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# *Learning Standards Digital Representation Specification: Publishing Agent Design and Requirements*

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*Granular Identifiers and Metadata for CCSS (GIM CCSS) Project*

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V 1.0  
2013-09-12**



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## Introduction

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*Note:* This section is informative.

This Specification presents the design and requirements for a “Publishing Agent” and a “Publishing Organization” – a computing environment and the organization that operates it – that supports the process of making the digital representation of a standards statement, developed through the *Granular Identifiers and Metadata for CCSS (GIM CCSS) Project* or other sources, available on the Internet for anyone to access and use.

The overall project objective is to “*develop a free, open, and faithful digital representation of the Common Core State Standards at a level of granularity that provides the necessary support for instructional, assessment and professional development implementation by states, districts, publishers, technology companies and others.*”

This Specification describes the implementation and deployment approach for distributing standards statements. It builds on the technical solution and requirements for representing the standards statements [GIM CCSS Scope], including:

- The **digital representation** and information model of the Common Core State Standards (CCSS).
- The **identifiers** assigned to statements within the CCSS.
- The **metadata** describing the statements within the CCSS.

The Specification addresses:

- The generic workflow process of creating and publishing a standards statement.
- The conceptual design of the Publishing Agent.
- Technical requirements for publishing, access and integration.
- Requirements for operating and supporting the Publishing Agent by the Publishing Organization.

The Specification includes:

- **Notation** – Definitions of normative terms used in the Specification.
- **Publishing Workflow** – The generic workflow of creating and publishing a standards statement.
- **Design Requirements** – Requirements for the design of the Publishing Agent.
- **Statement Publishing Requirements** – Requirements for publishing statements via the Publishing Agent.
- **Statement Access Requirements** – Requirements for accessing statements on the Internet.
- **Integration Requirements** – Requirements for integration with external systems.
- **Support Requirements** – Requirements for help desk and support.
- **Operating Requirements** – Requirements for operating the Publishing Agent and managing the technical activities of the Publishing Organization, including: Hosting Requirements, Backup Requirements, Monitoring and Logging Requirements, Deployment Schedule Requirements.
- **Security Requirements** – Requirements for secure data access and storage.
- **Testing Requirements** – Requirements for testing the Publishing Agent.
- **Legal Requirements** – Requirements for regulatory compliance.
- **Intellectual Property Requirements** – Requirements for licenses, rights and intellectual property, including: Data Rights Requirements, Document and Code Rights Requirements.
- **Governance Requirements** – Requirements for governance and management operations of the Publishing Organization.
- **Design Decisions** – Discussion of choices and rationale for the requirements, design and operations.
- **Glossary** – Definitions of key terms.
- **Normative References** – Normative references to other specifications used in this Specification.
- **Informative References** – References to other documents (informative).
- **Annexes** – Detailed requirement’s for data instances.

## Notation

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The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this Specification are to be interpreted as described in [RFC 2119].

Unless otherwise noted, sections in this Specification are normative.

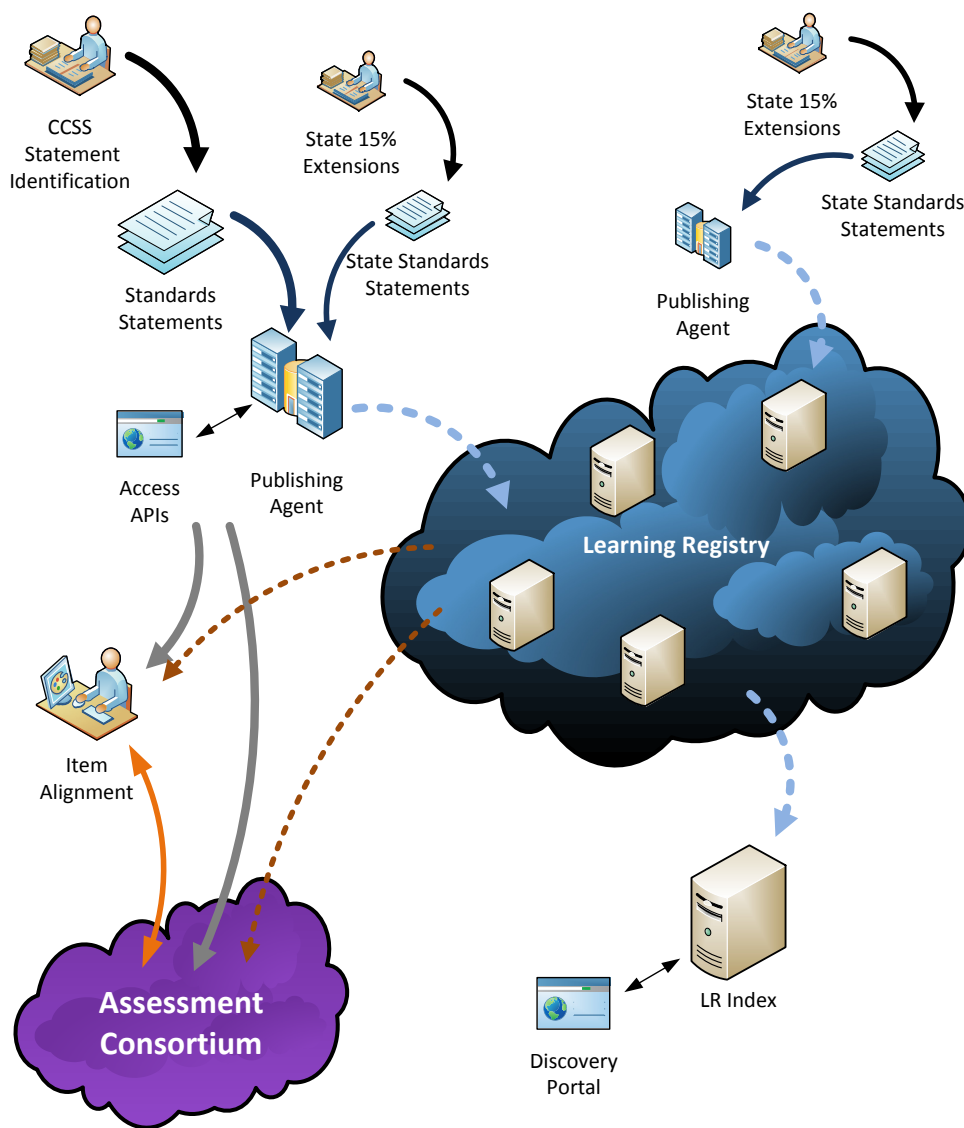
Additional specific terms used in the Specification are defined in the glossary.

