResponse[2759b1e0]: active:viola-gmpls,viola-mpls
18:51:09 getStatus[e79a5afe]: 1522
18:51:11 getStatusResponse[e79a5afe]: active:viola-gmpls,viola-mpls
[...]
18:53:38 getStatus[2d182ad0]: 1522
18:53:39 getStatusResponse[2d182ad0]: active:viola-gmpls,viola-mpls
18:53:55 getStatus[99402a2d]: 1522
18:53:56 createReservation[a5ff8659]: 10.7.1.3-10.7.12.5
18:53:56 getStatusResponse[99402a2d]: active:viola-gmpls,viola-mpls
18:54:04 createReservationResponse[a5ff8659]: 1523
      (10.7.1.3-10.7.1.6 / 10.7.11.106-10.7.12.5)
18:54:04 getStatus[df8bc602]: 1523
18:54:06 getStatusResponse[df8bc602]: active:viola-gmpls /
      setup_in_progress:viola-mpls
18:54:11 getStatus[ce5665f6]: 1522
18:54:13 getStatusResponse[ce5665f6]: active:viola-gmpls,viola-mpls
18:54:21 getStatus[c4cc281c]: 1523
18:54:22 getStatusResponse[c4cc281c]: active:viola-gmpls /
      setup_in_progress:viola-mpls
18:54:28 getStatus[e5ac364a]: 1522
18:54:29 getStatusResponse[e5ac364a]: active:viola-gmpls,viola-mpls
18:54:37 getStatus[052fee66]: 1523
18:54:39 getStatusResponse[052fee66]: active:viola-gmpls,viola-mpls
```

Figure 2.4: Poznan-Demo, Reservations #1522 and #1523 made by the middleware

2.2 Description of tests related to the ONDM'08 demonstration

Due to some hardware failures prior to the demonstration, only a reduced interdomain topology was available. At i2cat, the two endpoints 10.7.3.16 and 10.7.3.26 were not available, and the decision was made to make to connect the i2cat host to 10.7.3.15 (the new user endpoint) and 10.7.3.25 to VLAN 937 leading to the VIOLA domain. Furthermore, as a consequence of a technical issue in the SURFnet domain, DRAC could only connect endpoints 10.4.1.1 with 10.4.1.3 and 10.4.1.2 with 10.4.1.4.

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With this configuration, connectivity tests were made between all host pairs with the following TNAs (cf. Figure 2.1):

- 10.3.1.15 (i2CAT)
- 10.4.1.4 (SURFnet)
- 10.7.12.108 (VIOLA MPLS)
- 10.8.1.5 (CRC)

The test results are described in the following subsections.

2.2.1 I2CAT – SURFnet

The first path for this connection calculated by the path computer contains only the transit domain viola-gmpls:

10.3.1.15-10.3.1.25 / 10.7.3.1-10.7.3.2 / 10.4.1.1-10.4.1.4.

Due to the technical issue at SURFnet mentioned above, 10.4.1.1-10.4.1.4 is not available though, and the DRAC Adapter at SURFnet replies to the availability request for this connection with PATH_NOT_AVAILABLE. Therefore, this path is pruned from the path computer's internal topology, and the next path it returns also includes CRC as transit domain:

10.3.1.15-10.3.1.25 / 10.7.3.1-10.7.3.4 / 10.8.1.2-10.8.1.4 / 10.4.1.2-10.4.1.4.

Each of the intradomain connections of this path is reported to be available by the corresponding NRPS Adapters and the reservation is successfully established.

2.2.2 I2CAT – VIOLA MPLS

The i2CAT – VIOLA connection is setup along the path with the least domains, i.e. with the VIOLA GMPLS domain as transit domain.

10.3.1.15-10.3.1.25 / 10.7.3.1-10.7.3.7 / 10.7.13.107-10.7.12.108

2.2.3 I2CAT – CRC

The same holds for the i2CAT – CRC connection, which also is possible through the VIOLA GMPLS domain.

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10.3.1.15-10.3.1.25 / 10.7.3.1-10.7.3.4 / 10.8.1.2-10.8.1.5

2.2.4 SURFnet – VIOLA MPLS

The shortest path between SURFnet and the VIOLA MPLS domain

10.4.1.4-10.4.1.1 / 10.7.3.2-10.7.3.7 / 10.7.13.107-10.7.12.108

is not available for the same reason as already described for the i2CAT – SURFnet connection in section 2.2.1. Therefore, the connection is set up via CRC:

10.4.1.4-10.4.1.2 / 10.8.1.4-10.8.1.2 / 10.7.3.4-10.7.3.6 / 10.7.13.106-10.7.12.108

It can also be seen here that the path computer does not actually resort to partial paths whose availability has already been checked. In this example, a different link between the VIOLA MPLS and GMPLS domains has been chosen for the second path, although the link in first path was confirmed to be available.

2.2.5 SURFnet – CRC

Between SURFnet and CRC, the direct connection is available:

10.4.1.4-10.4.1.2 / 10.8.1.4-10.8.1.5

2.2.6 VIOLA MPLS – CRC

The shortest connection between the VIOLA MPLS domain and CRC traverses the VIOLA GMPLS domain and is available:

10.7.12.108-10.7.13.107 / 10.7.3.7-10.7.3.4 / 10.8.1.2-10.8.1.5

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2.3 Future demos – general considerations

Several demonstrations are planned for the next months. The same testbed will be used for all of them (cf. Figure 2.1). In each one of the demonstrations, the advance reservation system and the administration tools developed by WP1 will be used. There is the possibility to interact with the developments of other work packages (WP2-WP3-WP4) depending on the constraints of the demonstration venues and the status of the implementation.

