This application serves to demonstrate a number of AutoBAHN’s salient points:
- dynamic circuits provide an effective way of working with the e-VLBI network, which does not operate continuously
- the locations of the telescopes vary, thus there is a need for data transfer from a wide variety of locations
- in an advanced software-based correlator setup, the software can be run on many distributed clusters, so dynamic circuits are needed to interconnect those clusters on a case-by-case basis.

AutoBAHN was developed as a pilot within the GEANT2 project, which is co-funded by the European Commission as part of the Sixth R&D Framework Programme (FP6).

The SCARLe project is a collaboration between the JIVE (the Joint Institute for Very Long Baseline Interferometry (VLBI) in Europe), the University of Amsterdam and SARA, and is funded by the Netherlands Organization for Scientific Research. SCARLe aims to develop a distributed software correlator for real-time e-VLBI in conjunction with advanced networking technologies.

TAMING DEVELOPMENT COMPLEXITY IN SERVICE-ORIENTED e-INFRASTRUCTURES

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e-Infrastructure is the term coined for innovative research environments that provide modern scientists with seamless access to shared, distributed and heterogeneous resources. Within this domain, service-orientation is a common assumption where it provides a common abstraction to hardware, data and even application services as shareable resources. This approach, however, complicates resource management, since deployment, configuration, staging, scoping, monitoring and secure operation of services become fully dynamic and a responsibility of the infrastructure.

To fulfill this responsibility, infrastructures must be clear as to the description and run-time behaviour of services. This adds to the complexity typically associated with service development, whether generically related to distributed programming (e.g. concurrency, performance-awareness, and tolerance to partial failure) or specifically introduced...
by open technologies (e.g. reliance upon multiple standards, limited integration and documentation of development tools). This complexity challenges the operation, maintenance, evolution and third-party extension of the infrastructure, ultimately threatening its adoption.

gCube in DILIGENT and D4Science

DILIGENT and D4Science, two grid-based e-infrastructures for sharing resources within Virtual Research Environments (VREs), have faced these complexity issues. Both the infrastructures promote applications – the VREs – whose constituents are dynamically borrowed from the infrastructure, bound (and deployed) instantly, just at the time and for the period they are needed.

These infrastructures operate under the control of gCube, an open platform of about 140 software components (services and associated software libraries) for interactive inclusion and orchestration within VREs. gCube manages its services dynamically and offers a range of solutions to reduce the costs induced by its requirements. Most noticeably, support concentrates in the "gCore Distribution for gCube", or gCore for short. gCore includes a sophisticated Java-based service framework entirely dedicated to the development of gCube Services, a dedicated container providing a runtime environment for gCube services, and the minimal sets of gCube components required to operate in a gCube infrastructure.

Built as an extension of Globus technology, the gCore Framework (gCF) aims to simplify and standardise all systemic aspects of service development, as well as promote the adoption of best practices in multiprogramming and distributed programming. In particular, gCF:

- manages the entire lifecycle of gCube services, engaging in autonomous interactions with the infrastructure and local environment, and allowing customisation of deployment, initialisation, activation and failure response;
- enforces the scoping and security rules associated with shareable resources, handling the acquisition and renewal of service credentials, the delegation of caller credentials, and the propagation of scope and credentials from incoming to outgoing service calls;
- implements Web Services Resource Framework standards for publication, access, and notification of change to service state, offering a rich set of abstractions for modelling it, governing transparently its full lifetime, and managing its persistence on different storage media, including its recovery from remote media upon service migrations;
- standardises the use of systemic faults within service interfaces and implementations, transparently supporting retry-same and retry-equivalent semantics and converting faults into equivalent lighter-weight exceptions at service boundaries;
- mediates access to configuration resources on classpath and local file system, redirecting read failures to backups created prior to write operations and exposing object bindings for all aspects of service and container configuration;
- simplifies resource discovery via object bindings, templating, and XPath inspection for a range of queries to the information services of the infrastructure;
- simplifies multiprogramming via arbitrary combinations of event-based synchronisation, scheduling, parallelisation, and sequencing of local processes;
- simplifies distributed programming through the customisation of best-effort discovery and interaction strategies with stateless and stateful services.

Widely adopted within gCube infrastructures, the gCF guarantees a uniform quality of systemic behaviour across all its services, as well as a convenient basis for infrastructural evolution. As requirements for gCube compliance stem from a general model of shareable resources, we believe that the support offered by gCF can be exported to other infrastructures that make a similar commitment to service-orientation.
This work is partially funded by the European Commission in the context of the D4Science (FP7) project.

11.5 TERAFLOPS FOR AFRICA: THE BLUE GENE®/P SYSTEM

Jeff Chen, Meraka Institute, South Africa

Opportunities for economic development in Africa have been at the forefront of recent scientific discussion. As part of its Global Innovation Outlook, computer giant IBM recently donated a Blue Gene supercomputer to South Africa’s Centre for High Performance Computing. The donation was part of a USD 120 million investment in sub-Saharan Africa, announced by IBM in December 2007. The Blue Gene®/P system is capable of 11.5 Teraflops and is currently the fastest scientific computer in Africa. This donation has given impetus to “Blue Gene for Africa” (BG4A), an initiative that aims to build high-end computing capacity in Africa. The project aims to develop infrastructure, promote collaborative science that will impact Africa, and develop Africa’s human capital.

At the launch of the “Blue Gene for Africa” project, Dr Mark Dean, IBM Fellow and Vice President of IBM’s Technical Strategy and Worldwide Operations, called attention to the importance of research and development in giving organisations and countries a competitive edge. He suggested that Africa needs more R&D to spur further socio-economic development, and that investment in the development of human capital as well as infrastructure was therefore crucial. Blue Gene is thus part of IBM’s contribution to sparking scientific and socio-economic progress in the African continent.

Deputy Minister of Science and Technology, Derek Hanekom, shared Dr Dean’s view, emphasising the role that a tool like the Blue Gene supercomputer can and should play in addressing some of the major needs and challenges of the African continent. Johan Eksteen, Manager of Technology Research Programme at the Meraka Institute also agreed that the Blue Gene would be a holistic addition to the present cyberinfrastructure of the DST as implemented by the CSIR.

Flagships will find super-support

The BG4A supercomputer will predominantly be used to run Flagship projects, which are awarded following a stringent selection process. Frontrun-

International partnerships and potential

President and CEO of the Council for Scientific and Industrial Research (CSIR), Dr Sibusiso Sibisi, linked the research enabled by the “Blue Gene for Africa” initiative with prospects for improving quality of life of ordinary African citizens, particularly through poverty alleviation. Such outcomes are relevant in the context of the CSIR’s mandate. At the same time, however, Dr Sibisi stressed the importance of the “Blue Gene for Africa” initiative in promoting collaborative research internationally.

One such collaboration already exists between the Meraka Institute and the European Commission-funded BELIEF-II consortium; it is envisaged that BELIEF-II will make a significant contribution to the development of the “Blue Gene for Africa” project and subsequently foster a wider range of eScience partnerships between African and international institutions.

Official launch of the Blue Gene for Africa Project