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http://forge.gridforum.org/projects/ogsa-hpcp-wg

10/31/2007

Interoperability Experiences with the High Performance Computing Basic Profile (HPCBP), Version 0.1

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This memo provides information to the Grid community regarding the experiences of the authors in implementing the HPC Basic Profile. Distribution is unlimited.

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Abstract

This document describes the experience of interoperability testing of independent implementations of the High Performance Computing Basic Profile (HPCBP) and the specification which it profiles, the Basic Execution Service (BES) and the Job Submission Description Language (JSDL).

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1 Introduction

This document describes the experiences of multiple groups performing interoperability testing on their implementations of the HPC Basic Profile [HPCP10], including the HPCProfileApplication [HPCP-A], BES [BES10] and JSDL [JSDL10]. The organization for this document is as follows. Section 2 briefly describes the groups involved in the interop testing and the software systems employed. Section 3 describes the results of this testing and section 1 describes note-worthy experiences and discoveries made while performing the tests.

2 Implementations

The name and affliation of each implementation are listed here along with a brief description of their software stack and related tools.

Group	Software stack/Tools
University of Virginia e-Science Group	.NET 2.0, WSE 3.0, CCS
University of Virginia e-Science Group	Linux, GSoap, C, PBS
Microsoft	WCF, .NET 3.0, CCS
Platform Computing	GSoap, Linux, C, LSF
OMII-UK GridSAM	?
OMII Europe CREAM-BES	Java, OMII stack?
UNICORE	?
NorduGrid/KnowARC A-REX	?

3 HPC Base Profile Interoperability Tests

This section describes the tests performed using services implementing the HPC Base Profile as well as BES and JSDL as they relate to HPCBP. Testing was done using the HPC Basic Profile Interoperability Tester web site, a site designed to validate HPCBP-compliant services. This site acts as an HPBCP-compliant client which sends messages to a service provided by the user and verifies both the schema and values of the response to see if they are consistent with the tested specifications. This site allows its user to test the five BES methods supported by HPCBP, CreateActivity, GetActivityStatuses, TerminateActivities, GetActivitiesDocuments, and GetFactoryAttributesDocument. In addition, the Interoperability Tester can generate “erroneous” messages designed to test services’ responses to standard error conditions including the UnsupportedFeatureFault, InvalidRequestMessageFault and the UnknownActivityIdentifierFault. The Interoperability Tester can authenticate itself using either an X.509 certificate (via a mutually-authenticated SSL connection to the service) or using a username/password.

Since the “back-end” compute resources associated with any particular service differ, the Interoperability Tester does not provide a standard JSDL document for testing. Instead, the web site allows users to enter information which is transformed into an HPCProfileApplication element [HPCPA10] that is then incorporated into a JSDL document. The JSDL elements profiled by HPCPA which can be set by the user are:

Job name	Job project	Executable
Input	Output	Error
Working directory	Arguments	Environment
Candidate hosts	Exclusive execution	Operating system type
Operating system version	CPU architecture	Total CPU count

The user can also provide the service's URL, select which client authentication mechanism to use, and select which tests to perform. The results of each test appear on the web page after the user presses the "Begin" button.

3.1 Test Results

Currently, all projects' implementations pass all tests (except for NorduGrid which only recently began testing).

3.2 Security Interoperability

This section describes the experience using the HPC Profile defined security measures [HPCP10]. Namely, the HPC Profile requires services to support SSL v3.0/TLS v1.0 and therefore services are identified by X.509 certificates. Clients may be identified either with X.509 certificates or username/password.

The HPCBP Interoperability Tester can identify itself using either mechanism. Currently, all implementations have successfully interoperated using username/password, except NorduGrid which supports only X.509. The UVA e-Science Group implementation, NorduGrid and CREAM-BES have all successfully performed client authentication using an X.509 certificate.

4 Issues Encountered

While most service implementations have successfully interoperated with the HPCBP Interoperability Tester, there were several issues encountered while performing these tests. These issues are described here to potentially assist other implementers / Interoperability testers, who may encounter similar issues in the future, or people authoring future profiles.

Issue: The Microsoft implementation required both Operating System Type and Operating System Version information in order to create an activity. Initially, the Interoperability Tester only allowed specification of OS Type. While OS version is not required by JSDL, it is permissible for an implementation to require it.

Resolution: The Interoperability Tester was changed to allow this field to be specified.

Issue: The UVA e-Science Group's Linux implementation requires that ExclusiveExecution be set to true. The HPCBP does not specify a value that must be used for this element and the service does not specify that this value was required anywhere.

Resolution: The Interoperability Tester must be set to specify the correct value when communicating with this service.

Issue: Some implementations had issues generating the UnsupportedFeatureFault. The BES specification says that this fault should be thrown for unsupported non-JSDL elements. "Out of

the box", however, some tooling parses input based only on a provided schema (JSDL in this case). This means it ignores unsupported elements instead of generating faults.

Resolution: Code must be explicitly added to check for these "unsupported" elements.

Issue: The UVA e-Science Group's Linux/PBS implementation had difficulty returning semantically correct values for the ActivityStatus. While syntactically correct (i.e. schema compliant) values could always be returned, the service's PBS queue was configured such that finished jobs are removed immediately. In non-web services environments, this is not an issue because the job owner is sent an email informing them that their job is done. However, this means that an HPCBP service cannot simply rely on PBS's queue status to determine the status of any activity for which it has given out an ActivityIdentifier.

Resolution: The service must provide another mechanism for saving the state of jobs which are not currently queued or running.

Issue: Some tooling used incompatible timestamp formats in the SOAP security headers. While this is outside of the HPCBP, it can be an issue when using username/password for client authentication. Since the username token is framed according to the WS-Security UsernameToken Profile, it is placed in a message's SOAP headers. Some tools, by default, place a timestamp in any SOAP Security header.

Resolution: This auto-timestamping behavior either must be disabled or some mutually compatible timestamp format must be found.

5 Author Information

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We gratefully acknowledge the contributions made to this specification by [insert names].

7 Acknowledgements

We are grateful to numerous colleagues for discussions on the topics covered in this document, in particular (in alphabetical order, with apologies to anybody we've missed) [insert names].

We would like to thank the people who took the time to read and comment on earlier drafts. Their comments were valuable in helping us improve the readability and accuracy of this document.

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10 Normative References

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