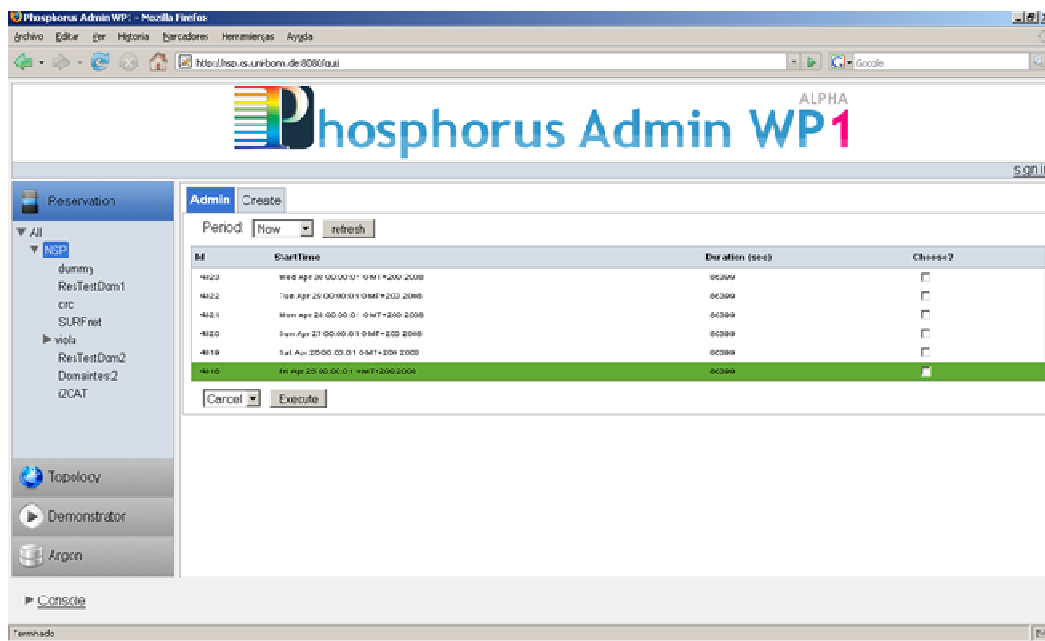


Figure 2.5: Administration GUI



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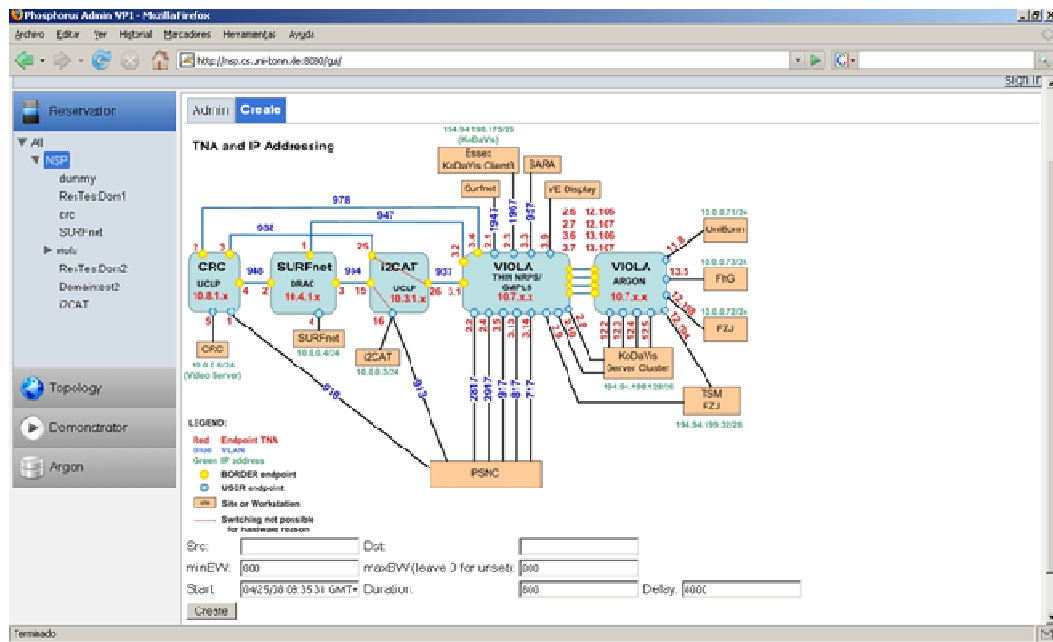


Figure 2.6: Reservation creation GUI

Each demonstration will have always a main common part: the management of inter-domain reservations (i.e. creation, query and cancel) like has been done until now. Depending on the progress of the developments, some new features could be shown in each case (integration with AAA, interoperability with G²MPLS/JRA3/Internet2, distributed NSP and other enhancements) but this new features are expected to be complete in the long term.

The typical workflow of the demonstrations is like the following (extracted from the General Assembly meeting in Barcelona):

1. Ping from 10.0.0.33 (I2CAT) to 10.0.0.8 (CRC) not working.
2. Administrator GUI. Start creating reservation.
srcTNA = 10.3.1.15, dstTNA = 10.8.1.5, duration = 800 seconds
 - a. Admin tab view: waiting for system dialog.
 - b. Admin tab view: once reservation created, query its status to NSP.
3. Once finished: ping works. Route trace: only 1 hop at level 3.
4. Video stream: Phosphorus video stream from CRC Canada (port 1234)
5. Demonstrator GUI. Cancel reservation.
 - a. Admin tab view: waiting for system dialog.
Ping stops and video froze.
 - b. Admin tab view: once reservation cancelled, query its status to NSP.

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To show that advance reservations are being made, reservation requests can be made for the same endpoints but with differing starting and ending times. E.g., the above reservation can be made for a starting time that is two minutes in the future and with a duration of 5 minutes. Then, the data plane connectivity (ping) will become available after this start time, and status requests sent before the starting time will yield the response PENDING (instead of ACTIVE).

If an additional reservation request is made for a time span that overlaps with the time span of the first reservation, the request will not be successful, but an error message is returned stating that the requested endpoints are blocked. A second successful reservation can be made though for a starting time that is after the ending time of the first reservation. An interruption in the data plane connectivity shows that this second advance reservation is enforced after the connection requested in the first reservation is torn down.

2.4 TNC08

The TERENA Networking Conference 2008 (<http://tnc2008.terena.org/>) will be hosted by BELNET, the Belgian national research network and held in Bruges (Brugge) from 19 to 22 May 2008. The conference will be held at the Oud Sint-Jan Congress Centre in Bruges (Brugge) in Belgium.

In this conference, the FEDERICA - PHOSPHORUS Tutorial and Workshop will be celebrated.

Date: Sunday, 18 May

Time: 09:00 – 17:00

Venue: Room Beethoven, 'Oud Sint-Jan' Conference Centre

Agenda:

09:00 – 12:00 Tutorial " Network Control & Service Planes in Next Generation Network and GRIDs "

12.00 - 13.00 Lunch break

13.00 - 17.00 Workshop: "Challenges in Network Control and Service Planes"

This workshop will discuss architectural solutions for network and IT service integration over high-speed network infrastructure. In particular, the workshop will present various implementations of network control and service plane architectures to support the emerging infrastructure-as-a-service model. The main goal is to share the collective experiences gained by major research projects and initiatives around the globe and explore common vision, outcomes and synergies. In the workshop there will be demonstrations of the available software.

2.5 The 23rd Open Grid Forum - OGF23

OGF-Europe's First International Event (<http://www.ogf.org/OGF23>) will be hosted by the Barcelona Supercomputing Center and co-Located with the BEinGRID Industry Days. It will take place in the Barcelo Sants Hotel of Barcelona (Spain) in June 2-6, 2008.

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OGF23 will show how grids have become a key enabling technology in a broad spectrum of IT environments. Participants will hear how researchers and scientists in both academic and commercial settings find grids useful to scale their compute capabilities and data analysis while enhancing their ability to collaborate across organizational boundaries. Participants will also hear how commercial users find grids to enable better business agility, reduce costs, and aid in the deployment of a shared, service-oriented infrastructure. OGF23 will also provide a unique forum for discussion on how grids form a necessary underpinning for emerging technologies such as virtualization and clouds.

