Application Submission Web Service Integration Guide for Grantee Systems

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REVISION HISTORY

Rev.	Date	Author	Reason for Changes
1.0	8/4/2009	Kim Deutsch	Initial Draft
1.1	10/2/2009	Kim Deutsch	Highlighted the requirement for MIME attachments
1.2	01/08/10	Kim Deutsch	Updates for new application name
1.3	2/24/10	Kim Deutsch	Changes from the Communication's team
1.4	7/28/10	Kim Deutsch	Updates to include the latest versions of the R&R Project/Performance Site Location (v1.4) and Research & Related Other Project Information (1.3) forms for Grants.gov and ASWS submissions.
1.5	8/27/10	Kim Deutsch	Removed references to CAREER having its own program specific form.
1.6	9/8/10	Kim Deutsch	Removed information about the funding opportunity being case sensitive

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1 INTRODUCTION

1.1 PURPOSE

The purpose of this document is to provide organizations with the information necessary for integrating their Grantee Systems with Research.gov's Application Submission Web Service. The document covers the technical requirements of the system.

1.2 SCOPE

The Research.gov Application Submission Web Service (ASWS) provides application submission capability through Research.gov to the National Science Foundation's (NSF) FastLane system using web services. The ASWS system design leverages research organizations' investments in Grants.gov by using the same web service calls (WSDL) and standards (SF 424 R&R and NSF specific) that are used in their Grants.gov interface.

This web service approach lays the groundwork for future opportunities to leverage Grantee Systems, such as post-award management (financial and project reports). Enhanced submission capability could include NSF applications with special forms (DUE, BIO, INT or SBIR) and pre-applications, once these forms are developed and offered through Grants.gov. NSF will work closely with Grantee System providers to see if additional validations can be added to ensure that the quality of submissions meet NSF business rules.

2   OVERVIEW

Research.gov provides Grantee Systems a web services interface for automated submission of completed applications (proposals). The service is designed for secure e-business transaction processing. The overall design currently reflects the standards defined by Grants.gov which is using the World Wide Web Consortium (W3C) standards.

2.1   TECHNICAL SUMMARY

- Operating System and Software Language Agnostic
- Open-specifications Driven
- W3C standards for Web Services
- Extensible Markup Language (XML) http://www.w3.org/XML
- Simple Object Access Protocol (SOAP) http://www.w3.org/TR/soap
- Hyper Text Transfer Protocol (HTTP) http://www.w3.org/Protocols/
- Web Services Description Language (WSDL) http://www.w3.org/TR/wsdl
- SSL and Mutual Certificate Based Authentication for security
- Delegation of responsibility to the applicant system for verifying AOR authority to submit applications to Research.gov
- Push Submission Method
- Reference Implementation

2.2   ASSUMPTIONS

- Grantee System providers participating in the electronic exchange between Research.gov and their Grantee System must have the technical capacity to do so and also have knowledge of the SF424 R&R and NSF agency specific schemas based on the corresponding Grants.gov forms.

- The information exchange is based on web services, where the Research.gov system device is listening for messages at all times.

- The communication exchange is based on an agreed upon standard protocol and standard transaction definition. Reseach.gov Web Services will process application submission requests one at a time; a separate submission request must be made for each application.

- Authentication is performed using mutual certificate based authentication

- **Verification of the Authorized Organization Representative (AOR) to submit the application is not validated by Research.gov**. The grantee organization is responsible for ensuring that electronic submissions accurately reflect organizational rules governing such permissions. Associating an AOR with a digital certificate is part of the Research.gov registration process.

- Organizations are registered in NSF's FastLane. If the organization's staff is not registered prior to submission, the NSF software will register the AOR, FastLane

Contact, Principal Investigators and any co-Principal Investigators based on information in the application and notify the AOR and PI through email.

- Software to populate the Research.gov application XML must be developed by the Grantee System. Client integrators must develop the software to produce XML that conforms to the Grants.gov schemas.

