K-WF GRID

Scope

Often in industry and science a set of pre-determined sequential tasks need to be completed by different people or resources in order to achieve a necessary result. The use of IT systems to manage such a sequence of structured tasks - known as a workflow - is commonplace in the modern working environment. Take for example a purchase order that moves through various departments for authorization and eventual purchase. IT systems exist to manage such a flow but, once in a while, some specific human knowledge is required at a certain point in the workflow before the next step in the flow can be initiated. Can that expert knowledge be recognized, captured and stored by the system in such a way that it could be automatically retrieved when required at some future point? And would it not greatly increase efficiencies and reduce costs if workflows, instead of being manually constructed, were to be dynamically composed from various Grid services without any dependency on a user's input?

Advances

The path is clear: IT world is heading for services. Big monolithic software systems are replaced by flexible, scalable and distributed solutions with reduced maintenance costs and improved performances.
On one side, the solution of complex problems in many domains requests powerful computation resources and data management facilities, both in local and wide networks; on the other side, the availability of a large number of services and resources is a real benefit only if management, maintenance and use are user-friendly activities.
K-wf grid (Knowledge-based Workflow System for Grid Applications) gets the best out of a Grid of services: as big calculations are made of smaller operations, big applications can be composed by smaller services, used in the correct order and fed with the correct data.
K-wf grid has already released an innovative, knowledge-based system to model, compose and execute workflows of operations, helping Grid users to exploit distributed services and resources in a very effective, time-saving way, possibly even making migration to advanced technology a painless process.
K-wf grid defines "workflow" as "the automation of distributed IT processes - in whole or part - during which documents, information or tasks are passed from one participant to another for action, according to semantic description of available resources and information gathered by their monitoring".
K-wf grid is developing technology to compose Grid workflows automatically on the basis of the desired output and of the description of Grid resources available: services are invoked in the correct order and fed with the correct data so that the results are compliant with the specification and that only the optimal resources are used.
Petri net theory has been used to model workflows, described by a new XML-based language called Grid Workflow Description Language (GWorkflowDL).
The innovation of K-wf grid comes from the merging of different technologies (Petri net theory, Semantic Web, Web Services and Grid, Performance Monitoring and Instrumentation) to provide services able to change radically the way Grid-based scientific research and business solutions are managed today.

Positioning in global context

K-wf grid has been the reference European research initiative merging the power of the Grid, the flexibility of workflows and the expressiveness of Semantic web in one integrated system.

Contribution to standardization and interoperability issues

The project has developed a new XML-based language (named GworkflowDL – Grid Workflow Description Language) that has the potential to become a de facto industrial standard for describing and modeling workflows on the basis of Petri net theory.
The K-wf grid system is also potentially interoperable with other knowledge-management systems compliant with the W3C OWL specification.

Target users / sectors in business and society

K-wf grid provides a framework to assist users in building complex workflows on the Grid. Two categories of users can be identified:

- software and application developers, i.e. IT technicians who develop Grid applications;
- service providers, i.e. private/public organisations that use complex distributed applications managing different sets of data.

Overall benefits for business and society

K-wf grid technology has the potential to increase the efficiency in dynamic competitive industrial settings where workflow is important, by automating the gathering of information about available services and storing it for future re-use.
The consequence is greater agility in the work place to adapt to fast changing business environments, allowing for products can get more quickly to the market place.

Examples of use

The past: using the Grid with application binaries
Users could use the Grid as a powerful distributed machine. Applications had to be installed on every Grid node and data had to be transferred to the local storage to execute the application. Apart from being insecure for the resource and quite uncomfortable for large scenarios, this approach required to know exactly the feature of each resource used.
The present: Grid of services
The application modules are instantiated as web or Grid services and the user are not obliged to know the technical details of the resource where the service is running. However, with the Grid increasing the offer of services, management and use pose a real problem for less experienced users. Additionally, even with some existing tools for workflow composition, the actual decisions in service pairing and data provision are still depending on the user's knowledge.
The future (with K-wf grid): automatically-built workflows
To relieve users of managing large pools of services, the middleware gathers information about these services, stores it and reuses it for further application. Users have not to remember which services to use, which is the best and which to avoid, since the system remembers it: the user must only specify which results to get, and the system uses its "map of the Grid" to find the best way to it.

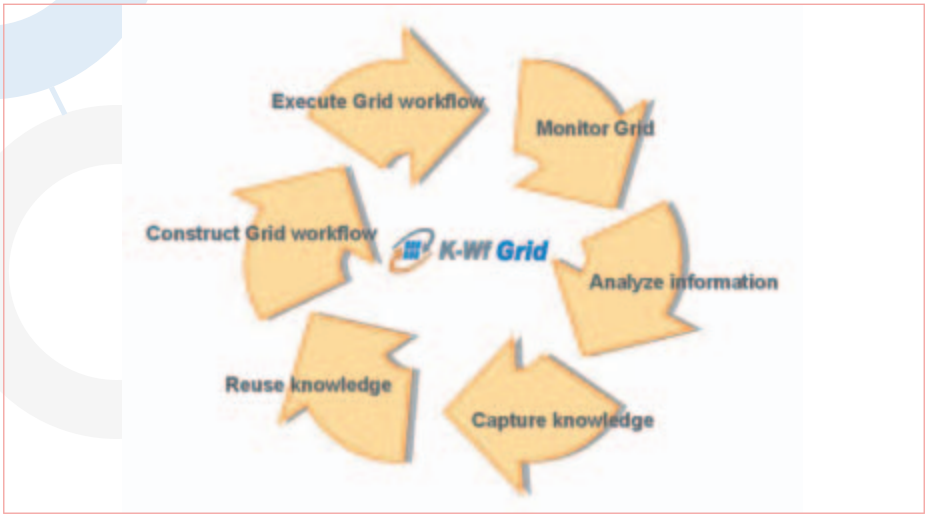
Achievements

The following software components of the **K-wf grid reference architecture** are available for download at http://www.kwfgrid.eu/ in final release with instructions and installation manuals:

- K-wf grid GWUI (Grid Workflow User Interface) & GWES (Grid Workflow Execution Service)
- K-wf grid UAA (User Assistant Agent)
- K-wf grid KAA (Knowledge Assimilation Agent)
- K-wf grid AAB (Automatic Application Builder)
- K-wf grid WCT (Workflow Composition Tool)
- K-wf grid GOM (Grid Organizational Memory)
- K-wf grid WSRF2OWL-S
- K-wf grid Grid Performance Monitoring, Instrumentation Service and Scheduler

A comprehensive overview on the achievements of the project can be found in the 'K-WfGrid Book' – the second volume of the Cracow Grid Workshop 2006 proceedings, which can be downloaded form the K-WfGrid WEB page or from the CGW'06 page: http://www.cyfronet.krakow.pl/cgw06/
The results of K-WfGrid are used and further developed in a number of European and National projects:

- Edutain@Grid (FP6 STREP)
- Coregrid (FP6 NoE)
- Askalon – Austrian National Project
- DGI, DGI II, MediGrid, BauVOGrid (National projects of German D-Grid initiative).



K-Wf Grid

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