## Publishing Workflow

*The generic workflow process of creating, publishing and accessing a standards statement.*

The typical workflows of publishing and accessing a standards statement are illustrated in Figure 1 (the diagram is illustrative, and does not show all potential workflows or use cases). These include:

- Statement identification.
- Statement publication (including identifier assignment or homing).
- Statement access (retrieving statements and resolving identifiers).
- Integration with the Learning Registry (submitting information about statements to the Learning Registry).
- Integration with external systems (such as the RTTA assessment consortia for purposes such as item alignment).
- Statement discovery through interfaces built using the Learning Registry.



**Figure 1: Deployment Model**

Various use cases and workflows are supported by this model. Key workflows are illustrated in Figure 2. Numbers in the text # correspond to steps shown in Figure 2.

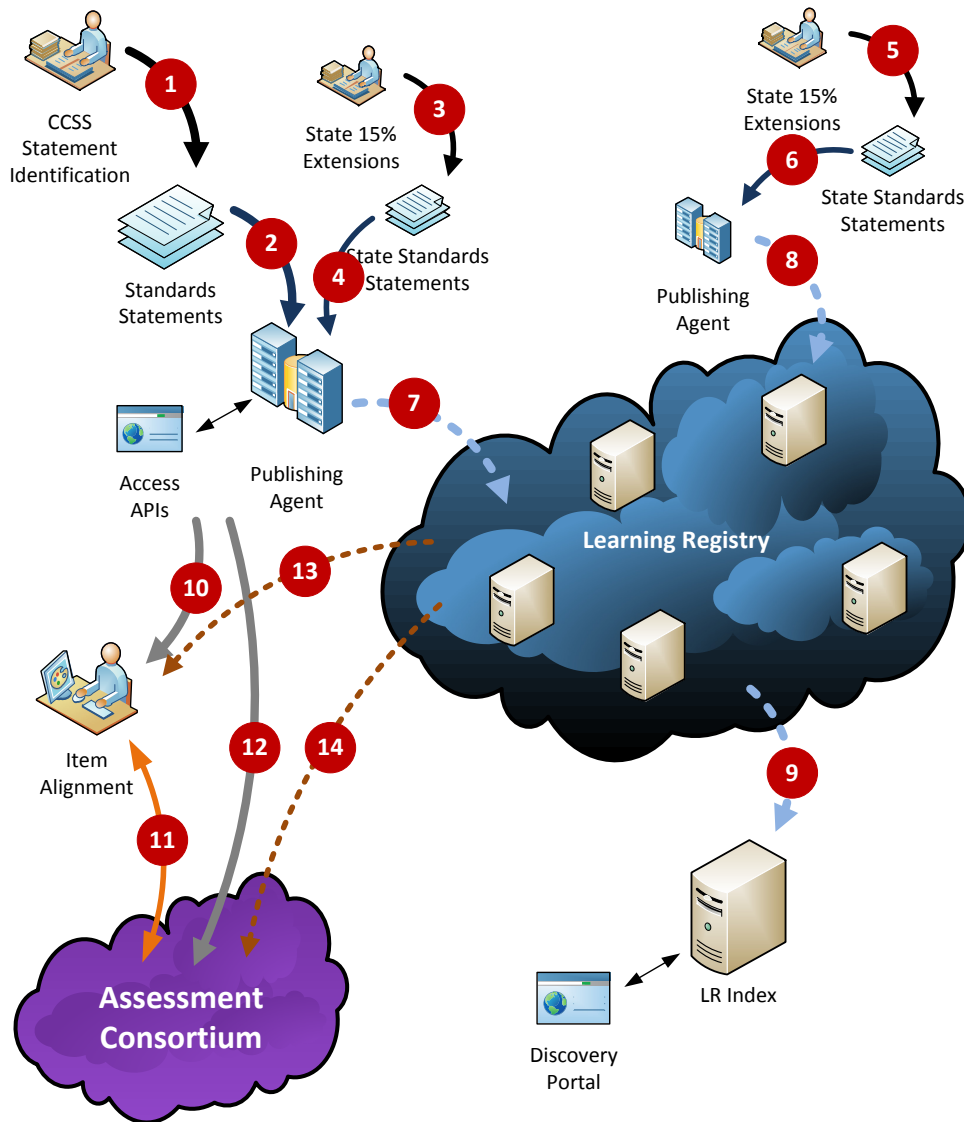


Figure 2: Workflows

*Creating statements/Statement Origination:*

- Statements and concepts are identified from the source standards statements, including CCSS statements or granular statements **1** and state extension statements **3**.
- Statements (both the description of the standards statement and its metadata) are documented in a digital form in terms of the information model.
- After an approval process (not illustrated), the statements are transferred to the publishing agent for publication and distribution **2** & **4**.

As illustrated, a state could use the same Publishing Agent. Alternatively, the same workflow could be used with a different Publishing Agent **5** & **6**. The model permits multiple, independent Publishing Agents. The choice of Publishing Agent to use is made by the statement originator.

Other organizations (not illustrated) could use the same workflow to create, identify or “originate” statements.