2.3   WEB SERVICES SECURITY

Research.gov uses Security Socket Layer (SSL) and mutual authentication for managing the security of a message transmission over the Internet. Research.gov requires both server-side and client-side authentication.

Grantee organizations are required to use digital certificates that have been signed by a Certificate Authority (CA) such as Verisign or Entrust. The Grantee Organization's public certificate will identify their system and the organization. The certificate key can be the same one that the organization uses for other web service communications.

2.4   GLOSSARY

Below is a glossary of common terms used in this document.

Term	Definition
ASWS	Research.gov's Application Submission Web Service
API	Application Programming Interface
CA	Certificate Authority
CFDA	Catalog of Federal Domestic Assistance
FastLane	NSF's Grant Application System
Grantee System	A commercial or institutional Web-based Application (Proposal) Development Software Provider that an organization uses to submit prepared applications to grantor agencies through web services.
SOAP	Simple Object Access Protocol

3   RESEARCH.GOV APPLICATION SUBMISSION WEB SERVICE INTERFACE

The ASWS Service requires an organization's grantee system to develop or use a W3C compliant SOAP client to interact with the Research.gov web services interface. Integrators must comply with the W3C Web Services standards (HTTPS, SOAP v1.1, SOAP with attachments XML, and WSDL). In addition, the client system must support certificate based mutual authentication over 128-bit SSL. Appendix B lists the specifications required of the grantee system and their purpose.

The Research.gov interface provides a platform independent messaging service that follows the SOAP with attachments specifications. The service will use the messages established by Grants.gov listed below in order of typical invocation:

- **GetOpportunityList** – Query for funding opportunities that are available on Research.gov for electronic submission to NSF.

- **GetOpportunitiesWithInfo** – Query for funding opportunities that are available on Research.gov for electronic submission to NSF, plus additional information not included in the GetOpportunityList message – CFDA Description, Offering Agency and Agency Contact.

- **SubmitApplication** – Submit application through Research.gov to NSF for the DUNS number associated with the client's digital certificate

- **GetApplicationList** – Obtain the submission status for a list of the applications submitted through Research.gov with the DUNS number associated with the client's digital certificate.

- **GetApplicationStatusDetail** – Retrieve detailed information about the submission status for a specific application submitted through Research.gov with the DUNS number associated with the client's digital certificate

4   PREPARING THE RESEARCH.GOV XML

Grantee systems must produce XML that conforms to Research.gov Opportunity Form Schemas which are based on the Grants.gov schemas. The Grant Application XML must pass strict XML schema validation defined by the Opportunity and Form schemas. Moreover, the application may require additional business rules defined within the opportunity instructions. Opportunity schemas also require a Header XML document that conforms to the Header schema.

The Grant Application XML must be validated by the Grantee system prior to submitting the application to Research.gov. The Grantee system must include an implementation of the XML Cataloging specification (http://www.oasis-open.org/committees/download.php/2384/cs-entityxml- catalogs-1.0.html) that will resolve external URI requests for schemas to local schema files downloaded by the Grantee from the Research.gov site.

Note that Research.gov requires SOAP messages to be encapsulated in Multipurpose Internet Mail Extensions (MIME).

4.1   WSDL SERVICE

The Research.gov Grantee WSDL uses SOAP protocol. Below is detail information about the service for each environment:

Port Information	Testing Environment	Production Environment
Name	ApplicantIntegrationSoapPort	ApplicantIntegrationSoapPort
Binding	ApplicantIntegrationSoapBinding	ApplicantIntegrationSoapBinding
Address	https://ws.acpt.research.gov/applyws/ApplicantIntegrationSoapPort	https://ws.research.gov/applyws/ApplicantIntegrationSoapPort

5   RESEARCH.GOV XML SCHEMAS

Details for the Applicant Web Service are defined in the Grantee WSDL Schema. Each funding opportunity on Research.gov has its' own unique opportunity XML schema. The schema uses the Grants.gov standard schema which includes the mandatory and optional form schemas. Below is a screenshot of the schema's overview.

