The OAI Data-Provider Registration and Validation Service

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Abstract

I present a summary of recent use of the Open Archives Initiative (OAI) registration and validation services for data-providers. The registration service has seen a steady stream of registrations since its launch in 2002, and there are now over 220 registered repositories. I examine the validation logs to produce a breakdown of reasons why repositories fail validation. This breakdown highlights some common problems and will be used to guide work to improve the validation service.

1 Introduction

The Open Archives Initiative (OAI) released the OAI Protocol for Metadata Harvesting (OAI-PMH) in 2001, to facilitate metadata harvesting from data-providers (repositories). A validation service was launched coincident with the initial protocol release to allow data-providers to check compliance with the protocol, and has been updated for versions 1.1 and 2.0 of the OAI-PMH [4].

In 2001 there were no standard OAI libraries or repository packages implementing the protocol, so every deployment of the OAI-PMH had new code to be tested. Since then several libraries and software packages implementing the protocol have become available and these have eased compliance problems. However, in 2003 an OAI harvesting project reported that over 10% of repositories had XML errors [2]. The validation service has helped identify errors in popular software packages (e.g. DSpace and eprints.org) and in particular deployments of these and other packages. Several other facilities are also available to test OAI-PMH implementations, the most important of which is the Repository Explorer [5].

In this paper I present a brief analysis of registrations (section 2) and validation requests (section 3) received via the OAI website\(^1\) during 2004. I then (section 4) discuss these results in the context of new work to improve the validation facilities.

2 Registration

A key function of the OAI data-provider validation facility is to build and maintain a centralized list of OAI-PMH compliant repositories\(^2\). Registration is a voluntary way to announce the availability of a data-provider and the registry has been a useful starting point for harvesting projects. It is now

\(^1\)\text{http://www.openarchives.org/Register/ValidateSite}  
\(^2\)\text{OAI registration service, list of registered repositories: http://www.openarchives.org/Register/BrowseSites}
supplemented by additional registries including those of Celestial\(^3\), eprints.org\(^4\) and OLAC\(^5\), and even what might be thought of as a ‘virtual registry’ through Google search \(^1\).

![Figure 1: Number of registered OAI-PMH v2.0 data-providers as a function of time since the release of v2.0 in June 2002.](image)

Figure 1 shows the number of data-providers, or repositories, registered with the OAI validation service as a function of time since version 2.0 of the protocol was released in June 2002 (see \(^3\) for data covering the period from 2001–2002 with earlier protocol versions). Earlier versions of the protocol were deprecated on release of version 2.0, and the 86 registrations of version 1.0 and 1.1 repositories were discarded in December 2002. Figure 1 shows that in just a few months the number of version 2.0 registrations exceeded that for earlier versions, indicating an effective transition. The steady increase in the number of registered sites suggests that the registration facility continues to valued by the community.

3 Validation

Registration requests differ from validation requests only in that, if validation is successful, registration requests result in the **baseURL**\(^6\) being entered in the central registry. In the following I consider all requests together and refer to them as ‘validation requests’. Table II shows a total of 1893 validation requests logged during 2004. An OAI-PMH **baseURL** could be extracted, and thus validation attempted, from 95% of requests. In the remaining 5% of cases, the web form was either not filled-in or an invalid **baseURL** was given, and thus no further tests could be made.

There are a number of error conditions which cause the validator to abort validation tests. These conditions include fundamental errors such as the wrong protocol version being reported in the **Identify** response, and errors where it is not possible to extract data required for subsequent tests. Table II shows a breakdown of the reasons for aborted validation requests. In 40% of aborted validations there was no response to the **Identify** request, usually because the **baseURL** was entered incorrectly (user error or

\(^3\) Celestial OAI Registry: [http://celestial.eprints.org/cgi-bin/status](http://celestial.eprints.org/cgi-bin/status)

\(^4\) eprints.org registry of Institutional Repositories: [http://archives.eprints.org/eprints.php](http://archives.eprints.org/eprints.php)