*Publishing statements:*

- Given a set of statements from some origination source, a Publishing Agent (or the publishing organization that operates the Publishing Agent):
  - Encodes the statements in the digital representation.
  - Augments the metadata with information about the digital encoding.
  - Homes or assigns identifiers used in resolution to retrieve a statement via the associated identifier management system.
  - Publishes the statements to its digital store where they are accessible by others through the Publishing Agent’s APIs and resolvable from the homed or assigned identifiers.
  - Submits records into the Learning Registry, on behalf of the statement originator, indicating that new statements have been published **7**.
    - The Publishing Agent submits information about the statements.
    - The Publishing Agent signs the submissions with the key of the statement originator, indicating that the statement submission is authentic.
    - In addition to the statements, the Publishing Agent may take parts of the statements, such as the relations, and publish those as additional paradata assertions about the statements.
- Once published, someone can access the statements directly from the Publishing Agent through the agent’s APIs.
- The Publishing Agent may provide additional (optional) distribution or access mechanisms to retrieve published statements.
- Once submitted to the Learning Registry, someone can discover the statements through the Learning Registry.
- Once resolvable identifiers are defined, an identifier can be used as a link in an external system.
- Resolvable identifiers presented to the resolver of the identifier management system can be used to retrieve a locator that is then used to retrieve the statement.

Multiple Publishing Agents may exist **8**, each differentiated by the services offered (e.g., some Publishing Agents may be closed and provide services only to known clients, others may be open and publish statements for any client, others may offer additional APIs and services).

*Updating statements:*

- The update process (not illustrated) is identical to the creation and publications steps outlined above. Appropriate metadata, relationships and versioning information are used to tag the standards statements, either when created or when published.

*Discovering statements:*

- From the Learning Registry, a tool such as the LR Index can monitor the Learning Registry for new instances of standards statements (submitted from Publishing Agents) **9**.
- The LR Index uses its policies to determine which statements are included in its index (e.g., only CCSS statements and state statements).
- The LR Index provides a discovery portal for users to search for statements matching specific criteria.

*Aligning assessment items to statements:*

- The item alignment process can retrieve statements (all or some) from the Publishing Agent through the agent’s API **10**.
- Once alignment is complete, the item alignment data can be stored by the assessment consortium **11** with the assessment item linked to the statement through the statement’s identifier.
- Alternatively, the assessment consortium can retrieve statements directly from the Publishing Agent **12** and pass these to the alignment process **10**:
  - The assessment consortium can hold a copy of the standards statements.
  - The assessment consortium can use the same identifier management system as the Publishing Agent to provide resolution, but internally, links within the assessment consortium item bank and assessment results data could resolve to the locally held copy of the statements.

- Accessing a single Publishing Agent only provides the statements held by that agent. The assessment consortium could connect directly to the Learning Registry **13** & **14** and find statements from multiple Publishing Agents that match the consortium’s policies.

*Aligning resources to statement:*

Any 3<sup>rd</sup> party can access the statements from the Publishing Agents or from the Learning Registry, align learning resources to statements, and submit the alignments to the Learning Registry through paradata assertions (not illustrated). The alignment workflow is similar to the assessment item workflow described above.

The Publishing Agent SHALL *enable* all of the workflows shown.

The Publishing Agent and the publishing organization SHALL directly support:

- Publication from multiple sources
- Statement access
- Identifier management
- Identifier resolution
- Integration with the Learning Registry

Discovery of standards statements through the Learning Registry and alignment of resources and assessment items to standards are enabled by publishing, but are not part of the Publishing Agent.