In this conference, there is the chance to make some demonstration as well, hopefully with some enhancement planned in the short term.

2.6 SuperComputing 2008

This conference will be held in November 15-21 in Austin, Texas (<http://sc08.supercomputing.org>). The SC Conference is the premier international conference on high performance computing (HPC), networking, storage and analysis, and it attracts from all over the world scientists, researchers, software developers, network engineers, policy makers, corporate managers, CIOs and IT administrators from universities, industry and government from all over the world.

In this conference, PSNC will have a booth where demonstrations can be done. At this stage, the system will be more mature and will include more functionalities that can be shown. Moreover, a joint demonstration with Internet2 is planned.

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3 WP2 demonstrations

3.1 G²MPLS demo on SuperComputing 2008¹

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 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 evolution.

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 3.1), 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

¹ From Deliverable D7.1.6

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scenario (Phosphorus Integrated demo), MSS only checks for availability of processing resources according to its scheduling algorithm and G^2 MPLS 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 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 G^2 MPLS call types in multi-domain environment and show cooperation with Grid middleware. In Phosphorus Overlay scenario, G^2 MPLS will implement just the inter-domain Network Service. In Phosphorus Integrated scenario, G^2 MPLS will implement the inter-domain Grid Network Service. The most interesting G^2 MPLS feature that will be presented during the demonstration is the anycast call service, which will occur when G^2 MPLS CP will find, choose and allocate the appropriate computing resources for the Grid job.

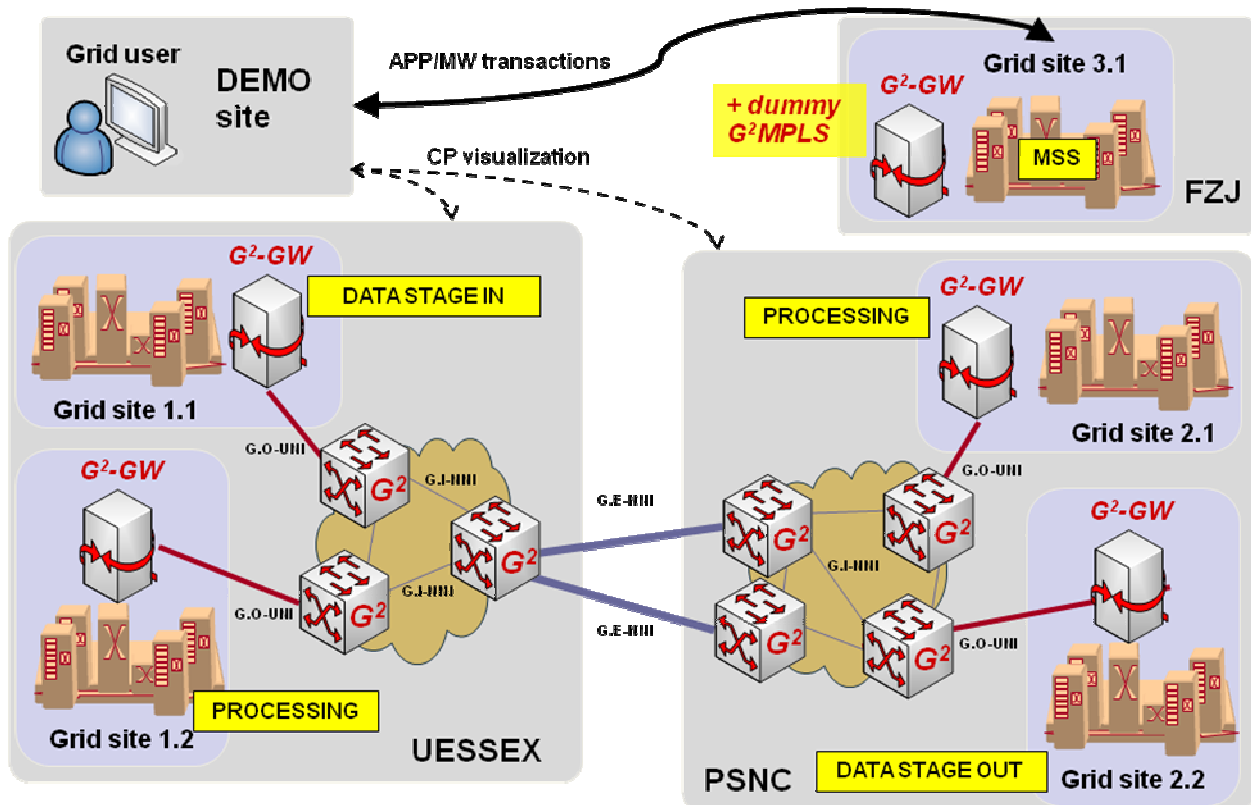


Figure 3.1: G^2 MPLS multi-domain demo testbed for WISDOM workflows.

Optionally and depending on the availability of international connectivity among the different sites, it will be possible to show G^2 MPLS and NSP interoperability scenario (Figure 3.2). 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



4 WP3 demonstrations

First part of this chapter describes applications which can be used on demonstrations, the second part focus on demonstrations. Work package 3 focuses on application which need to compute and transfers of huge amounts of data.

4.1 Applications

Work package 3 uses application which need to compute and transfer of huge amounts of data. These applications could show capabilities of PHOSPHORUS network. More information about applications can be found on deliverable D3.1.

4.1.1 KoDaVis

KoDaVis (Collaborative Data Visualisation) is a distributed, collaborative visualisation system with remote access to huge atmospheric simulation data originating from simulations of the transport of chemical tracers in the troposphere. Datasets are stored in central data servers or at the supercomputer where the simulation was performed. In a collaborative session, visualization clients team up, each connects to the data server, and triggered by user interaction, fragments of the data are sent to all visualization systems on demand, e.g. specific time steps or selected tracers. The main goal within Phosphorus is to enable KoDaVis to perform such reservations using the UNICORE middleware.

