

# Technical Solutions for an Achievement Standards Network

## Index

Introduction .....	2
Solution Components .....	2
Project Scope .....	2
Classes of Users Served and Use Cases .....	3
The Achievement Content Standards Repository (ACSR) .....	4
Overview.....	4
ACSR Application Profile .....	4
Relationship of the Achievement Content Standards Repository to the Schools Interoperability Framework.....	4
ACSR URIs and Identification Codes .....	5
Further ACSR Development .....	7
Repositories of Aligned Standards (RAS) .....	7
Overview.....	7
Relationship of the ACSR to the RAS.....	8
Open Vs. Proprietary Intermediaries.....	8
Further RAS Development.....	9
ASN Core Architecture .....	9
ASN Software Development Kit and APIs .....	10
ASN Demonstration Code and Utilities.....	10
Integration of the ASN within Digital Library and Portal Architectures .....	11
Inclusion Of ACSR and RAS Metadata Within Catalog Records .....	11
Exposing ACSR and RAS Literals on a Portal.....	11
Resolving ACSR and RAS literals through a Portal .....	11
Providing faceted searching on Learning Standards .....	12
Providing Learning Standards Cross-walking .....	12
Instantiating a local version of the ASN .....	12
Maintenance of the ACSR.....	14
Cost Model and Ongoing Sustainability.....	14

## *Introduction*

### **Solution Components**

Achievement Standards are statements of what learners should know and be able to do. They may be promulgated by state departments of education, national content groups, professional organizations, labor or skill boards, and certification bodies, both in the public and private sectors. They are often referred to as learning standards, academic standards, content standards, skill standards, competency standards and performance standards, or by other terms. Many include specific granular statements of achievement levels or proficiencies in the form of benchmarks or rubrics.

The Achievement Standards Network (ASN) is comprised of three distinct but related projects that when fully developed work together to form a coherent framework for alignment, discovery and retrieval of educational resources by learning standards:

- **The Achievement Content Standards Repository (ACSR)** that includes K-12 learning standards as promulgated by departments of education in each of the United States plus standards from nationally recognized content groups and other national and international achievement standards as individual use cases may require
- **Repositories of Aligned Standards (RAS)** that include sets of exemplary Intermediary statements and vocabularies along with alignments of those statements and vocabularies to the various learning standards contained within the ACSR; or other third party intermediaries or alignment services that interoperate with the framework
- The collection of services, interfaces, protocols and agents, including the **Achievement Standards Network Registry Service** that connects various classes of users to the content and functionality of the ACSR and the RAS.

### **Project Scope**

The project is intended to fulfill three key primary business cases:

- Building and maintaining the authoritative set of state and national learning standards and benchmarks, and making the data freely available to education and research communities of practice
- Building, maintaining and documenting a set of defined services that provides open access to learning standards and benchmarks and facilitates alignment of content to learning standards within an open and interoperable framework
- Developing and publishing sample APIs, code, and best practices relating to the databases and services so that other organizations can replicate, modify, and enhance the usability and functionality of the solution on technology platforms of their own choosing

## *Classes of Users Served and Use Cases*

Three primary classes of users will be served by the ASN: content providers, content consumers and content managers such as digital repositories and libraries. Technologies and other details supporting the use cases are described in more detail later.

**Content providers** will use the contents of the ACSR to help produce metadata for their resources that reflect direct alignments to any number of learning standards, or to an intermediary (for example, the RAS) from which alignments to other sets of learning standards can be inferred. Content providers may also use the RAS and intermediary together to generate static alignments to other sets of learning standards for incorporation within the metadata. Although tags can be created using the literal text of the standard, the preferred implementation will consist of generation of sets of unique URIs that are resolvable through the ASN Registry Service, a collection of protocols and software agents that allow the ACSR and RAS to interoperate.

Content providers may also use the contents of the ACSR to populate proprietary or alternative intermediaries and alignment systems serving internal or external clients. Optionally, content providers may also provide elements of their intermediary for inclusion in the ACSR, or they may elect to create their own URI scheme for proprietary registry and resolution services (i.e. a proprietary RAS that interoperates with the ACSR). The recommended best practice shall be that where explicit learning standards and benchmarks are referenced directly and included in metadata, the ACSR URI should be used for resolution.

**Content consumers** will use the ACSR to facilitate discovery and retrieval of resources in a number of different ways. Consumers may be either humans conducting manual retrieval tasks, or machine-based processes conducting automated discovery and retrieval.