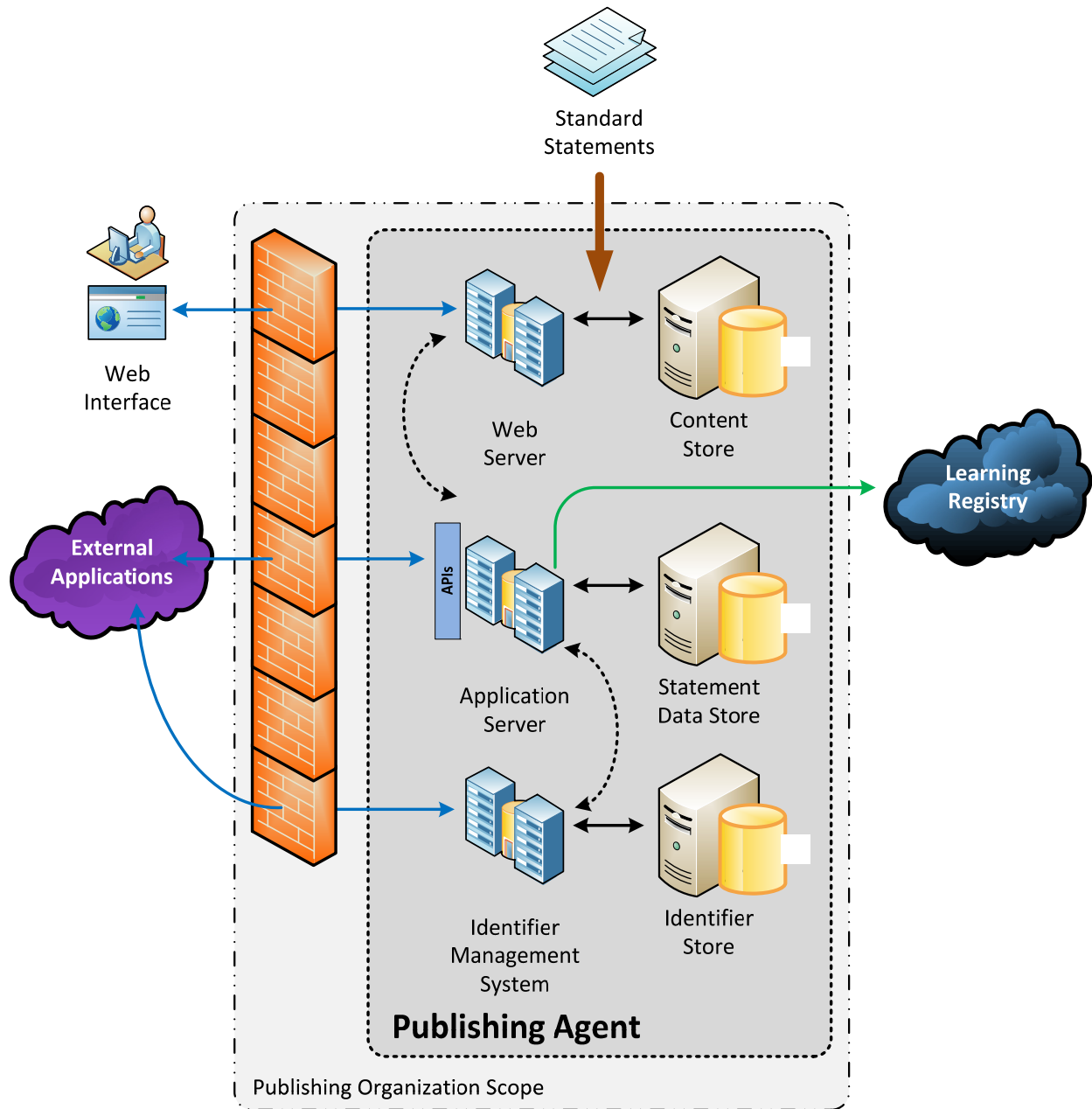


## Publishing Agent Design

### *Conceptual Design of the Publishing Agent.*

The conceptual design of the Publishing Agent is shown in Figure 3.

The Publishing Agent SHALL be one of the components deployed by the Publishing Organization; others SHALL include network connections, including the firewall (shown) and internal maintenance tools, procedures and support systems (not shown).



**Figure 3: Publishing Agent Design**

The Publishing Agent SHALL be composed of a collection of components.

#### The Application Server

- Is the core “publishing” component of the Publishing Agent.
- Encodes a statement in the digital representation.
- Augments the statement provenance metadata with information about the digital encoding.
- Homes or assigns identifiers to the statement using the associated identifier management system (loosely coupled with the Application Server).
- Stores the statement to its statement data store.
- Submits the statement to the Learning Registry (through external integration).
- Provides APIs for external applications to access statements.

#### The Web Server

- Provides user access to the Publishing Agent through web clients.
- Provides basic web document delivery services (general information, support documents, etc.).
- Stores documents to be served in its content store.
- Serves statements (e.g., the HTML5 representation of a statement) to web clients by accessing the digital representation from the statement data store through the Application Server.

#### The Identifier Management System

- Provides services to create, manage and resolve identifiers.
- Stores association data for identifiers in its identifier store.
- Integrates with the Application Server to provide identifier management services.
- Provides services for external applications to resolve identifiers.

The Application Server’s data store SHALL be tightly coupled with the Application Server.

The Application Server’s statement data store SHALL NOT be accessible from any component except with the Application Server.

The Web Server’s content store SHALL be tightly coupled with the Web Server.

The Web Server’s content store SHALL NOT be accessible from any component except with the Web Server.

The Identifier Management System’s identifier store SHALL be tightly coupled with the Identifier Management System.

The Identifier Management System’s identifier store SHALL NOT be accessible from any component except with the Identifier Management System.

The Application Server SHALL be loosely coupled with the Web Server and the Identifier Management System.

The Web Server SHALL provide an HTTPD for external access.

The Application Server SHALL provide an HTTPD for external access.

For end users, the Application Server SHALL be hidden behind the API facade.

The Identifier Management System MAY provide an HTTPD for external access.

## Design Requirements

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### *Requirements for the design of the Publishing Agent.*

The Publishing Organization SHALL design and develop a Publishing Agent that provides capabilities to support the statement publication and distribution use cases, workflow and statement information model.

The Publishing Agent SHALL conform to the technical solution and requirements for representing the standards statements [GIM CCSS Scope].

The Publishing Agent SHOULD be designed as a collection of independent components that can be incrementally upgraded or modified; components including, but not limited to: web front end and content store, application/service layer, statement data store, identifier management system, identifier store.

The Publishing Agent SHOULD be designed to be easily extended without requiring extensive changes in technology, software infrastructure or modification of existing components.

The Publishing Agent Application Server Content Store SHALL utilize existing data store/database software.

The Publishing Agent Application Server Content Store SHOULD be an open source data store.

The Publishing Agent Application Server SHALL utilize existing HTTPD and application server software.

The Publishing Agent Application Server SHOULD be an open source server.

The Publishing Agent Web Server SHALL utilize existing HTTPD software.

The Publishing Agent Web Server SHOULD be an open source web server.

The Publishing Agent Web Server Content Store SHALL utilize existing software.

The Publishing Agent Web Server Content Store SHOULD be an open source data/document store or content management system.

The Publishing Agent Identifier Management System SHOULD utilize existing software.

The Publishing Agent Identifier Management System SHOULD be an open source system.

The Publishing Agent Identifier Management System Content Store SHALL utilize existing software.

The Publishing Agent Identifier Management System Content Store SHOULD be an open source data store.

The Publishing Agent SHOULD utilize existing software for all ancillary components.

The Publishing Agent SHOULD utilize open source software for all ancillary components.

The Publishing Agent user interfaces SHALL comply to universal design principles.

The Publishing Agent user interfaces SHALL be web-based.

The Publishing Agent web interfaces SHOULD be accessible across a wide range of current Internet client devices, including, but not limited to: desktops, laptops, netbooks, tablets running recent versions of Windows, MacOS, Linux, Apple iOS, Android.

The Publishing Agent web interfaces SHOULD be developed using HTML5, ECMAScript (JavaScript) and JSON.

The Publishing Agent web interfaces SHOULD use media formats supported across all commonly deployed browsers.

The Publishing Agent web interfaces SHOULD NOT require browser plugins for end-user clients.

