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Survey of Major Tools and Technologies for Grid-enabled Portal Development

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Abstract

Grid portals that can provide a uniform access to underlying grid services and resources are emerging. Currently, there are a variety of technologies and toolkit that can be employed for grid portal development. In order to provide a guideline for grid portal developers to choose suitable toolkit, in this paper, we briefly classify grid portals into non portlet-based and portlet-based, and attempt to survey major tools and technologies that can be employed to facilitate the creation of grid portals.

1 Introduction

Grid portals can provide an integrated platform for end users to access grid services and resources via Web browsers without the need to download and install specialised software packages and libraries [2]. Currently, there are a variety of development tools, frameworks and components that can support the grid portal development. However, the features and usage of these tools, frameworks and components can be different. In order to provide a guideline for grid portal developers to choose appropriate toolkit, this paper aims to survey major grid portal development tools and technologies that can be employed to facilitate grid portal development.

2 Grid Portals: Non Portlet-based Vs. Portlet-based

According to the way of building portals, we can briefly classify grid portals into non portlet-based and portlet based.

Non-portlet based - Many early Grid portals or early version of existing Grid portals are non-portlet based, for example, Astrophysics Simulation Collaboratory (ASC) portal [3], UNICORE [4,5], etc. These grid portals provide a uniform access to the grid resources. Usually these portals were built based on typical 3-tier web architecture: (i) Web browser, (ii) application server/Web server which can handle HTTP request from the client browser, and (iii) backend resources that include computing resources, databases, etc.

Portlet-based portal - A portlet is a Web component that generates fragments – pieces of markup (e.g. HTML, XML) adhering to certain specifications. Fragments are aggregated to form a complete web page. Developing portlet-based portals can bring many benefits to both end-users and developers, which now gets more recognition [6]. This can be reflected through evolution of some grid portal projects. For example, although ASC portal [3] did provide functionalities for astrophysics community to remotely compile and execute applications, it was difficult to maintain when the underlying supporting infrastructure evolved. Eventually the ASC portal was retired and its functionality moved into the Cactus portal developed by adopting GridSphere [8]. Another example is the GridPort portal [9]. The early GridPort was implemented in Perl and made use of HotPage [10] technology for providing access to grid access. Now the GridPort 4.0.1 adopts GridSphere. Similarly, the upcoming releases of Java CoG kit 4 will support the portlet-based development as well [11].

Two portlet standards, i.e. JSR-168 [12] and WSRP [13] (Web Services for Remote Portlets) can ensure portlets pluggable and independent on actual portal frameworks.

3 Survey of Major Portal Tools and Technologies

3.1 Commodity Grid (CoG)Kits

CoG toolkits [11] provide native and wrapper implementations of Globus [14]; for example, it provides the implementation of GSI, gridFTP, myProxy, and GRAM client implementations. It uses and leverages existing commodity frameworks, technologies, and toolkits in

cooperation with Grid technologies. CoG is often used to build Grid portals [11]. It includes Perl CoG, Python CoG and Java CoG.

3.2 GPDK

GPDK was a widely used toolkit for building non-portlet based portals. GPDK itself was built on top of the Java CoG based on standard 3-tier architecture [2]. GPDK was a successful product in creating application specific portals by many research groups such as the GridGaussian computational chemistry portal, the MIMD Lattice Computation (MILC) portal, etc [2]. However, GPDK tightly coupled presentation with logic in its design and did not conform to any portal/portlet specifications. This can result in poor extensibility and scalability. Now the GPDK is not supported any longer, and the major author of GPDK has moved to GridSphere.

3.3 GridSphere

The development of GridSphere has combined the lessons learned in the development of ASC portal and GPDK. The GridSphere Portal Framework [8] is developed as a key part of the European project GridLab [15]. It provides an open-source portlet-based Web portal, and can enable developers to quickly develop and package third-party portlet web applications that can be run and administered within the GridSphere portlet container. One of the key elements in GridSphere is that it supports administrators and individual users to dynamically configure the content based on their requirements [6]. Another distinct feature is that GridSphere itself provides grid-specific portlets and APIs for grid-enabled protal development. The main disadvantage of the current version of GridSphere (i.e. GridSphere 2.1) is that it does not support WSRP.

3.4 GridPort

The GridPort Toolkit [9] enables the rapid development of highly functional grid portals. It comprises a set of portlet interfaces and services that provide access to a wide range of backend grid and information services. GridPort 4.0.1 was developed by employing GridSphere. GridPort 4.0.1 might be the last release as the GridPort team has recently decided to shift the focus from developing a portal toolkit to developing production portals [9].

3.5 LifeRay Portal

The Liferay portal [16] is more than just a portal container [17]. It comes with helpful features such as Content Management System (CMS), WSRP, Single Sign On (SSO). It is open-source, 100 % JSR portlet API and WSRP compliant. Liferay is suitable for enterprise portal development. Institutions and companies that adopted Liferay to create their portals include *EducaMadrid, Goodwill, Jason's Deli, Oakwood, Walden Media*, etc [16].