To locate resources that have been directly aligned to learning resources, consumers will conduct searches via a structured query in the form of an XML / SOAP request to the ASN registry service on the ACSR metadata to retrieve a set of one or more ACSR ID codes matching their query. In order to manage the collection of 100,000 or more individual standards and benchmarks, the contents of the ACSR are open to searching by any SOAP enabled client application, including java servlets, .NET applications and Perl. The resulting set may be used as a search against the metadata within a digital library or other type of metadata collection to identify a set of candidate resources matching the desired standards alignment.

To locate resources for which direct alignments to a particular set of learning standards may not exist but for which alignments to those sets might be inferred through use of an intermediary to crosswalk any existing direct alignments, consumers first conduct a search through the ACSR metadata to derive a set of one or more ACSR ID codes matching their query. This set is processed by the RAS or other service which returns a second set of ACSR ID codes representing potential inferred alignments. Lastly, this second result set may be used to search against digital library metadata to identify a set of candidate resources matching the desired standards alignment.

Finally, consumers who locate resources in resource metadata based on other search facets (e.g. through a query on a resource portal or catalog record look-up) may use the ACSR to decode any direct alignments containing ACSR URIs, retrieve both the text and context for any particular learning standard or benchmark, and may use the ACSR and RAS along with the Achievement Standards Network Registry Services to identify inferred alignments from existing direct alignments.

**Content Managers** can provide consolidated access to the services comprising the ASN and expose learning standards and benchmarks metadata through content portals, catalog services and metadata harvesting applications. Content managers may also elect to build additional services that further organize learning standard and benchmark metadata and provide enhanced search capabilities to their collections.

## *The Achievement Content Standards Repository (ACSR)*

### **Overview**

The ACSR is the electronic collection of faithfully represented learning standards and benchmarks as promulgated by states and national content organizations. Align to Achieve's current version of the ACSR has been in commercial use since 1997, and it was adapted and enhanced by JES & Co. in 1999 for use within the Academic Standards and Assessment System, also a commercially successful application. Currently, a prototype or early version of the ACSR is accessible through JES & Co.'s Academic Standards and Assessment System via SOAP-wrapped XML requests. This application uses web services to query a SQL database of Dublin Core-based resource metadata, including alignments to learning standards, to resolve those alignments against the embedded standards repository and to generate inferred alignments to any set of learning standards through application of the Align to Achieve intermediary and vocabularies.

Work on developing a prototype of a general purpose open version of the ACSR that can be consumed by the enhanced services that comprise the Achievement Standards Network (ASN) has already begun. When completed, the ACSR will consist of an RDF data model for the metadata relating to content standards, implementation of an RDF query engine, a SQL-based repository for persistent storage, and population of the repository structure with learning standards and benchmarks.

### **ACSR Application Profile**

The application profile for the database itself incorporates elements that are designed to describe the base documents from which learning standards derive, the literal text of the standards and benchmarks including any identification schemes developed by the promulgators of the standards, the relationship of each individual standard or benchmark in the hierarchy of the standards document, and a unique, assigned identification code associated with each element. Other aspects of the profile include internal elements for housekeeping, data management and change control.

The final details of the application profile remain to be resolved through a process of stakeholder engagement and input. A preliminary set of elements currently developed support all aspects of the recently adopted Schools Interoperability Framework objects for Learning Standard Document and Learning Standard Item.

### **Relationship of the Achievement Content Standards Repository to the Schools Interoperability Framework.**

The Schools Interoperability Framework (SIF; <http://www.sifinfo.org>) is a vendor neutral consortium effort supported by the great majority of education-related software and publishing providers serving the U.S. market. In simple terms, it addresses ways to make software and educational resources from disparate and individual providers work together. SIF, therefore, is becoming increasingly important as the only effective means to pull all of a school's, district's or state's information systems together in order to meet current and future accountability reporting requirements.

In the spring of 2004, the SIF membership balloted and approved version 1.5 of the specification that contains, for the first time, a number of objects supporting instructional services. Among the new collection are two objects relating specifically to Content Standards, a *LearningStandardDocument* object and a *LearningStandardItem* object. JES & Co, Align to Achieve, and representatives for the Information School at Washington participated in the development process.