The Publishing Agent component interfaces and component design SHALL conform to open Internet interoperability standards, including but not limited to:

- Data/Data Model Standards:
  - GIM-CCSS Information Model [GIM CCSS Scope]
  - Dublin Core Metadata Initiative DCMI Metadata Terms [DC]
  - Dublin Core Education Application Profile [DC ED]
  - Learning Registry Paradata (v1.0) [Learning Registry Paradata]
  - Learning Resources Metadata Initiative (v1.0) [LRMI]
  - Common Educational Data Standards (v3.0) [CEDS]
  - Schema.org [Schema]
  - Common Core State Standards Official Identifiers and XML Representation [CCSSO XML]
- Application Layer Interface/Protocol Standards:
  - Learning Registry v0.5x.x [Learning Registry Specification]
  - GIM-CCSS Learning Standards Digital Representation Specification: JSON Serialization Schemata [GIM CCSS JSON]
  - GIM-CCSS Learning Standards Digital Representation Specification: XML Serialization Schemata [GIM CCSS XML]
  - GIM-CCSS Learning Standards Digital Representation Specification: RESTful API [GIM CCSS API]
- Language Standards:
  - Hypertext Markup Language – HTML5 – Data/Markup Language [HTML5]
  - ECMAScript (ECMA-262) – Data/Scripting Language [ECMA 262]
  - JavaScript Object Notation – JSON (RFC 4627) [JSON]
  - eXtensible Markup Language – XML (1.1) [XML]
  - XML Schema Definition Language – XSD (1.1) [XSD 1, XSD 2]
- Internet Layer Interface/Protocol Standards:
  - Secure Sockets Layer – SSL (v3.0) [SSL]
  - Transport Layer Security – TLS (v1.2) [TLS]
  - Hypertext Transfer Protocol – HTTP (v1.1) [HTTP]
  - Representational State Transfer – REST [REST]
  - Simple Network Management Protocol – SNMP (v3) [SNMP]
  - Syslog (RFC 5424) [Syslog]

The Publishing Agent component interfaces and component design SHALL NOT use alternatives to the REQUIRED Internet interoperability standards.

## Statement Publishing Requirements

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### *Requirements for publishing statements via the Publishing Agent.*

The Publishing Organization SHALL provide the capability to accept statements from a Statement Originator and input statements into the Publishing Agent statement data store for storage and retrieval.

The Publishing Organization MAY enter into service agreements with Statement Originators to provide publishing services to accept and publish statements.

The Publishing Organization MAY limit publishing to those Statement Originators with whom it has a service agreement.

The Publishing Organization MAY provide publishing services to any Statement Originators without requiring a service agreement.

The Publishing Organization SHALL specify and publish, through the Publishing Organization support mechanism, the input formats/schemata and policies for statements that it will accept.

The Publishing Organization SHALL support the input and storage of least one input format/schema that encompasses the entire information model [GIM CCSS Scope], including, but not limited to: required elements, optional elements, element extensions, multiple instances, specified vocabularies, open vocabularies.

The Publishing Organization or Publishing Agent SHALL validate all input, including, but not limited to: being well-formed' schema validation, semantic validation (including checking for logical/meaningful values; data ranges; semantic constraints; validity of relations, including types and links), URI/link validation, vocabulary source and value validation.

The Publishing Organization or Publishing Agent SHALL report all validation errors to the Statement Originator.

The Publishing Organization or Publishing Agent SHALL NOT accept for storage any statement that does not validate.

The Publishing Agent SHOULD accept statements that conform to the JSON serialization [GIM CCSS JSON].

If the Publishing Agent accepts the JSON serialization, it SHALL accept and store the entire information model [GIM CCSS Scope].

If the Publishing Agent accepts the JSON serialization, it SHALL validate the JSON document.

The Publishing Organization or Publishing Agent SHALL augment any input to incorporate missing values.

The Publishing Agent SHALL encode the statement in a digital representation for storage in the Publishing Agent's digital store.

The Publishing Agent SHALL add complete provenance metadata about the digital representation as part of the encoding process, including, but not limited to: general description (e.g., title), authorship/ownership, history, version, language, status/state, licensing, rights and attribution.

The Publishing Agent SHALL home all statement identifiers in the digital representation meant for resolution, as part of the encoding process.

The Publishing Agent MAY add statement identifiers or locators to the digital representation.

The Publishing Agent SHALL ensure that the digital representation of the statement has at least one persistent, unique, opaque identifier.

The Publishing Agent SHALL ensure that the digital representation of the statement has at least one Web-resolvable identifier.

The Publishing Agent SHALL maintain in the digital representation the relationship links between a statement and all its children statements.

The Publishing Agent SHALL maintain in the digital representation the relationship links between a statement and its parent statement.

The Publishing Agent SHALL maintain in the digital representation the relationship link between a statement and the most recent previous version of the statement.

The Publishing Agent SHALL store the digital representation of statements in the statement data store.

The Publishing Agent's statement data store SHALL provide persistent storage of statements that supports the entire information model [GIM CCSS Scope], including, but not limited to: required elements, optional elements, element extensions, multiple instances, specified vocabularies, open vocabularies.

The Publishing Organization or Publishing Agent SHALL provide a mechanism for the Statement Originator to indicate that a statement is to be deleted.

The Publishing Agent SHALL provide a mechanism to delete a statement from the statement data store.

The Publishing Agent MAY delete a statement from the statement data store by permanently deleting it from persistent storage.

The Publishing Agent MAY delete a statement from the statement data store by marking it as being deleted and excluding it from user access results.

The Publishing Agent MAY provide the capability to purge deleted statements from the statement data store.

The Publishing Organization or Publishing Agent SHALL provide a mechanism for the Statement Originator to indicate that the status of a statement is to be changed.

The Publishing Agent SHALL provide a mechanism to change the status of a statement in the statement data store.

The Publishing Agent SHALL provide a mechanism to add a new version of a statement.