5.1   FORMS SCHEMA

A Form schema contains the actual data elements that comprise the grant application (e.g., SF-424 R&R and agency-specific). Form schemas are included by reference in the opportunity schemas. All Form schemas are published and available for download through the Grants.gov Resource Directory.

For Phase I of the Service, all NSF opportunities will use the same Form schemas

Mandatory

	Form Name	Version	Namespace Prefix
	SF 424 (R&R)	1.2	RR_SF424_1_2
	Project/Performance Site Location(s)	1.4	PerformanceSite_1_4
	Research and Related Other Project Information	1.3	RR_OtherProjectInfo_1_3
	Research And Related Senior/Key Person Profile (Expanded)	1.2	RR_KeyPersonExpanded_1_2
	Research & Related Personal Data	1.2	RR_PersonalData_1_2
	Research & Related Budget	1.1	RR_Budget
	NSF Cover Page	1.3	NSF_CoverPage_1_3

Optional

	Form Name	Version	Namespace Prefix
	R & R Subaward Budget Attachment(s) Form	1.2	RR_SubawardBudget
	NSF Deviation Authorization	1.1	NSF_DeviationAuthorization
	NSF Suggested Reviewers	1.1	NSF_SuggestedReviewers

Note that the same funding opportunity available for submission through Grants.gov will also include the NSF FastLane Registration form as an optional form. Because organizations have to be registered in FastLane as part of the Research.gov registration process, this form is not included in the forms schema for submissions through Research.gov.

Effective August 23, 2010, NSF application packages will include the latest versions of the R&R Project/Performance Site Location (v1.4) and Research & Related Other Project Information (1.3) forms for Grants.gov and ASWS submissions.   Opportunities posted prior to August 23 will continue to use the older versions of these forms since applicants may be in the process of preparing their application.

5.2   HEADER SCHEMA

The Header schema is required when submitting opportunities to Research.gov. The schema can be accessed by the following URL for production at

http://xml.research.gov/apply/system/Header-V1.0.xsd or the test URL at
http://xml.acpt.research.gov/apply/system/Header-V1.0.xsd

The following is a list of the required elements:
- HashValue – The Hash Value of the Application XML is based on the "grant:Forms" sub-element in the Grant Application XML.   This excludes the Header and Footer XML and Attachments. .

- OpportunityID – The opportunity ID for the Grant Application. To avoid any potential conflicts, applicant systems should utilize the opportunity meta-data returned by the GetOpportunityList web service when populating the Header schema XML.

- CompetitionID – The Competition ID for the Grant Application (Not used by NSF)

- CFDA Number – The CFDA Number associated with the Grant Application

5.3   ATTACHMENTS SCHEMA

The Attachments schema is required when adding attachments to an application. When attaching a file to a form schema you must include the file details defined in the Attachments schema. The schema can be accessed by the following URL for production http://xml.research.gov/apply/system/Attachments-V1.0.xsd or the test URL at http://xml.acpt.research.gov/apply/system/Attachments-V1.0.xsd

FileName – The file name for that attachment
MimeType – The mime content-type of the file   **Note that Research.gov uses only MIME.**
FileLocation href attribute – This attribute should match the Content-ID that is assigned to the SOAP Attachment part. This allows the attachments to be associated in the grant form xml.
HashValue – The hash value of the attachment
HashAlgorithm – Attribute to indicate the algorithm used.

6   MESSAGES, ELEMENTS AND TYPES

This section of the document provides a summary of the messages and elements (including parameters and data types) as defined in the WSDL.
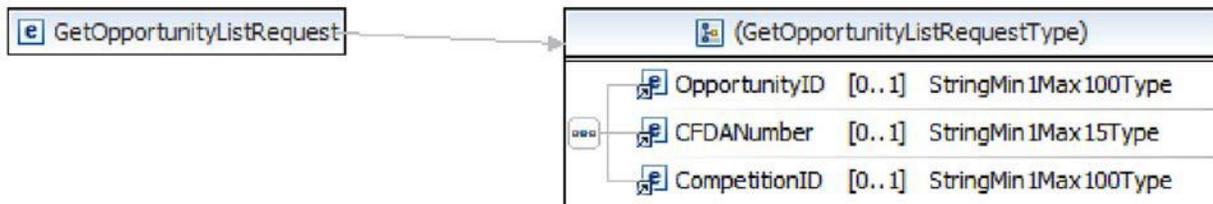
6.1   GETOPPORTUNITYLIST MESSAGE

The GetOpportunityList message is used by a Grantee system to request a list of open funding opportunities for which applications can be submitted.