Align to Achieve provided early input into the recommended structure of the objects, and they reflect a subset of the schemas currently deployed in both A2A's working database and JES & Co.'s Academic Standards and Assessment system. The intended use of the SIF learning standards objects is to facilitate the exchange of metadata among various functional classes of application software such as content management systems, learning management systems, and accountability systems. Systems that track assessment, learning plans, resource utilization and other processes may include alignment to learning standards as a descriptive property of a resource or event.

The *LearningStandardDocument* object is comprised of a set of elements describing a content standards document, and includes metadata such as promulgating organization, effective dates, and other generally descriptive elements. The *LearningStandardItem* object describes individual learning standards and benchmarks and is designed to support a hierarchically structured format. DTDs for the current versions of the two objects may be reviewed at <http://www.sifinfo.org/infrastructure/1.5/DTD.zip>.

The SIF objects presuppose the existence of a database of content standards within a unified collection of applications (that is, a SIF Zone, e.g. a school district). One or more learning standards databases might reside within catalog systems, learning management systems, and assessment systems, for example. The SIF Learning Standard objects are designed to describe a common set of elements and a method for either publishing to or subscribing to the learning standards repositories within a zone. SIF, however, does not provide a reference database, and the problems of the proprietary instantiations of private learning standards collections is not insignificant.

The ACSR will serve to provide a SIF-compatible collection of learning standards to any subscribing application for use within applications comprising a SIF zone. More importantly, the ACSR will provide a unique identifier for each standard and standard document to facilitate the sharing of metadata across zones. Currently, SIF only uniquely identifies objects within a zone through a pseudo-GUID. The ACSR ID Code, which also comprises the URI for the registry service, will uniquely point to a SIF-compliant XML document for each unique learning standard and benchmark.

## **ACSR URIs and Identification Codes**

The key to successful use and long-term sustainability of the ACSR is the ability to relate each learning standard statement or benchmark to a uniquely assigned and maintained code accessible through a registry service that is freely and openly available to all consumers. Learning standard statements themselves, when represented as semantically distinct taxons contextually related to broader terms within a hierarchical structure, are often cryptic – in extreme cases represented by only a single word (e.g. Oklahoma English/Language Arts, which has only the single word “adjectives” as benchmark text for multiple ELA learning standards at different grade levels). The use, therefore of the literal text of a standard element in metadata is problematic; without additional metadata representing context, it is not clear what the alignment really is.

By maintaining a database of standards and a registry service that can resolve a unique identification number in the form of a URI to both the literal text of a standard and its context (including promulgating organization and document properties), the problem of attempting to deal with arbitrary and non-interoperable application profiles for metadata representations of standards and benchmarks in resource descriptions is eliminated. Additionally, the use of standardized identification codes for learning standards and benchmarks that uniquely identify correlations to specific points in standards documents facilitates not only automated accountability systems but interoperability of the data those systems track.

<b>Standards Hierarchy</b>	<b>ACSR ID Code</b>	<b>ASN Registry Service URI</b>
<b>← ...Document Identifier</b>	<b>1f73 xxxx xxxx</b>	<b>Http://purl.org/tf/1f73xxxxxxx</b>
<b>← ... Broader terms/grade</b>	<b>1f73 yyyy yyyy</b>	<b>http://purl.org/tf/1f73yyyyyyy</b>
<b>SCIENCE PROCESSES AND INQUIRY</b>	<b>1f73 87b2 1012</b>	<b>http://purl.org/tf/1f7387b21012</b>
<b>Process Standard 4: Interpret and Communicate - Interpreting is the process [etc]...</b>	<b>1f73 87b2 1023</b>	<b>http://purl.org/tf/1f7387b21023</b>
1. Report data in an appropriate method [etc]...	<b>1f73 87b2 1035</b>	<b>http://purl.org/tf/1f7387b21035</b>
2. Interpret data tables, line, bar, trend [etc]...	<b>1f73 87b2 1044</b>	<b>http://purl.org/tf/1f7387b21044</b>
3. Evaluate data to develop [etc]...	<b>1f73 87b2 1053</b>	<b>http://purl.org/tf/1f7387b21053</b>
4. Accept or reject hypotheses [etc]...	<b>1f73 87b2 1066</b>	<b>http://purl.org/tf/1f7387b21066</b>
5. Communicate scientific [etc]...	<b>1f73 87b2 1073</b>	<b>http://purl.org/tf/1f7387b21073</b>
<b>Process Standard 5: Inquiry - Inquiry can be defined as the skills necessary [etc]...</b>	<b>1f73 87b2 1085</b>	<b>http://purl.org/tf/1f7387b21085</b>
1. Use systematic observations, make accurate [etc]...	<b>1f73 87b2 1092</b>	<b>http://purl.org/tf/1f7387b21092</b>