The Publishing Agent SHALL provide a mechanism to update a statement.

The Publishing Agent SHALL treat an update to any values except metadata as a new version of a statement.

The Publishing Agent SHALL treat an update to the provenance metadata of the source statement or the provenance metadata of the digital representation as an update to the digital representation.

The Publishing Agent SHALL NOT treat an update to the provenance metadata of the source statement or the metadata of the digital representation as a new version of the statement.

The Publishing Agent SHALL create a version number for every version of a statement if the version number is not provided by the Statement Originator.

The Publishing Agent SHALL record the version number for a statement in the provenance metadata.

Publishing Agent SHALL treat a new version of a statement as a new item to be stored in the statement data store.

The Publishing Agent SHALL create a relationship between the new version and the current version of the statement if the version relationship is not provided by the Statement Originator.

The Publishing Organization's Service Agreement SHOULD include agreement to the Publishing Organization's Terms of Service.

If the Publishing Agent submits statements to the Learning Registry, the Publishing Organization's Service Agreement SHALL include agreement to the Learning Registry's Terms of Service.

If the Publishing Agent submits statements to the Learning Registry, the Publishing Organization's Service Agreement MAY require that the Statement Originator provide a public-private key-pair that the Publishing Agent can use to sign submissions to the Learning Registry as the proxy for the Statement Originator.

*To Do:* Verify that the storage model and access API provide sufficient information to walk the tree – go from statement to parent/child, new version to old, across other relationship, including being able to pull the entire path when there are incremental state changes or version updates within the path.

*To Do:* Verify if there is a need for any other identifier requirements.

## Statement Access Requirements

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*Requirements for accessing statements from the Publishing Agent on the Internet.*

The Publishing Organization SHALL provide open access to all published statements through the Internet.

The Publishing Agent SHALL NOT require any access credentials to access the published statements, including, but not limited to: passwords, API keys.

The Publishing Agent SHALL provide a RESTful API that conforms to all required features the API Specification [GIM CCSS API].

The Publishing Agent SHOULD provide a RESTful API that conforms to all features the API Specification [GIM CCSS API].

The Publishing Agent MAY provide an HTTP URI-based access mechanism through the Web Server to access and retrieve a statement given a locator-based statement URI.

If the Publishing Agent provides access through the Web Server, the Publishing Agent SHALL support retrieval of the HTML5 encoding of a statement given a locator-based statement URI requesting HTML results.

If the Publishing Agent provides access through the Web Server, the Publishing Agent SHOULD support retrieval of the JSON serialization of a statement conforming to JSON serialization schemata [GIM CCSS JSON] given a locator-based statement URI requesting the JSON serialization of the statement.

If the Publishing Agent provides access through the Web Server, the Publishing Agent MAY support retrieval of the XML serialization of a statement conforming to XML serialization schemata [GIM CCSS XML] given a locator-based statement URI requesting the XML serialization of the statement.

If the Publishing Agent provides access through the Web Server, the Publishing Agent MAY support retrieval of other serializations of a statement given a locator-based statement URI requesting the specific serialization of the statement.

The Publishing Agent MAY provide a HTTP URI-based query mechanism through the Web Server to access and retrieve a collection of statements conforming to the JSON serialization of a collection [GIM CCSS JSON] that match the query encoded in a URI.

*To Do:* Determine if query should remain or become SHOULD NOT and leave it to LR Index to provide.

*Note:* The URI access requirements would be simplified if there were a full URI-based access specification.

The Publishing Agent MAY provide additional access mechanisms through the Web Server.

If the Publishing Agent provides access through the Web Server, the Publishing Agent SHALL document the provided functionality and publish it through the Publishing Organization support mechanisms.

The Publishing Agent MAY provide a download mechanism that can be used to retrieve an entire standard or some other Publishing Organization-defined collection of statements through a batch transfer protocol.

The Publishing Agent MAY provide a WS\* Web Services API.

The Publishing Agent MAY provide additional APIs.



The Publishing Agent SHOULD NOT provide additional APIs that mirror or duplicate the functionality of the RESTful API.

*To Do:* Verify if there is a need for any identifier resolution services.

## Integration Requirements

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### *Requirements for integration with external systems.*

The Publishing Organization SHALL integrate the Publishing Agent with the Learning Registry.

The Publishing Agent SHALL submit to the Learning Registry a Resource Data Description for each statement the Publishing Agent publishes.

The Publishing Agent SHALL submit a Resource Data Description for the statement with the statement encoded in the payload in JSON.

The Publishing Agent SHALL use the encoding and attribute values specified in the Annex for the statement encoded in the payload in JSON.

The Publishing Agent MAY submit a Resource Data Description for the statement with the statement encoded in the payload in XML.

The Publishing Agent SHALL use the encoding and attribute values specified in the Annex for the statement encoded in the payload in XML.

The Publishing Agent SHOULD NOT submit other Resource Data Descriptions for the statement.

The Publishing Agent MAY submit to the Learning Registry a separate Paradata Assertion describing each relationship in the statement for each statement the Publishing Agent publishes.

If the Publishing Agent submits relationship Paradata Assertions, the Publishing Agent SHALL submit an individual Resource Data Description Paradata Assertion for each relationship in the statement.

The Publishing Agent SHALL use the encoding and attribute values specified in the Annex for a relationship Paradata Assertion.

When a new version of a statement is published by the Publishing Agent, the Publishing Agent SHALL submit to the Learning Registry a Paradata Assertion describing the relationship of the new version of the statement to the prior version of the statement.

The Publishing Agent SHALL use the encoding and attribute values specified in the Annex for a version Paradata Assertion.

When a statement is deleted by the Publishing Agent, the Publishing Agent SHALL submit to the Learning Registry a Paradata Assertion indicating the deletion of the statement.

The Publishing Agent SHALL use the encoding and attribute values specified in the Annex for a deletion Paradata Assertion.