Note that NSF will also post opportunities to Grants.gov APPLY so GetOpportunityList or GetOpportunityListWithInfo requests to both Research.gov and Grants.gov may result in duplicate funding opportunities. The software at the Grantee System will need to aggregate the results from both sources. Applications should only be submitted to the sources identified in the schema of each search result.

6.1.1   GETOPPORTUNITYLISTREQUEST

The message will accept one of the three parameters based on the Grants.gov design for this message -- OpportunityId, CFDANumber or CompetitionID. Research.gov will use an "AND" condition when multiple query criteria are submitted. However, NSF does not use the CompetionID and no opportunities will be returned when searching on this field.
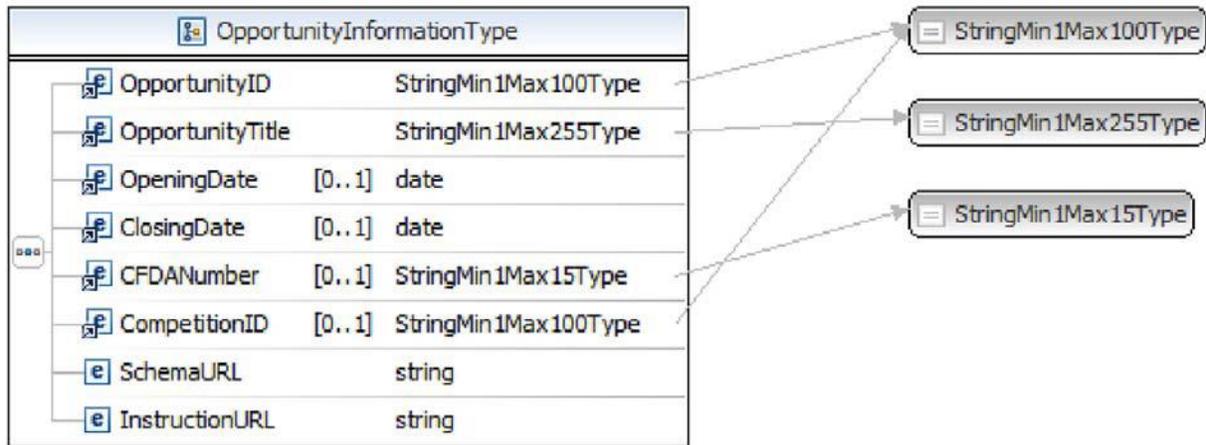

6.1.2   GETOPPORTUNITYLISTRESPONSE

The GetOpportunityListResponse returns a list of open funding opportunities available at Research.gov for Application Submission in the OpportunityInformationType.

Below is the structure of the Opportunity information returned in the OpportunityInformationType

6.2   GETOPPORTUNITIESWITHINFO MESSAGE

The GetOpportunitiesWithInfo message is used by a Grantee system to request a list of open funding opportunities for which applications can be submitted. This message contains more information than the GetOpportunityList message.

Note that NSF will also post opportunities to Grants.gov APPLY, so GetOpportunityList or GetOpportunityListWithInfo requests to both Research.gov and Grants.gov may result in duplicate funding opportunities. The software at the Grantee System will need to aggregate the results from both sources. Applications should only be submitted to the sources identified in the schema of each search result.

6.2.1   GETOPPORTUNITIESWITHINFO REQUEST

The GetOpportunitieswithInfoRequest message is used by a Grantee system to request a list of open funding opportunities for which applications can be submitted.

