★ The Phosphorus project focuses on delivering advanced network services to Grid users and applications interconnected by heterogenous infrastructures. The project is addressing some of the key technical challenges to enable on-demand end-to-end services across multiple domains

Empowering Grid users with improved services

Grid infrastructure – comprising of dedicated optical bandwidth, shared data services, shared instruments and widely distributed computing resources, has enabled vast processing power and data sharing capabilities, not only across Europe but across the globe.

Phosphorus is a European project to essentially create software tools (and associated developments) to make users/applications acutely 'resource-aware' in the vast Grid environments, which will in turn make the best and optimal use of these powerful networks.

end-to-end, on-demand provisioning of network services in this field, need to be developed, in coordination with other resources (CPU and storage) and will also need to span multiple administrative and network technology domains.

The developments and achievements of the project will also be verified in a real environment with real applications.

This is being achieved by means of distributed test-bed demonstrations in major conferences and on a global scale involving European and international

of authentication, authorization and accounting (AAA) across all planes.

See below for a breakdown of aims within each of these planes.

Service plane

- The creation of middleware extensions and APIs to expose network and Grid resources and make reservations of those resources for users.
- The implementation of policy mechanisms for networks participating in a global hybrid network infrastructure, allowing both network resource owners and applications to have a stake in the decision to allocate specific network resources.

Network Resource Provisioning plane

- The Adaptation of existing Network Resource Provisioning Systems (NRPS) to support the framework of the project.
- The implementation of interfaces between different NRPS to allow multi-domain interoperability with the Phosphorus resource reservation system.

Control plane

- Work on enhancements of the GMPLS Control Plane (G^2MPLS) to provide optical network resources as first-class Grid resource.
- The inter-working of GMPLS-controlled network domains with NRPS-based domains, i.e. interoperability between G^2MPLS and UCLP, DRAC and ARGON Being in its crucial test-bed design

The Phosphorus project is gathering information and analysis to create the first user tested platform for experimentation and development

The Phosphorus project is endeavoring to make applications aware of their complete computational and networking resources.

This will make applications more adaptive, by making dynamic use of various connected high-end resources. The development of appropriate middleware to enhance interoperability between various sites and maximise the scope and level of available facilities for a project undertaken will enhance the usage of Grids that offer great opportunities for large scale international research initiatives.

Software tools and frameworks for

resources and test-beds. The most recent of this was at the largest IT conference, the SuperComputing conference, held in Reno, USA where high end scientific and Grid applications were set on Phosphorus testbed interconnecting domains across Europe (Spain, the Netherlands, Germany and Poland), USA and Canada to demonstrate Phosphorus achievement to date.

The technical goal is to develop smooth integration between applications, middleware and transport networks, based on three planes which consist of the service plane, NRPS plane and control plane and policy related issues

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TESTBED

The Phosphorus test-bed components and applications

phase, the Phosphorus project is gathering information and analysis to create the first user tested platform for experimentation and development.

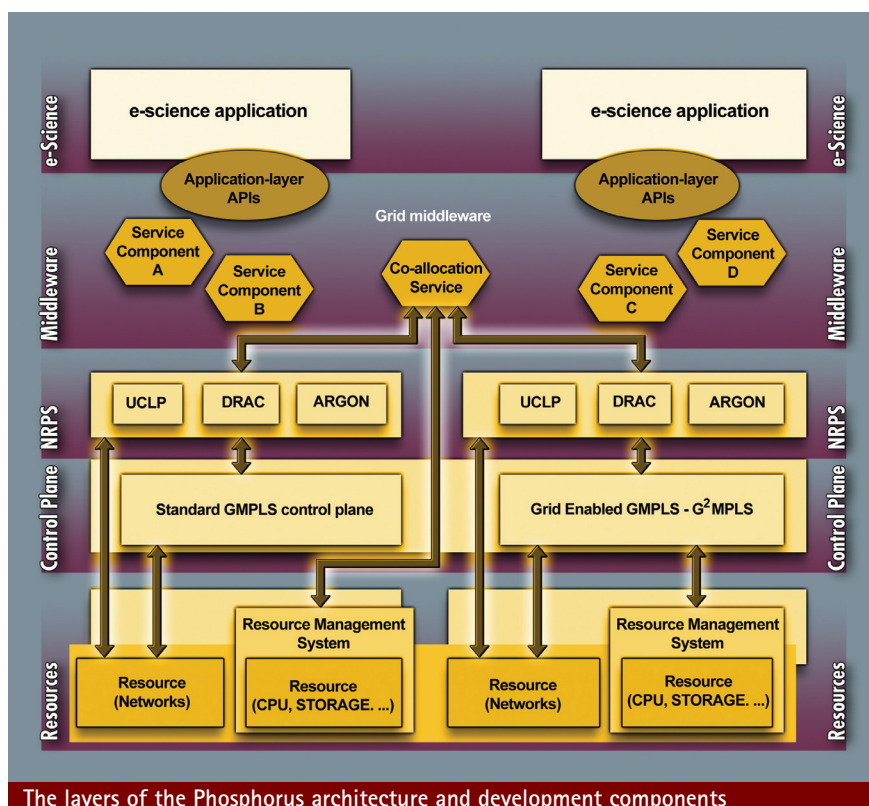The project is continually evaluating the outcomes of these implemented changes within the relatively risk free environment of the test-bed, and will be closely studying resource management within this context in order to create effective job scheduling algorithms, incorporating network awareness, constraint based routing and highly advanced reservation techniques.