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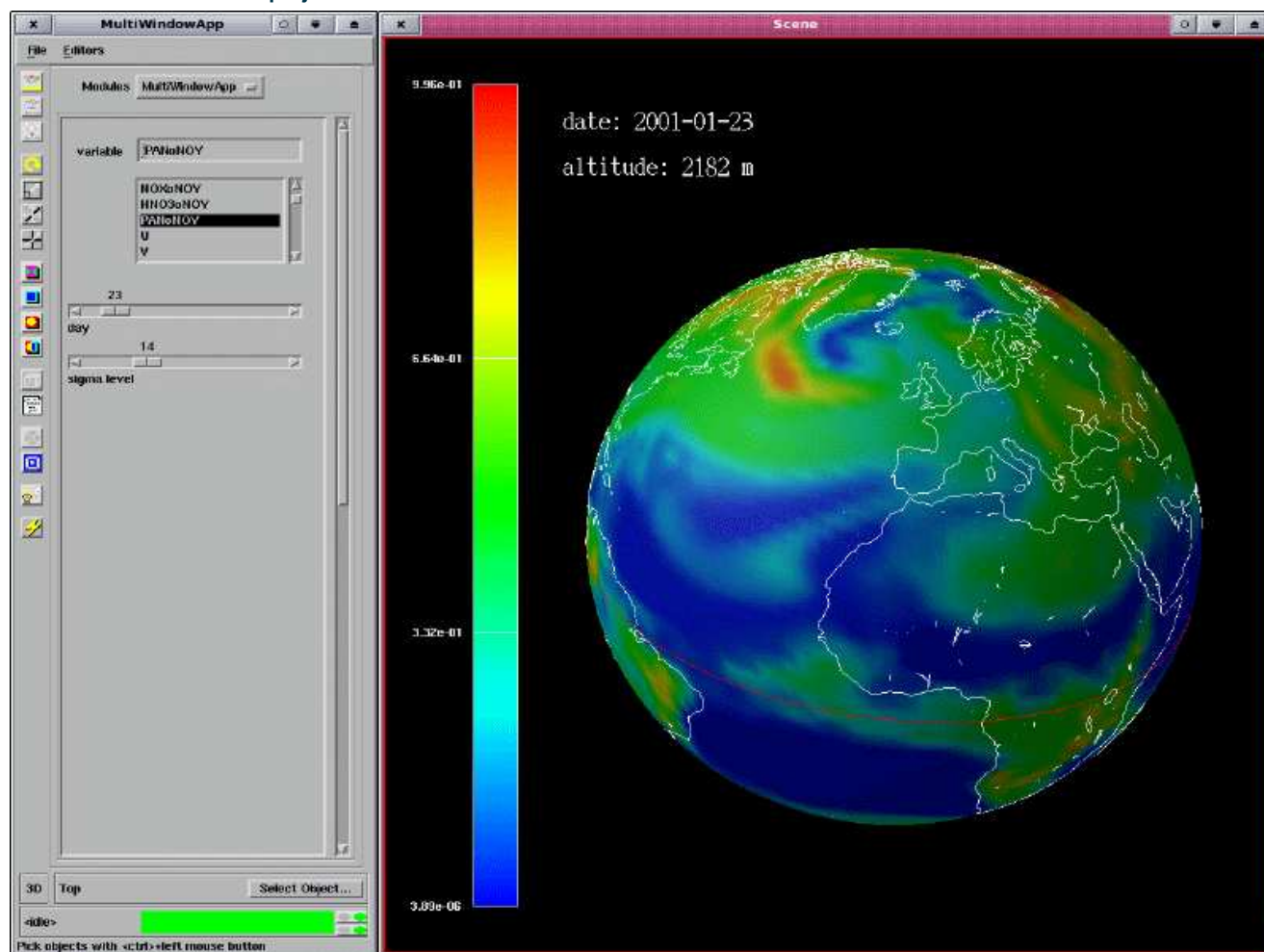


Figure 4.1: KoDaVis

4.1.2 WISDOM

WISDOM (Wide In Silico Docking On Malaria) is a docking workflow/service which allows the researcher to compute millions of compounds of large scale molecular dockings on targets implicated in diseases like malaria. In silico docking enables researchers to compute the probability that potential drugs will interfere with a target protein and it is one of the most promising approaches to speed-up and reduce the cost to develop new drugs to treat diseases such as malaria. In this case Grids provide resources to identify potentially promising compounds and to refine virtual screening and further assess selected compounds.

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4.1.3 TOPS

TOPS system is used to streaming of ultra high resolution data streams. It enables remote viewing of large scientific datasets on high resolution display devices (Tiled Panel Displays). These displays typically have 30 to 100 million pixels. TOPS streams these pixels, uncompressed, from the data centre to remote displays.

4.1.4 DDSS

DDSS (Distributed Data Storage Systems) are widely used in scientific and commercial applications in order to transport, exchange, share, store, backup/archive and restore data. Phosphorus project uses GridFTP application which is the high performance, secure, reliable client-server data transfer protocol optimized for high-bandwidth wide-area IP networks, and backup/archive application (B/A) which is used for automatic backups/archive copies of data that are originally stored in the Grid or end-user nodes. The main goal within Phosphorus is to enable applications to perform reservations of bandwidth and/or guarantee low latency for one-to-one and/or one-to-many high-volume data transfers.

4.2 Demonstration on SuperComputing 2007

The connection topology of KoDaVis demonstration is shown on Figure 4.2. The central data-server with data was placed on Jülich, Germany. Two visualization clients were in Poznan, Poland. Clients are connected via remote desktop to computers located in Reno, USA. The Phosphorus testbed was used to interconnect the KoDaVis server with the clients in Poznan. The reservation systems NRPS, Argon, UCLP, DRAC, Thin-NRPS and GMPLS were applied to establish a connection and data from server to clients was send via a few domain VIOLA, i2CAT, SURFnet and CRC to Poznan, and next to Reno.

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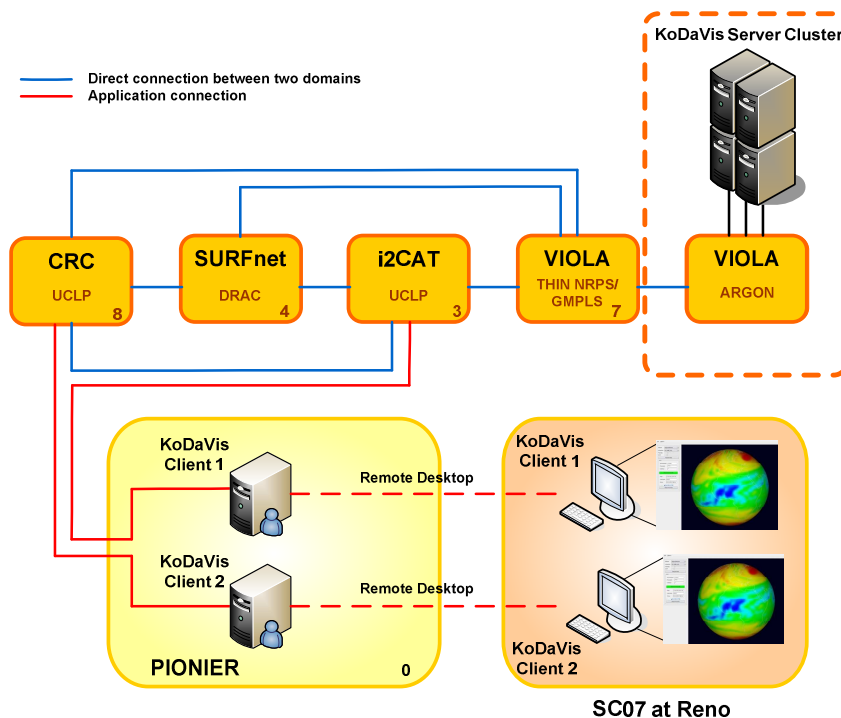


Figure 4.2: Demonstration KoDaVis on SuperComputing 2007

Due to the huge distance between Poznan and Reno and the latency between these cities usefulness of KoDaVis application on Reno was limited.