Table: Section from Oklahoma Department of Education 8<sup>th</sup> grade science standards showing the hierarchical nature of the standards document, an example of the proposed ACSR ID code, and the URI that could be resolved by the Achievement Standards Network Registry Service

The format for the ACSR Identification code, which will operate similarly to a UPC or EAN bar code in terms of functionality, is proposed to be a 12 digit hexadecimal number. This has been

chosen to make something that is manageable by human data operators, but is unique enough to adequately cover the magnitude of the problem domain.

Twelve hex digits accommodate potentially almost 3 trillion distinct entries, however we propose breaking it up into a 4-character block and an 8-character block. The first four characters are proposed to be designated as an assigned code for each promulgating standards body. This would provide the capacity to handle approximately 65K standards bodies/orgs, each with over 4 billion standards.

A check digit would provide additional data validation at the point of manual entry. If a check digit is included as the last digit of the 8-character block, it would reduce that number of elements that could be addressed, but each of the standards bodies buckets could still represent over 250M individual standard and benchmark statements. In practice, the use of the first four characters as an assignment code means that aligners using a manual process would only have to annotate eight digits (the first four would be assumed), significantly reducing errors.

Few states exceed 1,500 benchmarks per subject, and to that number needs to be added the broader term hierarchical elements. Assuming a total number of 2,500 elements for each of 10 subjects (25K objects in all, per state per promulgating organization for all subjects), the structure would then potentially accommodate 10,000 complete revision cycles.

## **Further ACSR Development**

Continued development on the ACSR will be conducted in three phases. The first phase consists of stakeholder engagement and use-case needs analysis, especially relating to assuring development of a comprehensive and sufficient application profile and an appropriate set of XML schemas for the exchange of metadata. Both content providers and content consumers will participate and assure that the use cases have been adequately described.

The second phase consists of porting the existing learning standards and benchmarks from the prototype systems (the Align to Achieve and Academic Standards and Assessment System databases), collecting and filling any missing data, and populating the database with additional sets and collections of standards.

The third phase consists of development of the internal code necessary to support internal housekeeping and database quality assurance.

Finally, maintenance consists of working with the various states and standards organizations to assure that the ACSR is complete, up-to-date and accurately represents the standards.

## ***Repositories of Aligned Standards (RAS)***

### **Overview**

A Repository of Aligned Standards (RAS) is comprised of a set of subject-oriented learning standard exemplars, concept vocabulary terms providing additional refinement of the exemplars, and tables of relationships between the exemplars and actual learning standards and benchmarks. The specific RAS included in the initial reference implementation of the ASN is the intellectual

work product of Align to Achieve, Inc. and has been in commercial use since 1998. Its inclusion now in the ASN serves two primary purposes. First, it provides access to an initial set of alignments that relate the standards of the various states and organizations to each other. Second, it serves to model explicitly and openly how any intermediary – or any other kind of proprietary or open alignment system – interfaces with the ACSR and can use its URIs and registry services to provide learning standards text and context resolution.

**Content providers** use the RAS to align resources to the intermediary statements and vocabularies from which correlations to other specific state and national standards may be inferred. Providers also may use the RAS to generate static alignments to any desired number of learning standards and benchmarks. Access to the RAS for alignment purposes is through a license agreement that is free for non-commercial and educational use, and fee-based for commercial purposes including alignment of commercial and fee-based learning objects.

**Content consumers** use the RAS to retrieve inferred alignments to specific state and national standards for resources that have been aligned to the RAS. The RAS can also be used to produce indirect inferences that, in effect, cross reference direct alignments from one set of standards to another. Resolution of alignments to the RAS is available to content consumers without license or fee requirements.

## **Relationship of the ACSR to the RAS**

The ACSR and RAS are two distinct repositories, each with a unique application profile, that complement and consume each other through interoperable services, agents and protocols (discussed in more detail in a following section). In fact, the ACSR can interoperate with any alignment system or intermediary that conforms to the open, published communications and query specifications.

Resources that are directly aligned to specific state or national standards with an ACSR ID code are resolved by the ACSR, which can return text, context, document information and other metadata relating to the standard. This includes static alignments content providers derive by using the RAS to generate ID codes that can be resolved by the ACSR.