The Publishing Agent MAY submit to the Learning Registry additional paradata Activity objects describing any statement the Publishing Agent publishes.

The Publishing Agent SHALL submit all data to the Learning Registry within 24 hours after the statement is published by the Publishing Agent.

The Publishing Agent SHALL submit all data to the Learning Registry using the Learning Registry Basic Publish Service API [Learning Registry Specification].

The Publishing Agent MAY submit a Resource Data Description for each statement individually.

The Publishing Agent MAY submit multiple Resource Data Descriptions for multiple statements in a batch.

The Publishing Agent SHALL issue an obtain request to the Learning Registry after data has been submitted to verify submission using the Learning Registry Basic Obtain Service API [Learning Registry Specification].

The Publishing Agent SHALL trigger an alert if the submitted Resource Data Description cannot be retrieved.

The Publishing Agent SHALL be capable of submitting a Resource Data Description to multiple nodes in the Learning Registry network.

The Publishing Agent SHOULD maintain a prioritized list of nodes in the Learning Registry to which it will submit Resource Data Description.

The Publishing Agent SHOULD submit the Resource Data Description to the Learning Registry nodes serially, in priority order, until the submission is successful.

The Publishing Agent SHALL trigger an alert if the Resource Data Description cannot be submitted to any node.

For each Statement Originator, the Publishing Agent SHALL store and maintain the private key of the Statement Originator assigned to the Publishing Organization as the Statement Originator proxy.

The Publishing Organization SHALL acquire and maintain one or more key pairs for the Publishing Agent to use in signing Resource Data Descriptions.

The Publishing Agent SHALL store and maintain the private keys of the Publishing Agent used in signing Resource Data Descriptions.

The Publishing Organization SHALL publish the public keys of the key pairs that the Publishing Agent uses in signing Resource Data Descriptions.

The Publishing Organization SHALL publish the public keys of the key pairs that the Publishing Agent uses in signing Resource Data Descriptions in one or more key stores.

The Publishing Organization SHALL publish the public keys of the key pairs that the Publishing Agent uses in signing Resource Data Descriptions through the Publishing Organization support mechanisms.

The Publishing Organization SHOULD sign with its keys the proxy keys of Statement Originators it uses in signing Resource Data Descriptions.

The Publishing Organization MAY integrate the Publishing Agent with other external systems.

## Support Requirements

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### *Requirements for help desk and support.*

The Publishing Organization SHALL provide user help desk and support services.

The Publishing Organization SHALL provide help desk and support services through email.

The Publishing Organization SHALL provide a single dedicated email address for help desk and support services.

The Publishing Organization MAY provide telephone help desk and support services.

If telephone help desk and support services are provided, the Publishing Organization SHALL provide live telephone help desk and support services Monday through Friday, except US Federal Holidays, during the normal business hours of the Publishing Organization.

If telephone help desk and support services are provided, the Publishing Organization SHOULD provide a single dedicated phone number for help desk and support services.

If telephone help desk and support services are provided, the Publishing Organization SHALL provide telephone answering service for help desk and support outside of the normal business hours of the Publishing Organization.

The Publishing Organization SHOULD provide help desk and support services through a moderated, community web forum or discussion group.

The Publishing Organization SHALL acknowledge help desk and support requests within 1 business day.

The Publishing Organization SHALL provide an email distribution list for dissemination of information.

The Publishing Organization SHALL provide help and support information through the Publishing Agent's web site. Information provided SHALL include, but is not limited to: FAQs, documentation, tutorials, sample files.

The Publishing Organization SHALL provide contact or subscription information about all help desk and support services through the Publishing Agent's web site. Information provided SHALL include, but is not limited to: email addresses, discussion forum addresses, mail list subscription procedures, phone numbers, business and support hours.

The Publishing Organization SHALL maintain and use an error tracking/ticket system holding all requests and resolutions for information, help and support requests received through the help desk and support services.

The Publishing Organization SHALL monitor help and service request response and resolution time data.

The Publishing Organization SHALL use service requests and response metrics to develop guidelines and procedures to ensure adequate trained staffing, technical/support information and support services to respond to and resolve requests in a timely manner.

*To Do:* Determine if there should be required/suggested response and resolution times.

## Operating Requirements

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*Requirements for operating the Publishing Agent.*

### Hosting Requirements

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The Publishing Organization SHALL host and operate the Publishing Agent.

The Publishing Organization SHALL deploy and host the Publishing Agent in a hardware/network environment that provides adequate capacity and redundancy to meet the expected capacity and performance requirements.

*To Do: Determine if there should be required/suggested capacity/performance metrics.*

The Publishing Organization SHALL deploy and host the Publishing Agent and all ancillary systems and data within the US.

The Publishing Agent SHALL be available for all users 365 days per year, 24 hours per day, with the exception of scheduled maintenance.

The Publishing Organization SHALL deploy at least one production instance of the Publishing Agent with an annual target uptime of 99.9%. The target uptime excludes any scheduled maintenance procedures.

The Publishing Organization SHALL schedule all Publishing Agent and system maintenance during off peak hours. Peak hours are defined as 06:00 US Eastern through 18:00 US Hawaii (local time), Monday through Friday, excluding US Federal Holidays.

The Publishing Organization SHALL publically announce all planned system maintenance activities (scope, expected duration of outage) at least 14 calendars days before the scheduled maintenance.

The Publishing Organization SHALL host and operate a separate Publishing Agent and ancillary systems solely for the purposes of development and testing.

The Publishing Agent test instance SHALL be integrated with the Learning Registry sandbox network.

The Publishing Agent test instance SHALL NOT be integrated with the Learning Registry production network.

The Publishing Organization SHALL monitor Publishing Agent performance including, but not limited to: uptime, system load, capacity/headroom, outage response time, system restore time.

The Publishing Organization SHALL use Publishing Agent performance metrics to develop guidelines and ensure adequate capacity and operating procedures.