4.3 Demonstration plan on SuperComputing 2008

The knowledge which was gained on SC07 are very useful to plan demonstration on SC08. The demonstration will be created with cooperation with others WP, a especially WP1 and WP2. Four application will be used to shown Phosphorus project achievements:

- WISDOM
- KoDaVis
- TOPS
- DDSS

The Phosphorus test-bed will be used to interconnect resources which are required for SC08 demo. Some reservation will be made via the UNICORE client the MSS-NSP interface (WISDOM, KoDaVis) or via the UNICORE client and the MSS-G-OUNI interface (WISDOM), other reservation will be made by using the command-line interface to the NSP (TOPS, DDSS) or by web-service interface (DDSS).

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5 WP4 demonstrations

5.1 UvA testbed for multidomain AAA and Network Resource provisioning and Token Based Network

5.1.1 Multidomain AAA testbed

This testbed is being constructed and became operational at the end of Q3 2007 providing UvA facility for the joint Internet2-UvA demo at SC07. It will re-designed to incorporate recent development in WP4 and to allow integration with the WP1/Phosphorus NSP and global testbed.

The AAA testbed allows using different NRPS domains (see Figure 5.1 below). Currently it is built using DRAGON as testbed GMPLS base and will support other GMPLS implementations such as G²MPLS when available from WP2. Each domain in shown picture has 3 CPU nodes, 2 nodes are intended to act as a control plane node, driving 802.1Q VLAN switches (or other types if necessary and made available to this testbed) and accepting and forwarding signalling messages via an east-west interface and communicating operation and control messages via a North/South bound interface, which are generated by the 3rd node. The 3rd node will act as a service plane / AAA node that provisions the control plane with service and AAA information. The testbed will be made accessible to both partners from the Phosphorus project and organizations that want to collaborate in the area of AAA, such as Internet2.

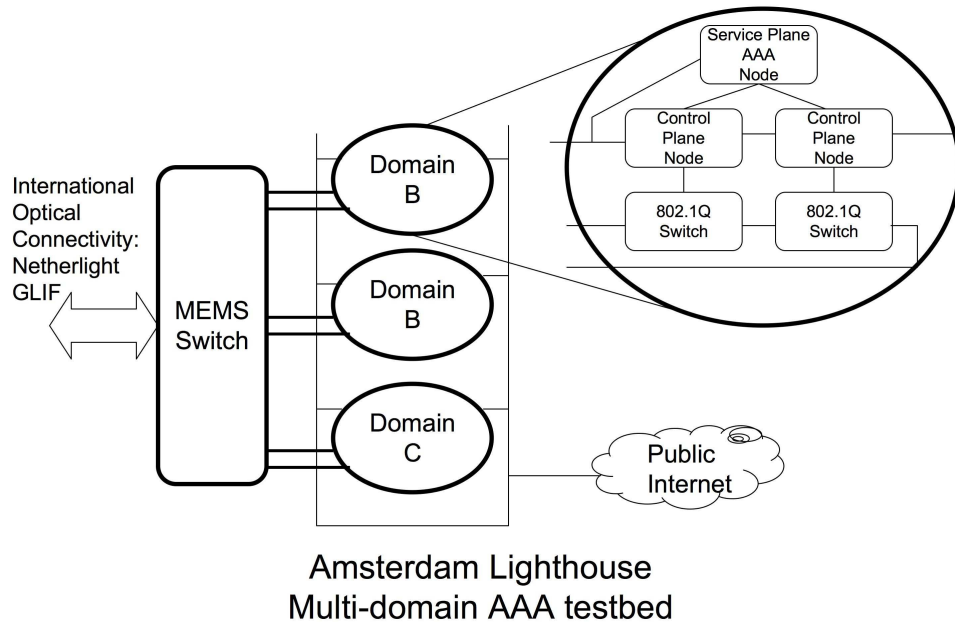


Figure 5.1: Multi-domain Generic AAA Testbed at UvA Lighthouse

The GAAA testbed will be used to demonstrate multidomain network resource provisioning scenario that will use developed GAAA Toolkit (GAAA-TK) library to support token-based policy enforcement mechanism being developed in WP4 and allow different advance reservation scenario.

The testbed will provide test implementation of the token concept into DRAGON/OSCARS system. Figure 5.2 provides more details what components of the GAAA-TK will be used in the planned demo and their interaction.

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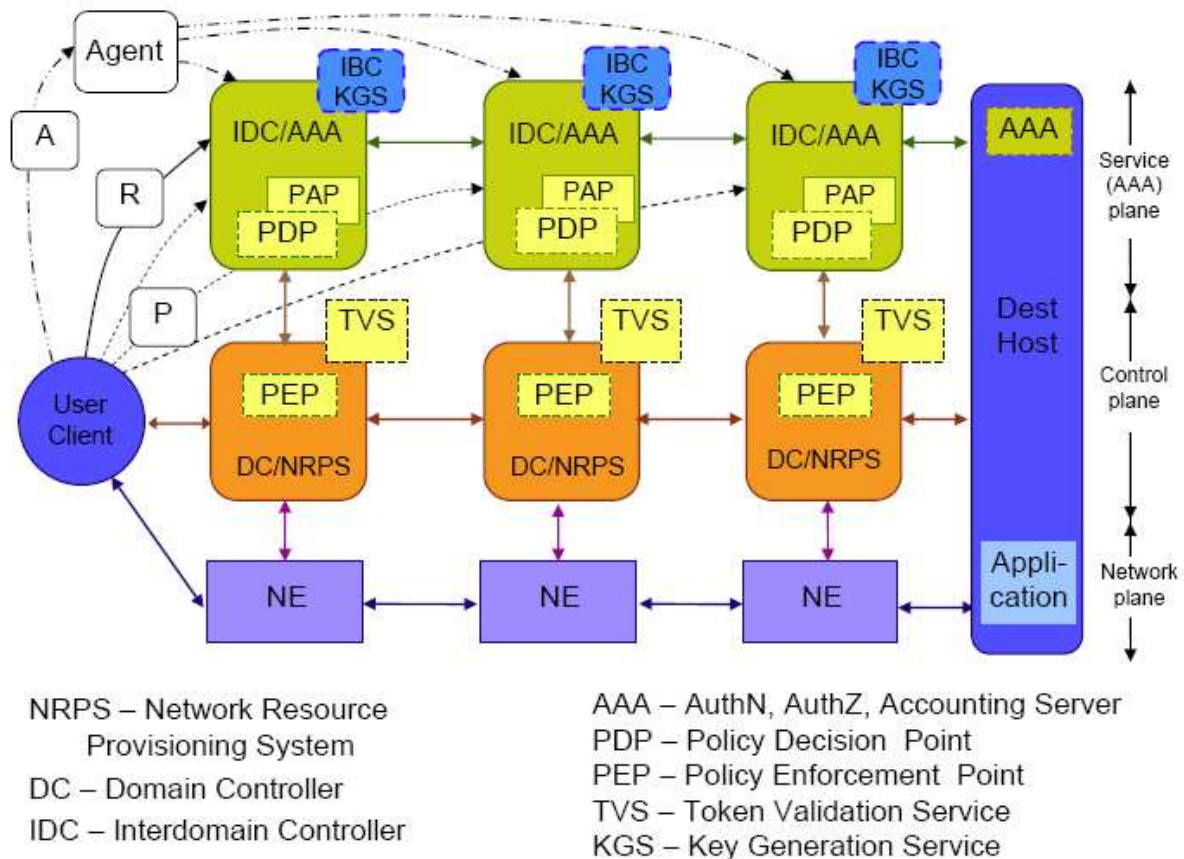


Figure 5.2: GAAA-TK components of the AAA testbed participating in the multidomain network resource provisioning.