Resources that are aligned to the RAS or other intermediary or alignment service and contain ID codes unique to the service are resolved by the respective service. Interoperability with the ACSR is achieved by consuming the ACSR ID codes as the authoritative collection of taxonomies for learning standards and benchmarks, and by returning ACSR ID codes in result sets which can be resolved by the ACSR in the same manner as a direct ACSR alignment.

## **Open Vs. Proprietary Intermediaries**

The alignment service may choose to expose its own underlying intermediary explicitly or not. If, as in the case of the RAS, the intermediary is itself a set of learning standards, then those standards can be incorporated like any other set of learning standards and benchmarks within the ACSR. The RAS can then provide ACSR ID codes for its own statements as part of the resolution service. If the alignment service is closed or proprietary, however, it need only provide ACSR ID codes for the inferred alignments.

## Further RAS Development

Like the ACRS, a commercial version of the RAS is already in use operating as a closed subscription-based system.

Further refinement and full integration with the ASN will require the following development phases in completion of the current proposal:

- Incorporation of the ACSR ID codes into the table structure of the RAS
- Completion of the human alignment process that links each of the intermediary exemplars to learning standards and benchmarks
- Development of the internal code that will support the resolution service API

## *ASN Core Architecture*

Because the core components of the Achievement Standards Network – the ACSR, the RAS, and the related schemas for interchange of interoperable data – are represented by .XML files and data streams, the ASN is fundamentally platform and database agnostic. The ASN is, in essence, a framework for interoperable communication of learning standards data and processes and not a product that is installed.

A reference implementation of the ASN and the master databases for the ACSR and the RAS will be maintained by JES & Co., Align to Achieve and the University of Washington's Information School. URIs will be aliased using PURL redirects (<http://purl.org/>) to avoid problems associated with static URLs that might change over the course of project development and maintenance.

A final determination of the most suitable platform for the reference implementation of the core services is not yet determined. Current pilot and commercial versions of both the ACSR (in the form of JES & Co.'s ASAS and Align to Achieve database) were developed on Microsoft components primarily due to the overwhelming preponderance of Microsoft network and database solutions in the K-12 market, the target audience for K-12 standards alignment services. However the RDF query engine components currently selected for deployment of the reference implementation (Siderean Seamark) is multi-platform capable as described by the following technical requirements document (<http://www.siderean.com/TechnologyWhitePaper.pdf>).

The Seamark Server is implemented using the Java 2 SDK version 1.4.X, runs on the Windows 2000, Windows XP, Solaris and Red Hat Linux operating systems, and is compatible with any JDBC-compliant database. Siderean offers specific support for SQL Server 2000, PostgreSQL 7.2, and MySQL 3.23 and higher.

The three tiers of a Seamark Server application are:

**Web application front end:** Search and server administration applications are implemented as Java servlets.

**Infrastructure component middleware:** An RDF query engine, utilizing a RDF triple store and in-memory resource description cache, is embedded behind a SOAP server, running on top of the Apache Tomcat servlet container.

**Persistent storage:** The query engine and search and administrative applications interface read and write configuration and RDF model data to

and from a relational database using JDBC.

The choice of an RDF/XML-based reference implementation provides the means for keeping the project and its registries and repositories at the forefront of the evolving technologies driving the Semantic Web without sacrificing the project's general ability to serve the currently broader-based XML community and its applications. The choice of platform for the reference implementation, however, does not restrict or limit platform choice of any consumer of the RAS or ACSR services. All communication between and among consumers of the ASN is accomplished through SOAP messaging. Because the ASN is a service, the ACSR and RAS data does not need to be directly integrated within an end-user's infrastructure in order to resolve learning standards metadata.

### *ASN Software Development Kit and APIs*

Users may, of course, wish to duplicate the structure and service architecture of the ASN for their own purposes, and they may wish to add functionality or additional data facets to it. The ASN SDK will comprise the full and open documentation of the structure of the XML schemas, the syntax and structure of the SOAP/XML requests, documentation of the table structure of the ACSR, and code samples in both .NET and Java demonstrating each of the available XML/SOAP conversations.