\(^5\) OLAC archives registry: [http://www.language-archives.org/archives.php](http://www.language-archives.org/archives.php)

\(^6\) For details of the **baseURL** see [http://www.openarchives.org/OAI/2.0/openarchivesprotocol.htm#HTTPRequestFormat](http://www.openarchives.org/OAI/2.0/openarchivesprotocol.htm#HTTPRequestFormat)
|                | Number | % total |
|----------------|--------|---------|
| No base URL    | 89     | 4.7     |
| Nonsense base URL | 7      | 0.4     |
| Valid base URL | 1797   | 94.9    |
| **Total requests** | 1893   | 100.0   |

Table 1: Validation requests logged during 2004.

an interface issue, not a problem with the protocol). In 21% of cases, bad XML was returned resulting in failure to parse the **Identify** response. Here the validator returns the diagnostic output from the Xerces XML validator. While this output is specific about both the location and reason for an error, it is rather difficult to interpret without detailed knowledge of the W3C XML schema specification and the particular schema being used. In many cases such errors were corrected quickly though in a significant minority additional explanation and/or help was requested via email. As the response to the **Identify** request is particularly important, several other checks are made on this response and bad protocol version and bad administrator email address errors are highlighted in the table. Errors in the response to the **Identify** request are often the result of incomplete repository setup or simple administrator mistakes. In most cases they were quickly corrected in response to validator error messages.

|                                | Number | % total |
|--------------------------------|--------|---------|
| No **Identify** response       | 349    | 40.1    |
| Failed to parse **Identify** response | 184    | 21.1    |
| Bad protocol version number    | 3      | 0.3     |
| Bad admin email address        | 62     | 7.1     |
| Other errors with **Identify** response | 212    | 24.4    |
| Excessive 503 **Retry-After** replies | 9      | 1.0     |
| No identifiers from **ListIdentifiers** | 29     | 3.3     |
| No datestamp in sample record  | 22     | 2.5     |
| **Total aborted requests**     | 870    | 100.0   |

Table 2: Breakdown of aborted validation requests by reason.

The last three reasons shown in table 2 are more indicative of problems with the repository implementations. The validator correctly handles HTTP 503 **Retry-After** responses by waiting the specified period and then retrying. However, in some cases repositories repeatedly give **Retry-After** responses and 1% of the aborted validations were because of more than 5 successive **Retry-After** responses. The last two reasons relate to tests that obtain the identifier of a sample item from a **ListIdentifiers** response. In 3.3% of cases there were no items in the repository and validation was aborted because it is not possible to comprehensively test an empty repository. In a further 2.5% of cases, no datestamp could be extracted from the sample record. Without the datestamp of a sample record it is not possible to test datestamp-based incremental harvesting requests. This error indicates a mistake in the implementation of OAI-PMH records as all records must have a datestamp.

Of the 927 completed validation requests, 318 were successful, 198 had errors only in the handling of exception conditions and 411 had other errors. Failures occurred in all conditions tested although certain failures were particularly common. The 5 most common errors are shown in table 3.

To show how many attempts were required to validate each data-provider, figure 2 histograms validation attempts per repository before success. The figure separates cases where repositories pass all tests using valid requests (‘validation excluding exceptions’) from cases where repositories also correctly respond

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7 Xerces XML parser and validator: [http://xml.apache.org/xerces](http://xml.apache.org/xerces)

8 [http://www.openarchives.org/OAI/2.0/openarchivesprotocol.htm#HTTPResponseFormat](http://www.openarchives.org/OAI/2.0/openarchivesprotocol.htm#HTTPResponseFormat)
| Error                                                                 | Number |
|---------------------------------------------------------------------|--------|
| Schema validation errors in standard verb responses                  | 168    |
| Empty response when from and until set to known datestamp            | 57     |
| Empty resumptionToken in response to request without resumptionToken | 42     |
| Malformed response to request with identifier invalid"id             | 40     |
| Granularity of earliestDatestamp doesn’t match granularity value     | 35     |

Table 3: Most common validation errors in cases where validation was completed.