The TVS/TB represents the Token Builder (TB) part of the Token Validation Service (TVS). The TB in the last domain creates a token after authorization processes in each domain indicated to its downstream domain that a particular domain can honour a path request. After being build, the token is subsequently either handed to the upstream domain or handed to the requesting application when it is the first domain in the chain. Also the Policy Enforcement Part (PEP) of the TVS will also receive a copy during this process. The PEP of the TVS will check the validity of the token, once it is passed from the requesting application down to the control-plane signalling channel. If the token is valid, the PEP will allow the DRAGON VLSR to provision the switch with the correct information to create the path. If – as part of the GMPLS protocol – periodic signalling stops, the VLSR code will tear the connection down.

One of the goals of the experiment is to gain experience with the GMPLS mechanisms and the token usage inside them, and to re-use this experience to build the token mechanism into the Phosphorus GMPLS implementation and perform Phosphorus – DRAGON/OSCARS interoperability tests. Also, DRAC and OSCARS are working on creating interoperable implementations.

5.1.2 Token Based Network testbed

The Token Based Network (TBN) testbed is the Token Based Network which uses Token Based Switch over IP (TBS-IP) as a low-level system for traffic switching at high speeds (multi gigabits/sec) based on packet authentication. TBS-IP helps high-performance computing and grid applications that require high bandwidth links between grid nodes to use priority links for authorised packets with policy constraints. TBS-IP is fast and safe and uses the latest network processor generation (Intel IXP2850). The associated testbed architecture is depicted in the next pictures. Figure 5.3 shows an overview of the context where TBS-IP systems will be plugged in. In this first case, we suppose to build an end-to-end connection composed of lightpaths based only on IP packets. Figure 5.4 shows another context where TBS-IP systems work together with GMPLS test-bed connected as a separate network domain. In other words, in this scheme we suppose to have some GMPLS lightpaths within the end-to-end connection that uses normally IP packets.

The test-bed, as illustrated in Figure 5.3, consists of four hostPCs (IBM 330x CPUs) with gigabit NICs interconnected in 2 separate VLANs with the help of the Force10 gigabit switch. We also have two IXP2850 network processor systems which are programmable via ForCEG hosts. The entire demo is controlled by IDCs (Inter Domain Controllers hosts).

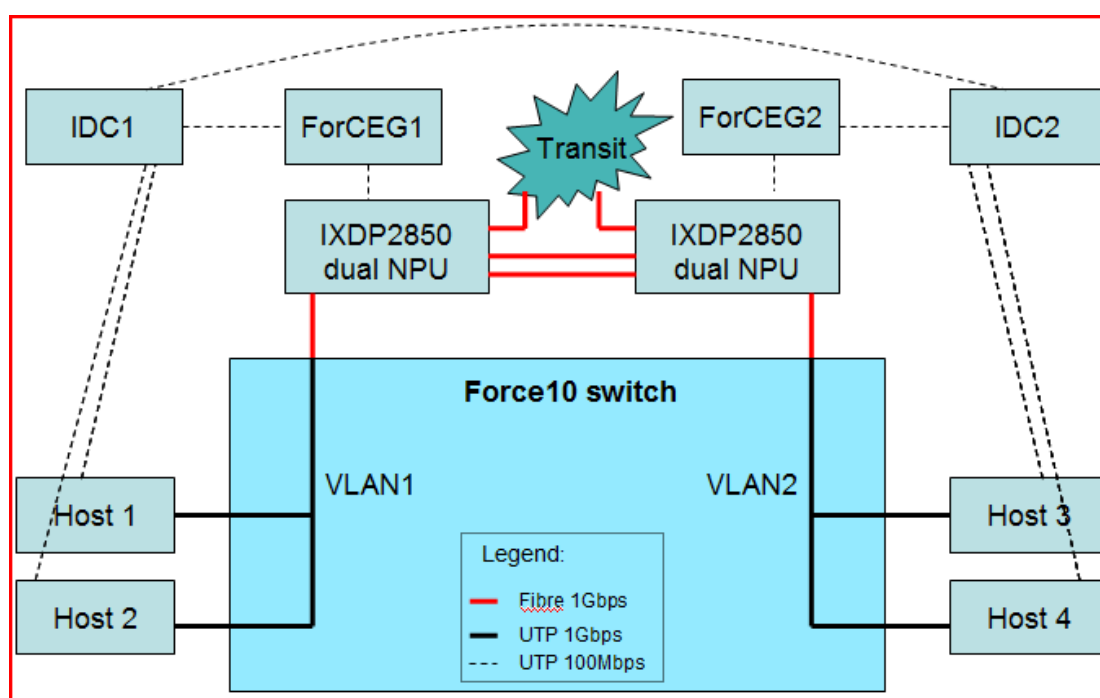


Figure 5.3: TBN testbed in Lighthouse.