3.6 eXo platform

The eXo platform [18] can be regarded as a portal and CMS [17]. The eXo platform 1 was more like a portal framework. The eXo platform 2 proposed a *Product Line Strategy* [19] as it is realised that end user customers need to get ready to use packaged solutions instead of monolithic product. The eXo platform 2 is now a core part on which an extensive product line can be built [19]. It features that it adopts Java Server Faces and the released Java Content Repository (JCR – JSR 170) specification. The eXo platform 2 adopts JSR-168 and supports WSRP.

3.7 Stringbeans

Stringbeans [20] is a platform for building enterprise information portals. The platform is composed of three components: (i) a portal container/server, (ii) a Web Services platform, and (iii) a process automation engine. At this time the portal server and Web services platform have been released. The process automation engine will be released in the near future [20]. It is JSR-168 compliant and supports WSRP. The Stringbeans was used for the UK National Grid Service (NGS) portal [21].

3.8 uPortal

uPortal[22] is a framework for producing campus portal. It is now being developed by the JA-SIG (Java Special Interest Group). It is JSR-168 compliant and supports WSRP. uPortal is now widely used in creating university portals, for example, the Bristol university staff portal.

3.9 OGCE (Open Grid Computing Environment)

The OGCE (Open Grid Computing Environment) project was established to foster collaborations and sharable components with portal developers [23]. OGCE consists of a core set of grid portlets that are JSR 168 compatible. Currently OGCE 2 supports GridSphere and uPortal portlet containers.

	JSR-168 compliant	WSRP compliant	Grid-specific portlets	Open source	Notes
Java CoG 1.2	✗	✗	-	✓	Development of grid portal framework, grid service, etc
GPDK	✗	✗	-	✓	Not supported any longer
GridSphere 2.1.4	✓	✗	✓	✓	**UK**: RealityGrid [29], MyGrid [30] GeneGrid [31], p-GRADE portal [32], SAKAI VRE Portal Demonstrator [33], etc **US**: Cactus [6], etc **EU**: GridLab, etc
GridPort 4.0.1	✓	✗	✓	✓	Developed based on GridSphere. Last release
Liferay 3.6.1	✓	✓	✗	✓	Widely used in developing portals
eXo 2	✓	✓	✗	✓	Widely used in many company portals
Stringbeans 3.0.1	✓	✓	✗	Dual licenses	Used in UK National Grid Service portal, etc
uPortal 2.5.1	✓	✓	✗	✓	Widely used in many universities
OGCE 2	✓	✗	✓	✓	Support GridSphere and uPortal
Pluto	✓	✗	✗	✓	Simple portlet container
Jetspeed -2	✓	✓	✗	✓	Widely used in creating portals
IBM WebSphere Portal 6.0	✓	✓	✗	Free for research	Widely used in creating portal at enterprise level. Free for research under *the IBM Academic Initiative.*

Table 1 Grid portal development toolkits comparison matrix

3.10 Pluto

Pluto is a subproject of Apache Portal project. It is the reference implementation of the JSR 168 [24]. Pluto simply provides a portlet container for portal developers to test the portlets, and does not provide many specific portlets.

3.11 Jetspeed

Jetspeed is another Aapche Portal project, which includes Jetspeed-1 and Jetspeed-2. Jetspeed-1 "provides an open source implementation of an Enterprise Information Portal, using Java and XML" [25]. Jetspeed-2 is the next-generation enterprise portal, and offers several architectural enhancements and improvements over Jetspeed-1 [26]. Jetspeed is more sophisticated than Pluto. Jetspeed is concentrated on portal itself rather than just a portlet container.

3.12 IBM WebSphere Portal

IBM's WebSphere Portal [27] is a framework that includes a runtime server, services, tools, and many other features that can help integrate an enterprise into a single, customizable interface portal. It implements the JSR 168 Portlet API and WSRP [27]. WebSphere Portal is a powerful tool and is widely used in many business companies and enterprises. IBM also provides a scheme called *the IBM Academic Initiative* [28] for academic and research institutes. Membership in *the IBM Academic Initiative* can have the latest technology and majority IBM software to use for free, which includes IBM WebSphere Portal.

4 Comparison and Findings

Having surveyed the major grid portal development tools, frameworks, and components, a comparison matrix table is produced as shown in Table 1. The evaluation criteria include (i) JSR-168 compliant, (ii) WSRP compliant, (iii) provision of grid-specific portlets and (iv) open source.

The table has revealed that:

1) Developing portlet-based grid portals now gets more recognition.

2) GridSphere has been widely used for grid-enabled portal development. GridSphere itself provides grid-specific portlets. The main disadvantage of the current version is that it dose not support WSRP.

3) Other open source portal frameworks and portlet containers such as uPortal, liferay, eXo, Jetspeed-2, etc are also appropriate for grid-enabled portal development. Although they do not directly provide grid-specific portlets, the existing open source JSR-168 grid portlets (e.g. OGCE, GridPort) can be reused or new grid portlets need to be developed.

4) For developing commercial grid portals, the toolkit of IBM WebSphere portal would be a good choice. Likewise, although WebSphere portal itself does not provide grid-specific portets, we can reuse the existing JSR-168 grid portlets or develop new ones. Under *the IBM Academic Initiative*, academic and institutional researchers can use the IBM WebSphere portal for free.

5) GridPort provides grid-enabled portlets, but GridPort 4.0.1 might be the last release as the team will now focus on the production portal development instead of portal toolkit.

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