The reference implementation of the ACSR and RAS is intended to be the master repository from which any other instantiations derive the authoritative and current version of the data. Users may poll the ASN for the most current XML copy of the data at any time and devise appropriate methods for update and synchronization according to their requirements. Automated synchronization of remote or subsidiary databases is beyond the scope of the initial development effort and is currently premature. Current work undertaken by the Schools Interoperability Framework architecture committee to extend the concept of the SIF Zone will inform this ASN functionality as part of future development. The SIF Zone Integration Server is designed to define an architecture for automated publication and subscription of this kind of data. When SIF completes its architectural recommendations, work on automated synchronization of the ACSR can commence.

### *ASN Demonstration Code and Utilities*

In order to demonstrate how the web services exposed by the ASN can be called and used in applications, and to provide core alignment and resolution services to those without the technical capacity to access the ASN programmatically, two simple browser-based applications will be developed and hosted for manual operation.

The first will provide a faceted search into the ACRS by state, subject, grade and other search terms in order to produce a set of ACRS URIs matching a query that can be cut and pasted directly into a catalog record. This will give content providers the capability of doing one-off alignments for resources they wish to expose. It should be noted, however that most content providers already maintain alignment systems, and it is anticipated that the majority of them will consume the ACSR XML directly for incorporation with existing systems.

The second will provide limited access to the RAS for end-users who wish to execute one-off cross-walks of one standard to another, or who have resources aligned to an intermediary statement and need to resolve them to their own standards. This will be valuable to end users such

as teachers who find resources aligned to one standard or the RAS and need to determine how the alignment matches up with their own or another set of standards. Again, however, it should be noted that most cross-walking will be executed directly by either portal managers in code or by content developers using the crosswalk to facilitate structured access into resource metadata repositories.

The code developed will be open and available, constituting a portion of the SDK which will be freely available.

### *Integration of the ASN within Digital Library and Portal Architectures*

Integration of the ASN within a portal or digital repository architecture may take place at several levels and with varying degrees of complexity and required development. In general, the comments that follow would apply to anyone wishing to integrate with the ASN.

### **Inclusion Of ACSR and RAS Metadata Within Catalog Records**

Once stakeholders begin to use the ACSR and RAS to generate metadata tags and include it as part of contributed records, the information is available to anyone querying the records through OAI servers or with direct query capabilities to a repository database. The ACSR URI may be encoded in the Dublin Core *relation* element designed for that purpose. Currently, a number of applications and content repositories support the *DC:Relations* element as qualified by *conformsTo*. This element may easily be cross-walked to other schemas and application profiles as necessary according to individual user needs.

Many repositories maintain records currently tagged with some kind of learning standards metadata, but there has been no consistent or universal approach to this effort. Updating of existing records must be analyzed on a case by case basis. It is conceivable that in some specific cases, it may be possible to automate or script batch updates for some contributing members' records depending on how the original tagging was performed. In other cases, learning standards tags may require new generation.

### **Exposing ACSR and RAS Literals on a Portal**

Once ACSR URIs are embedded within the learning standards elements of any given application profile, they will (or optionally may be) exposed as a navigable hyperlink. Because the ASN URI will respond to an HTTP 'get' request with resolution and an XML return that will be displayed verbosely by current versions of most browsers including Netscape and Internet Explorer, users will have some capability of determining the nature of the alignment from that data alone, although it will not serve as an effective search facet without additional integration.

### **Resolving ACSR and RAS literals through a Portal**

Portal developers may elect to go one step further and resolve the URIs for the user by preprocessing the ACSR ID codes and returning document, text and context metadata as part of the detail return page on resource queries. This would provide a better human-interpretable

display. In order to accomplish this, code would have to be implemented by the portal that constructs a SOAP/XML request to the ASN for resolution of each single URI within the resource metadata. The result would be rendered according to available methods (e.g. through a simple XSLT ).

## **Providing faceted searching on Learning Standards**

Portals may also wish to consider facilitating searches for learning standards. They might accomplish this by developing a query form for the end user that would create a formatted request that could be passed to the ACSR via a SOAP/XML conversation (the format for the SOAP header and syntax for the XML request will be included with the ASN SDK). The response from ACSR will be a formatted set of one or more URIs that can be located within the portal repository as with any other currently implemented search facet. This method is valid for all direct alignments, that is, any metadata indicating an alignment directly to a set of standards.