Like GetOpportunities, the message will accept only one of the three parameters based on the Grants.gov design for this message -- OpportunityId, CFDANumber or CompetitionID.

Research.gov will use an "AND" condition when both the OpportunityID and CFDANumber are submitted. However, NSF does not use the CompetionID and no opportunities will be returned when searching on this field.

6.2.2   GETOPPORTUNITIESWITHINFO RESPONSE

The GetOpportunityListResponse returns a list of open funding opportunities available at Research.gov for Application Submission in the OpportunityWithInfoType. In addition to the information included in GetOpportunities Response, the response includes the CFDA Description, Offering Agency and Agency Contact.

Below is the structure of the Opportunity information returned in the OpportunityWithInfoType

OpportunityInfo – optional, unbounded; type OpportunityWithInfoType

- OpportunityID type OpportunityID
- OpportunityTitle type OpportunityTitle

- OpeningDate – optional; type Opening Date

- ClosingDate – optional; type Closing Date

- CFDANumber – optional;type CFDANumber

- CompetitionID – optional; type CompetitionID

- SchemaURL – type string

- InstructionURL – type string

- CFDADescription – optional; type CFDADescription

- OfferingAgency – optional; type Offering Agency

- AgencyContact – optional; type string

6.3   SUBMITAPPLICATION MESSAGE

This message is used by a Grantee system to submit an application for a given funding opportunity through Research.gov to NSF. Once grantee systems have prepared the SOAP message containing the Grant Application XML and any existing Attachments, the electronic application must be submitted to Research.gov with the SubmitApplication web service. A successful transaction will receive a response that contains the Research.gov tracking ID and a receipt date/time stamp. If an unexpected condition occurs, a SOAP fault will be returned containing a detailed error message.

6.3.1   SUBMITAPPLICATIONREQUESTMESSAGE

The SubmitApplicationRequest message is used by an organization to submit an application for a given opportunity.
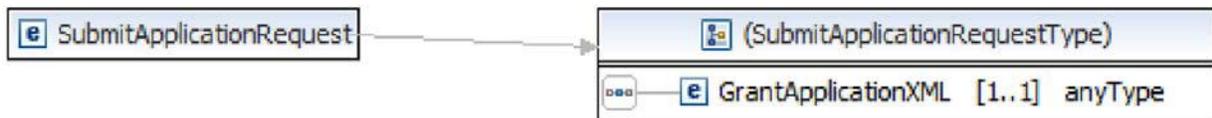
6.3.2   SUBMITAPPLICATIONRESPONSEMESSAGE

The SubmitApplicationResponse message is used by Research.gov to indicate the result of a grant submission, as well as provide the Research.gov Tracking Number for further application submission status inquiries and tracking.
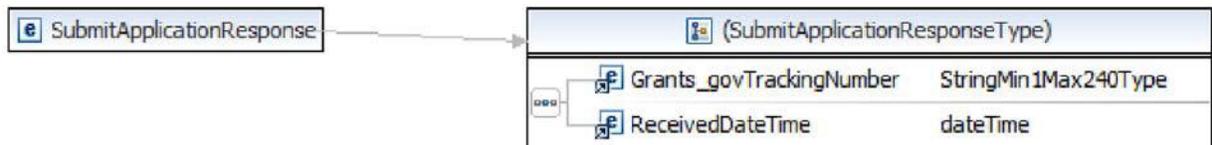
Research.gov will perform basic validations for submissions received via Research.gov web services. If the application fails to meet any of the validation rules listed in Appendix A, the application will be assigned a rejected status. Grantee organizations must use the

GetApplicationStatusDetail web service to retrieve the explanation for why the application was rejected.

6.4   GETAPPLICATIONLIST MESSAGE

The GetApplicationList and GetApplicationStatusDetail web services provide grantee organizations a mechanism for verifying the submission status of electronic applications submitted to Research.gov. The application information that is returned from web services at Research.gov will display all of the applications submitted by the DUNS number(s) associated with the grantee organization's digital certificate. In other words, the grantee organization will only have access to view data about grant applications that were submitted by their system.