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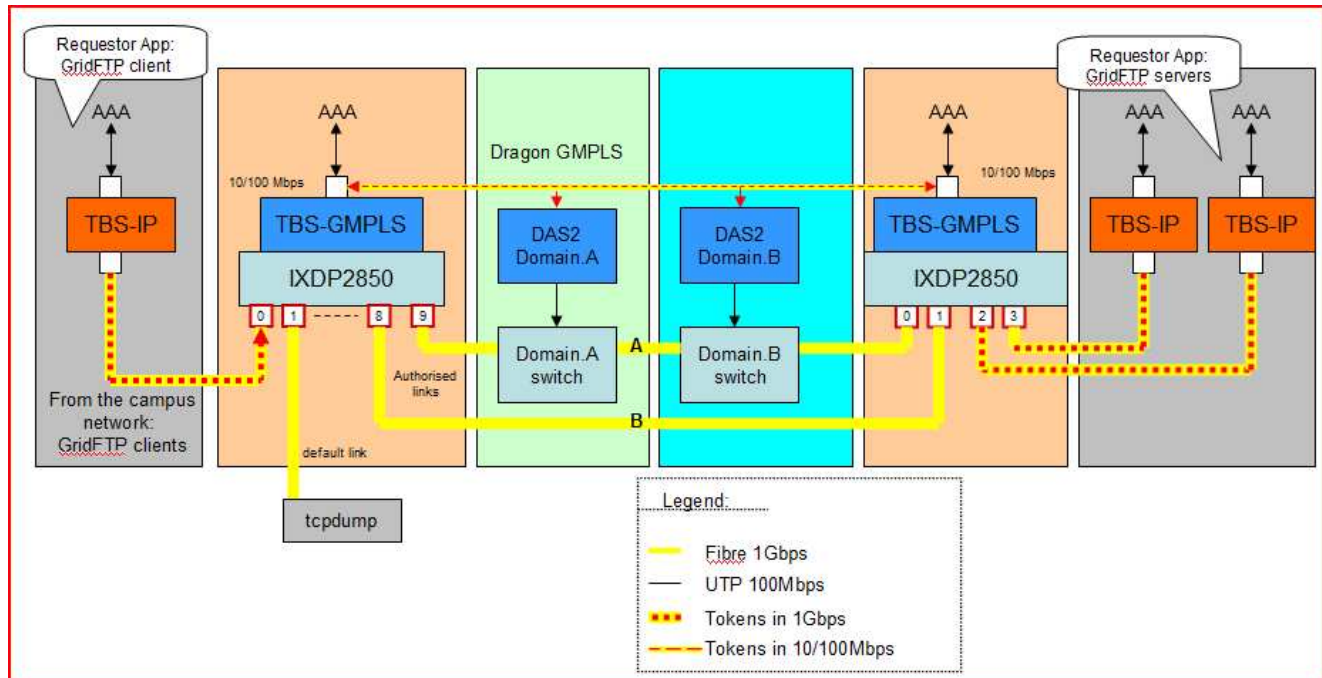


Figure 5.4: Multi-domain Token Based test setup using GMPLS.

5.2 Token Based Switch over IP Demo at OGF23

OGF-Europe's First International Event (<http://www.ogf.org/OGF23>) will be hosted by the Barcelona Supercomputing Center and co-Located with the BEinGRID Industry Days. It will take place in the Barcelo Sants Hotel of Barcelona (Spain) in June 2-6, 2008.

WP4 together with UvA CTI/UoP will presented the Token Based Switch over IP (TBS-IP) demonstration for Firewall Issues Research Group (FI-RG). The demonstration will use the general TBN testbed at Lighthouse (see Figure 5.3).

Figure 5.5 illustrates the lightpath request scenario between two domains operating TBS-IP:

- App.1 and App.2 on Host_A and App.3 on Host_B, each request a lightpath to Host_C from IDC1;
- IDC1 finds 2 available lightpaths: "yellow" and "red", and it can map:
 - App.1+App.2+App.3=>"red";
 - App.1+App.3=>"yellow", App.2=>"red";
 - App.1+App.2=>"yellow", App.3=>"rejected";

For a first demonstration we chose to use ftp and gridFTP applications over end-to-end paths. For instance, we would like to demonstrate the following scenarios:

1. One ftp session per path:

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- a. FTP Client1 => Path A (yellow)
- b. FTP Client2 => Path B (red)
- c. FTP Client3 => transit
2. Multiple sessions per path
 - a. FTP Client1, Client2 => Path A (yellow)
3. FTP Client3 => Path B (red)

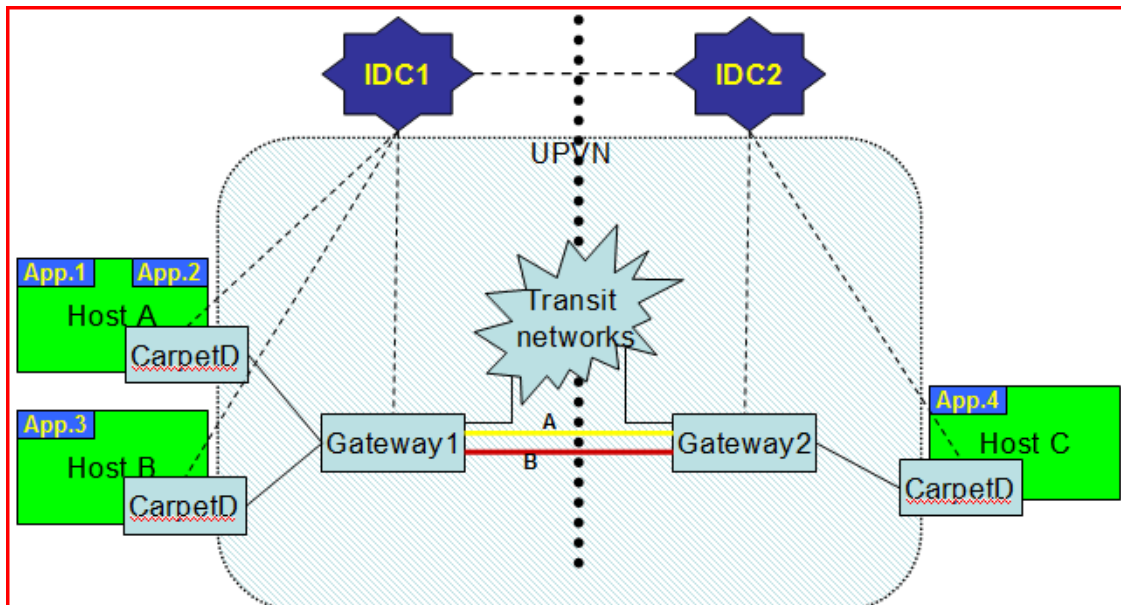


Figure 5.5: End-to-end path request between 2 domains operating TBS-IP.

We enhance the previous ftp demonstration with grid-oriented applications such as gridFTP, as described in the following scenarios:

1. One session per path:
 - a. Client1 => Path A => Server1
 - b. Client2 => Path B => Server1
2. Multiple sessions per path
 - a. Client1 => Path A => Server1 & 2

Note that in this demonstration we also use domains which are not TBN, such as GMPLS or G²MPLS to show the inter-operability of our TBN with other network domains. Details on the GMPLS setup is described in the following sections.

5.3 Multidomain Network Resource Provisioning Demo at SuperComputing 2008

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.

In particular, SC08 demo will demonstrate two advance reservation and signalling models using token based policy enforcement concept and access tokens that allow separate reservation and access stages and use access token for signalling and access control at the access stage.

Figure 5.6 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.