## **Providing Learning Standards Cross-walking**

The last step in integrating a portal with the ASN reference repository and services would be to facilitate end-user resolution of RAS alignments and queries of indirect or inferred alignments using the cross-walking capabilities of the RAS. The process proceeds similarly to direct faceted searching, except, however that once the SOAP/XML query is constructed, it is passed to the RAS rather than the ACSR. The RAS accepts the incoming query which contains the details of the particular subset of learning standards the user is seeking and returns the URIs representing RAS alignments that may be incorporated within the metadata by resource providers that use the RAS to create the alignments. Once the portal processes the search within its database and returns a set of detailed records to the end user, the portal would pass back any specific RAS alignments found within the result set back to the RAS for cross-walking to the specific standard set the user is seeking, using ACSR URIs for the return. These are rendered for the user as with the previously described use case. Again, documentation of the specific format for these SOAP/XML requests and the result set will be incorporated within the ASN SDK and is within the scope of the proposal.

It should also be noted that any other third party intermediary or resolution service that follows the format of the open SOAP/XML requests and data streams can participate on a level playing field with this process.

Development of the SOAP header format, schemas for exchange of data according to these use cases, and development of the communication between the ACRS and the RAS is within the scope of this proposal and will be informed through the stakeholder engagement process.

## **Instantiating a local version of the ASN**

Although code development and the necessary implementation services to provide installable versions of the ASN are outside the scope of initial project development, it should be noted that all the required data, information and methods necessary for any portal or application to instantiate a version of the ASN locally is provided. Anyone may use the XML output generated

by the ACRS to construct and populate a local repository of learning standards and construct the web services that would allow it to communicate in an open, interoperable way.

## *Maintenance of the ACSR*

Evaluation of content. The work of collecting content standards from states, national organizations and research centers includes a significant effort to validate the source and accuracy of the collected standards. National organizations started developing and issuing content standards in the late 1980s and early 90's – for example the National Council of Teachers of Mathematics and the American Academy for the Advancement of Science. Most State Education Agencies started after the mid-90s with their first subject standards implementations and at the turn of the century with complete revisions. Throughout this 17 year period, SEAs, LEAs and national organizations have had no consistency of document naming, element naming, document and standards format, or grouping/grade assignment. Further, within many of the organizations, there has been little or no consistency of organization structure and staff responsible for creating and revising content standards.

In 1998, when content standards collection and IT organization were initiated by this project's subcontractor, a comprehensive process of discovery and validation for was developed so that, for each standards organization, the process could locate and validate the responsible individual(s), the correct document(s), and the correct information and structure within the document(s). Part of this discovery process is to document, for each organization, the person(s) contacted, the results of the discussions, and the feedback on the collected standards and benchmarks. These records can be made available on request.

It is expected that this well-honed discovery process will continue for the duration of the project. However, this process will gradually be phased out as states and organizations distribute and make available their standards documents formatted according to SIF specifications.

## *Cost Model and Ongoing Sustainability*

There will be no charge, subscription or fee imposed upon end-users of the Achievement Standards Network reference implementation for resolution of learning standards metadata, including retrieving verbose text, context and learning standards document metadata using the Achievement Content Standards Repository (ACSR) URI . There will also be no charge, subscription or fee imposed upon end-users of the Achievement Standards Network for resolution of metadata aligned using the Registry for Alignment of Standards (RAS). Resolution of all metadata through the reference implementation will be through an open and publicly accessible URI.

Access to the full contents of the ACSR -- including download capability for all learning standards data in XML format -- for purposes of creating metadata tags or for consumption by alignment and cataloging systems will be provided through an annual subscription model based on a sliding scale according to gross sales revenue. Initial analysis of the business model and long term sustainability indicates that the following range of fees will be sufficient to assure ongoing operations:

- a. Non-commercial use for education and research, non-profit and academic use for alignment of free content, no charge
- b. Non-profit and academic institutions for alignment of fee-based content, \$500 per year
- c. For-profit and other commercial ventures, sliding scale based on gross sales revenue, not to exceed \$5000 per year.

Similarly, access to the RAS for purposes of alignment and correlation of alignments to multiple standards and standards documents is through an annual license fee based on a sliding scale according to gross sales revenue, as follows:

- a. Non-commercial use for education and research in schools and state education agencies, no charge
- b. For commercial content and service providers the sliding scale is based on annual revenue derived from aligned material for the commercial organization or business unit, contact Fred Balfour, Align to Achieve, [fbalfour@aligntoachieve.org](mailto:fbalfour@aligntoachieve.org):

It is not necessary to license the RAS in order to receive access to the ACRS.

Once the project achieves maintenance mode, changes to the fee tiers will be evaluated and adjusted periodically to assure cost recovery and ongoing operations.