6.4.1   GETAPPLICATIONLISTREQUEST

The GetApplicationList Request message as shown below is used to request the submission status of specific applications using any combination of:
    Processing Status – The current processing status associated with the application
    CFDA Number – The Catalog of Federal Domestic Assistance number
    Opportunity Number – The opportunity number
    SubmissionTitle – SubmissionTitle xml element from the Header Schema
    Research.gov Tracking Number – Unique identifier used to track the submission.

Research.gov will use an "AND" condition when multiple criteria are submitted.


Processing Status
The following is a list of application processing statuses in the Research.gov system:
- Receiving – Research.gov is in the process of receiving the application.
- Received – Research.gov acknowledged receipt of the application.
- Processing – Research.gov is validating the application package and performing internal processes.
- Validated – Research.gov has validated the contents of the application submission
- Rejected with Errors – Research.gov has rejected application submission. Grantee organizations must use the GetApplicationStatusDetail web service to retrieve the explanation for why the application was rejected
- Download Preparation – Research.gov is preparing to send the application to NSF's FastLane.
- Received by Agency – NSF has acknowledged receipt of the application
- Agency Tracking Number Assigned – NSF has assigned a Proposal ID to the application.

6.4.2   GETAPPLICATIONLISTRESPONSE

The GetApplicationListResponse returns the submission status of the application in the ApplicationInformationType. Note the status will be in the GrantsGovApplicationStatus field and the Research.gov Tracking Number will be in the Grants_govTrackingNumber field.
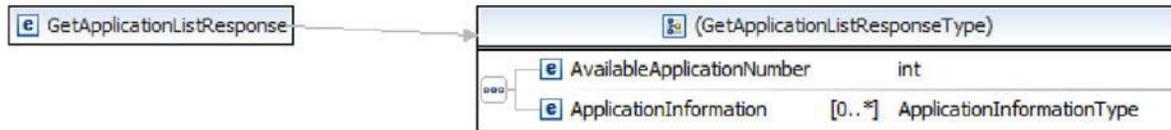
Below is the structure of the Application Information returned in the ApplicationInformationType
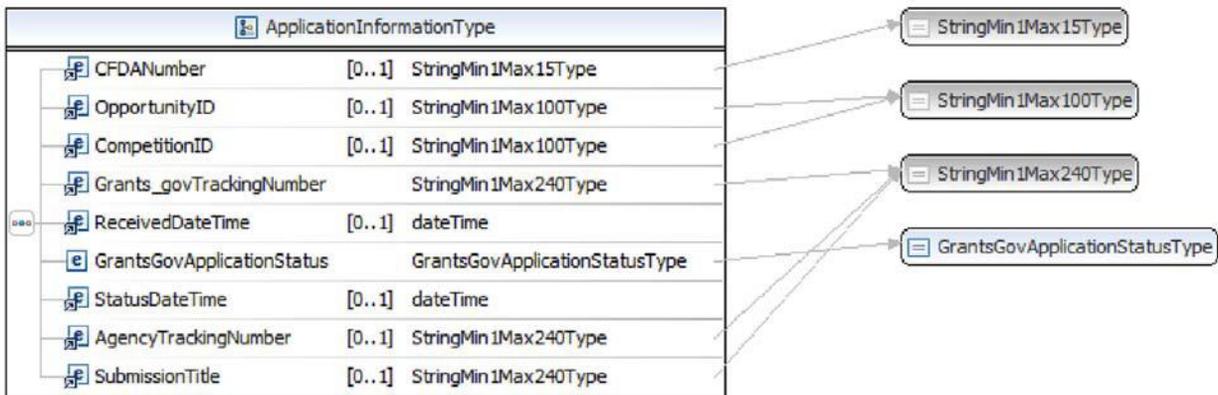
6.5   GETAPPLICATIONSTATUSDETAIL MESSAGE

The GetApplicationStautsDetail message takes the Research.gov tracking ID in the request, and returns the current status of the application. If the application was rejected, it will return the reasons for the rejected status.