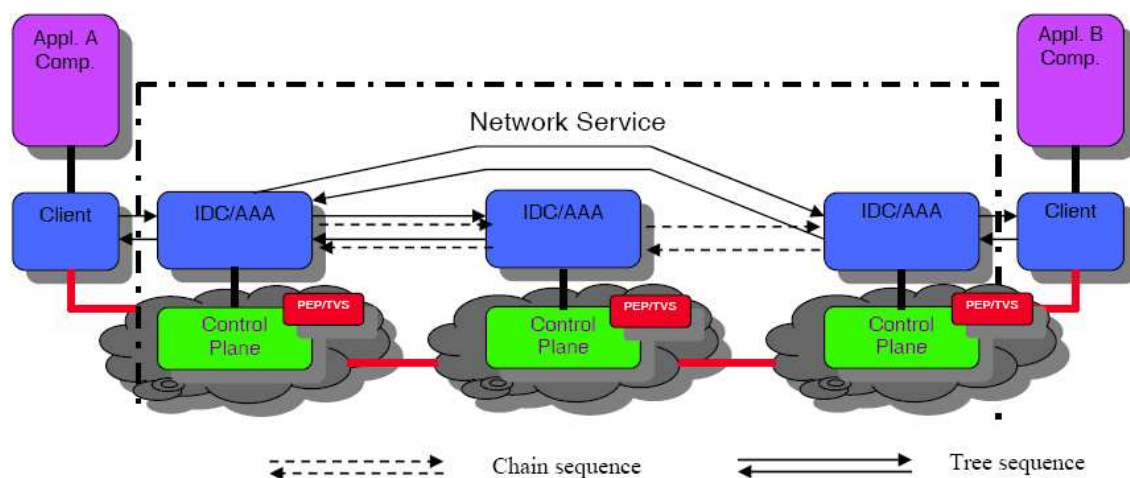


Figure 5.6: Interaction between network domains and related services during tree/chain reservation and signalling

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

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discussed how the proposed basic setup can be connected to the WP1 NSP infrastructure and common project testbed.

Figure 5.7 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 tree/centralised model will require obtaining information about network resource in all domains that is why it will be first modelled and implemented in the UvA AAA testbed

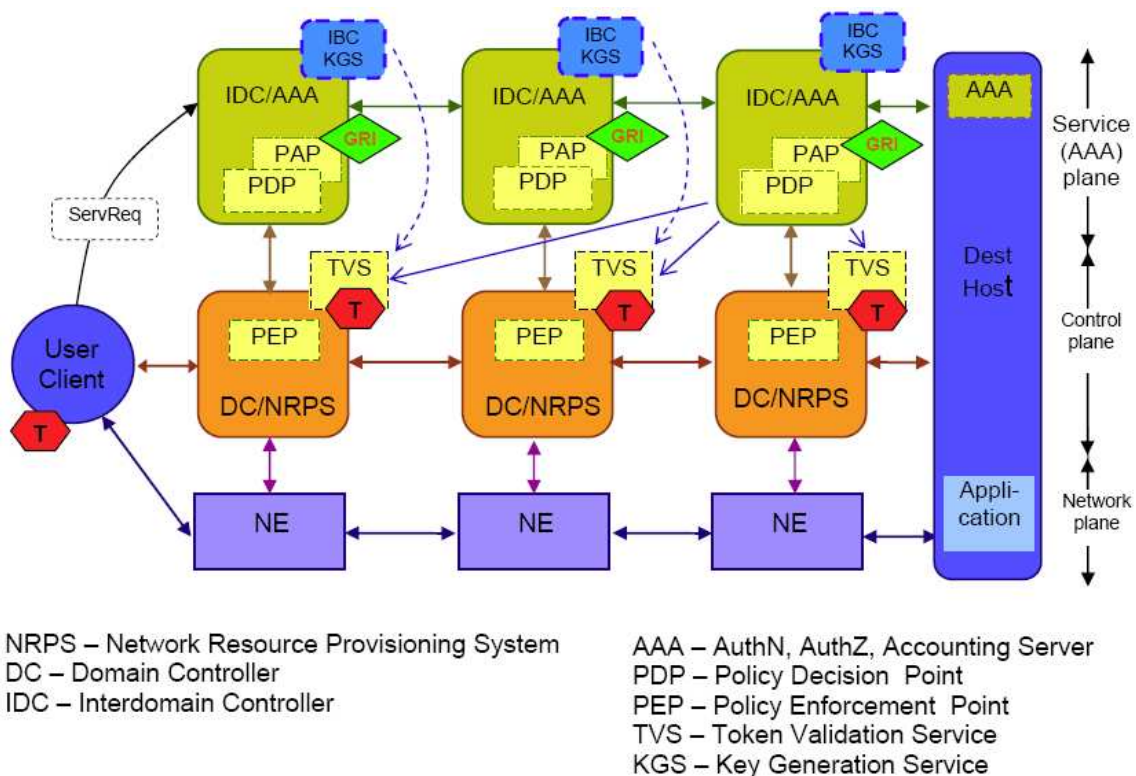


Figure 5.7: GAAA-TK components participating in the multidomain network resource provisioning

The following ideas and solutions are planned to be demonstrated in the UvA SC08 demo:

1. Flexible (“elastic”) scheduling that will allow to optimise user bandwidth reservation depending on the user application requirement.
2. Using GRI concept/mechanism for identifying and referencing the reserved resource and optionally for tracing/tracking the reservation process. The GRI concept is implemented in the OSCARS and integrated with TVS and currently being discussed with WP1.
3. XACML based domain and inter-domain access control policy.



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4. Using Identity Based Cryptography (IBC) for token key distribution. This can be used as an alternative to currently used shared secret security model or PKI based key distribution model.

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6 Conclusions

The documents shows the PHOSPHORUS consortium's plans for demonstrations of the project ideas and developments. Chapter one gives information about the planned demonstration events in 2008 while the other chapters show the plans for demonstrations of the results of four PHOSPHORUS workpackages – the workpackages which aim in developing new tools and protocols for optical networks which supports GRIDs. The integration of the developments of the four workpackages will take place and its results will be demonstrated in the last months of the project duration. The demonstrations planned by the PHOSPHORUS consortium will allow people from outside the consortium to see and verify the PHOSPHORUS developments in a real network with real scientific applications. The consortium believes this is the best way of convincing the potential users of the qualities of the new mechanisms proposed and developed by the PHOSPHORUS project.



7 Acronyms

B/A	backup/archive
DDSS	Distributed Data Storage Systems
GÉANT2	Pan-European Gigabit Research Network
GÉANT+	the point-to-point service in GÉANT2
GLIF	Global Lambda Integrated Facility
GMPLS	Generalized MPLS (MultiProtocol Label Switching)
G ² MPLS	Grid-GMPLS (enhancements to GMPLS for Grid support)
IP	Internet Protocol
KoDaVis	Collaborative Data Visualisation
MPLS	MultiProtocol Label Switching
MSS	MetaScheduling Service
NREN	National Research and Education Network
NRPS	Network Resource Provisioning System
OGF	Open Grid Forum (www.ogf.org)
SC 08	Supercomputing 2008 (sc08.supercomputing.org)
TBS	Token Based Switch
TOPS	Technology for Optical Pixel Streaming
UCLP	User Controlled Light Paths
UNI	User to Network Interface
UNICORE	UNiform Interface to COmputing REsources
WISDOM	Wide In Silico Docking On Malaria
VLAN	Virtual LAN (as specified in IEEE 802.1p)



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