The final global test-bed in Phosphorus project will be composed of a number of local test-beds interconnected using multiple optical international networks. These will include GÉANT2, CBDF, GLIF connections and NRENs. E-Science applications with extreme communication demands will be put in particular test-beds to demonstrate services delivery. The test-bed infrastructure will be available for all interested NRENs, End-Users and Research and Development projects.

Partnership with NRENs and End Users with highly demanding applications is very welcome. NRENs and their research end users from all over the world are invited in order to share the knowledge and results of the Phosphorus project.

With its service-centric, single-step approach to resource provisioning in which network and Grid-specific resources are controlled and set-up at the same time, Phosphorus is poised to reshape the network infrastructure. It provides a set of seamlessly integrated procedures that re-organise deployment of on-demand and in-advance Grid and network services. From the resource operator's perspective, it provides an efficient all-round resource provisioning and utilization. From the user's perspective, it results in a real, node-to-node deployment of on-demand Grid services.

Distributed computing

By means of simulations, real test-bed demonstrations, third-party initiative applications, and numerous scientific publications, Phosphorus is to date, proving its concepts by practical results that demonstrate interoperability in a heterogeneous environment across inter-domain infrastructures and technologies.

Several initiatives have become the focus for the testing stage of the Phosphorus' project, including

The final global test-bed in Phosphorus project will be composed of a number of local test-beds interconnected using multiple optical international networks

The layers of the Phosphorus architecture and development components

applications such as WISDOM, KoDaVis, TOPS and DDSS. All these initiatives need to rely on the power of distributed computing so would benefit from the most efficient and effective approach to accessing Grid resources on-demand, that is possible.

The initiatives are varied in scope. For instance, the WISDOM initiative seeks to demonstrate the impact of the Grid approach to address drug discovery for neglected and emergent diseases.

Heterogeneous infrastructures

KoDaVis also requires serious computing power, relying on collaborative computing to generate an atmospheric simulation based on a huge amount of data describing the transport of chemical tracers in the troposphere. TOPS – Technology for Optical Pixel Streaming involves the streaming of ultra high resolution data sets over Lambda Networks; and then there is DDSS which stands for Distributed Data Storage System, a high performance, secure, reliable data transfer protocol optimised for high bandwidth wide area-area IP networks.

The potential difference that the improvements to Grid access could make through Phosphorus' studies may ultimately refine the way organisations

approach these heterogeneous infrastructures.

As the project continues, Phosphorus will continue to disseminate procedures, toolkits and middleware to the EU NRENs and their users, such as Supercomputing centres and the wider European and worldwide scientific users.

Paving the way with its innovative single-step approach to resource provisioning, Phosphorus realises an infrastructure that supports the deployment of mission-critical applications on a global scale.

Its vision of the network as a Grid resource coupled with its perspective of service-centric resources and infrastructure allows Phosphorus to significantly enhance the capability of Grid and e-science applications and provides a unified network/Grid infrastructure that can flexibly adapt to application's demands, regardless of the diversity of resource requirements.

In this way the Phosphorus project pioneers a new approach in communications, in which applications rely on a network infrastructure that adapts to the application, rather than having the application to adapt to the network as per the status-quo in research. ★

At a glance
PHOSPHORUS – Lambda User Controlled Infrastructure for European Research

Objective:
Phosphorus is demonstrating on-demand end-to-end network services across multiple heterogeneous network and Grid domains.

Project partners:
PSNC, Poland
ADVA, Germany
CESNET, Czech Republic
Nextworks, Italy
Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V., Germany
i2CAT, Spain
Forschungszentrum Jülich GmbH, Germany
HITACHI, France
IBBT, Belgium
RACTI, Greece
AIT, Greece
SARA, Netherlands
SURFnet, Netherlands
Universität Bonn, Germany
Universiteit van Amsterdam, Netherlands
University of Essex, United Kingdom
University of Leeds, United Kingdom
NORTEL, Netherlands
Communications Research Centre, Canada

Contact details
e: artur@man.poznan.pl
t: +48 618582010
f: +48 618525954
www.ist-phosphorus.eu

Artur Binczewski
Network Division Manager
Poznan Supercomputing and Networking Centre

Professor Dimitra Simeonidou
University of Essex