6.5.1   GETAPPLICATIONSTATUSDETAILREQUEST

Query for the detailed submission status for a specific application submitted to Research.gov with the DUNS number associated with the client digital certificate using the Research.gov Tracking ID.

6.5.2   GETAPPLICATIONSTATUSDETAILRESPONSE

The GetApplicationStatusDetailResponse message as shown below is used by Research.gov to return submission status detail information for a specific submitted application.
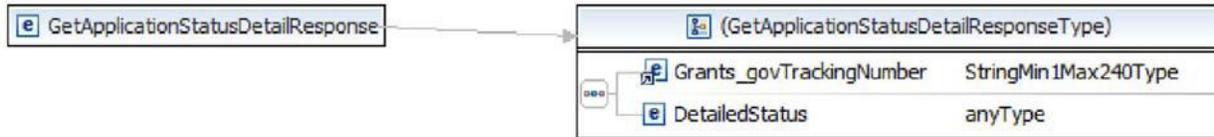
7   TESTING WITH RESEARCH.GOV

Please refer to Research.gov's Application **Submission Web Services Test Plan for Grantee Systems** for detailed instructions on testing the Research.gov Application Submission Web Services.

8   APPENDIX A – RESEARCH.GOV VALIDATIONS FOR APPLICATION SUBMISSIONS

- The system shall ensure that the application is a complete well-formed XML document.
- The system shall perform strict XML schema validation of the Grant Application XML against the opportunity XML schema.
- The system shall verify that the application is for an open NSF Funding Opportunity Number. To avoid any potential conflicts, applicant systems should utilize the opportunity meta data returned by the GetOpportunityList web service when populating the Header Schema XML. The data returned in the GetOpportunityList web service will always accurately reflect the data stored in the Research.gov system.
- The system shall verify that the opportunity was submitted within the Opening and Closing timeframe.
- The system shall verify that the DUNS number in the xml submission matches the DUNS number for the applicant organization (that is, the DUNS number of the submitter).
- The system shall verify the CFDA number(s) present on the application match known CFDA catalog numbers.
- **The system shall check any attached files to verify that they are virus free.**

9   APPENDIX B – CLIENT SIDE SPECIFICATIONS

Specification	Purpose/Description	Comments
HTTPS	HTTPS (Hypertext Transfer Protocol over Secure Socket Layer or HTTP over SSL) is a Web protocol that encrypts and decrypts user page requests as well as the pages that are returned by the Web Service. HTTPS is the use of SSL (Secure Socket Layer) as a sub-layer under its regular HTTP application layering	The system-to-system message exchange will occur over HTTPS and will use mutual certificate based authentication
SOAP	SOAP (Simple Object Access Protocol) defines a standard data communications protocol for Web Services. SOAP provides a simple and consistent mechanism that allows one application to send an XML message to another application. SOAP specifies the structure of message rather than how it is transported.	Research.gov will use SOAP as the messaging protocol for any system-to-system message exchanges.
SwA	SwA (SOAP with Attachments) describes a standard way to associate a SOAP message with one or more attachments in their native format in a multipart MIME structure for transport.	Grantee systems will use SOAP with Attachments to package the main application data and any PDF attachments in the SubmitApplication web service.
WSDL	WSDL (Web Services Description Language) defines a standard mechanism to describe a Web Service. A WSDL document defines the functionality a Web Service offers, how it is communicated and where it is available.	Research.gov will provide a WSDL file as a means of concisely describing its Web Service interface.
XML	XML (eXentisble Markup Language) is a meta-markup	Research.gov will use XML in all system-to-system message

	language that can be used to define data formats. XML data formats can be interpreted by any application written in any language, running on any platform	exchanges.
XML Schema	XML Schemas express shared vocabularies and provide a means for defining the structure, content and semantics of XML documents.	Research.gov will use XML Schemas.