Figure 2: Histogram of attempts before successful validation. Two cases are shown: ‘validation excluding exceptions’ indicates that the repository passed all tests using valid requests; ‘robust validation’ indicates that the repository not only passed all tests using valid requests but also correctly responded with appropriate exception and error codes to various illegal requests. In cases where repositories failed validation after initially passing, only the number of validation attempts until the first success are counted.

46 of the 152 robustly validating repositories achieved validation excluding exceptions before robust validation, and it took about 3 further attempts on average to correct problems in the responses to illegal requests. 33 repositories managed validation excluding exceptions but never passed robust validation and were thus not eligible to register. In most cases only a few validation attempts were required before success, and in 38% of cases, often deployments of standard software, validation was successful on the first attempt. Not shown in the graph are 376 sites which never passed validation. Of these, 238 can be discounted as validation was attempted only once, typically trial runs and test deployments. Most tried just a few times though a significant tail of 24 repositories failed validation more than 5 times, which suggests a serious attempt to validate, yet were never successful. These cases were investigated and table 4 shows a breakdown of the current status of these repositories.

The 5 repositories shown in table 4 as being able to be harvested successfully all still fail the validation test. One simply returns server errors. One includes style-sheet information in the XML responses which Xerces cannot parse. The other three all fail under certain exception conditions. All three incorrectly handle a GetRecord request for metadata from an item with the illegal identifier invalid"id by attempting to include that value as an attribute of the request element and by failing to escape the quotation mark.
Table 4: Breakdown of current status of repositories that failed validation tests more than 5 times and we never successful.

| Reason                                      | Number |
|---------------------------------------------|--------|
| Repository no longer accessible             | 14     |
| Repository reports OAI-PMH v1.1             | 1      |
| Internal server errors (HTTP 500)           | 2      |
| Old DSpace with OAI problem                 | 1      |
| XML errors                                  | 1      |
| Repository can be harvested from successfully | 5      |
| Total number of repositories examined       | 24     |

4 Discussion and future work

The continued use of the validation facility and the registration of new repositories attests to the value of these services. It is reassuring to see that most repositories manage to correct errors and pass the validation test in just a few attempts. However, personal assistance has been provided in a number of cases and a significant number of sites tried to validate several times but never succeeded. These cases suggest that there is room for improvement in the protocol documentation and the helpfulness of the validation suite.

Improvements in the validation facility should include more detailed explanation of common error conditions. There should also be specific tests that help identify common XML errors which we see are still common. Once identified it should be possible to provide messages that are more helpful than the standard Xerces output. A number of frequently recurring errors such as correctly dealing with an illegal identifier should be easy to correct. However, there is some subtlety in the specification and it has often required off-line email exchange to clarify the issue. More detailed on-line explanations of common or confusing cases may help address this.

The results presented here show a number of cases where repositories work sufficiently well to be harvested from yet fail strict compliance tests. Perhaps it is time to re-evaluate the decision to provide only black and white, registration or failure. The registration site might be augmented with a status that could indicate, for example, basic compliance (valid requests work), robust compliance (exception conditions also handled correctly), and compliance with Dublin Core (to allow sites that don’t use the oai_dc Dublin Core metadata to check compliance with the rest of the protocol).

The analysis presented here is the first step in a project to produce improved OAI validation tools for the NSDL and the broader OAI community. Future work will include refinement of the existing validation suite, and development of validation and testing software for harvesters through the development of test repositories displaying various error conditions. New facilities will be announced to the OAI community through the usual email list and on the OAI website.

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9http://nsdl.org/
10OAI-implementers email discussion list and archive: http://www.openarchives.org/mailman/listinfo/oai-implementers
11http://www.openarchives.org/
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