*To Do: Determine if there should be required/suggested performance metrics.*

### Backup Requirements

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The Publishing Organization SHALL establish, implement and test backup and restore procedures.

The Publishing Organization SHALL establish, implement and test disaster management and disaster recovery procedures.

The Publishing Organization SHALL perform periodic backups of all essential information, including, but not limited to: application software, data and databases, procedures, configurations files, documents.

Backup information SHALL be sufficient to completely restore the Publishing Agent, all ancillary systems and all data on a hardware platform (or platforms) that has not been configured to run the Publishing Agent.

The Publishing Organization SHALL perform periodic backups at a frequency such that no more than 24 hours of submission data is lost in a failure of the Publishing Agent.

The Publishing Organization MAY perform backups through any combination of incremental and full backups.

The Publishing Organization SHALL all maintain at least 1 copy of the backup information at a secure off-site US location.

The off-site backup information SHALL be sufficient to completely restore the Publishing Agent, all ancillary systems and all data on a hardware platform (or platforms) that has not been configured to run the Publishing Agent. Restoration SHALL be deemed acceptable if the restored system passes the normal system *upgrade* tests.

The Publishing Organization SHALL perform a periodic test of the full backup and restoration procedures of the complete Publishing Agent.

The Publishing Organization SHALL perform a complete test install/restore of the Publishing Agent, all ancillary systems and all data on a hardware platform (or platforms) that has not been configured to run the Publishing Agent. Restoration SHALL be deemed acceptable if the restored system passes the normal system *upgrade* tests.

The Publishing Organization SHALL perform a periodic test of the full backup and restoration procedures of the complete Publishing Agent within 10 working days of any major system upgrade, including, but not limited to: hardware upgrade, software upgrade (application or system), network/connectivity upgrade.

The Publishing Organization SHOULD perform a periodic test of the full backup and restoration procedures at least annually.

The Publishing Organization SHALL develop and apply guidelines that ensure adequate and timely recovery and restoration from failures.

*To Do:* Determine if there should be required/suggested restore metrics.

## Monitoring and Logging Requirements

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The Publishing Organization SHALL establish and implement monitoring, logging and alerting procedures.

The Publishing Organization SHALL monitor the Publishing Agent operations and alert staff of potential issues and anomalies, including, but not limited to: hardware failures, networks outages, service and applications outages, bandwidth usage, security violations.

The Publishing Organization SHALL alert management staff of alerts via email or SMS.

The Publishing Organization SHALL provide proactive monitoring of all network activities.

The Publishing Organization SHALL provide proactive blocking of all suspicious activities.

The Publishing Organization SHALL provide proactive monitoring of CERT and other security alerts to identify known security holes.

The Publishing Organization SHALL address all known security holes in a timely manner.

*To Do:* Determine if there should be required/suggested response times.

The Publishing Agent SHALL maintain normal web logs solely for operations and management.

The Publishing Agent SHALL NOT track user activity, including, but not limited to: web tracking bugs, browser cookies (except as essential to provide REQUIRED functionality).

The Publishing Organization SHALL develop and implement a procedure to purge web logs on a regular basis.

The Publishing Organization SHALL publish their data privacy and data retention policies through the Publishing Organization support mechanisms.

## Deployment Schedule Requirements

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The Publishing Organization SHALL develop, test and deploy the Publishing Agent in a timely fashion.

The Publishing Organization SHALL have the Publishing Agent deployed for internal testing NLT YYYY-MM-DD.

The Publishing Organization SHALL have the Publishing Agent deployed for public testing NLT YYYY-MM-DD.

The Publishing Organization SHALL have the Publishing Agent and all ancillary systems fully deployed and operational NTL YYYY-MM-DD.

## Security Requirements

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### *Requirements for secure data access and storage.*

The Publishing Organization SHALL provide a secure system.

The Publishing Organization SHALL review and adjust the security settings of all software components as part of installation and configuration to establish the highest level of security possible.

The Publishing Organization SHALL NOT use default passwords.

The Publishing Organization SHALL NOT use default security configurations without review.

The Publishing Organization SHALL provide secure storage for all confidential data, including, but not limited to: user data, passwords, private keys, digital certificates.

The Publishing Organization SHALL secure all network connections, including, but not limited to: blocking of unused/unneeded ports and protocols.

The Publishing Organization SHALL use strong authentication controls for all access to confidential data, including, but not limited to: use of multi-part authentication, one time credentials, configurable policies and controls on passwords and credentials.

The Publishing Organization SHALL establish and implement administration and management workflow rules and policies for access to confidential data, including, but not limited to: controls on when operations are permitted, REQUIRED prerequisite checks.

The Publishing Organization SHALL establish and implement multiple authorization roles and data factoring to limit access to confidential data.

The Publishing Organization SHALL store confidential data in encrypted form, including, but not limited to: passwords, user credentials.

The Publishing Organization SHALL maintain secure access and access controls for all physical infrastructure holding confidential data, including, but not limited to: servers and backend systems, client devices, offices and filing systems.

The Publishing Organization SHALL perform regular security audits, including, but not limited to: physical infrastructure, operating systems, Publishing Agent, ancillary systems, data.

The Publishing Organization SHALL develop and adopt guidelines that ensure adequate security of the Publishing Agent, ancillary systems and data.



## Testing Requirements

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### *Requirements for testing the Publishing Agent.*

The Publishing Organization SHALL test the Publishing Agent and ancillary systems.

The Publishing Organization SHALL develop and implement a test plan for the Publishing Agent, including but not limited to: end-to-end testing for all critical workflows, component testing, regression testing, interoperability testing, accessibility/user interface testing, integration testing with the Learning Registry, deployment testing, recovery testing, data integrity testing.

The Publishing Organization SHALL develop sufficient sample/test data to exercise the complete test plan.

The Publishing Organization SHALL test the Publishing Agent and all ancillary software before deploying the operational system.

The Publishing Organization SHALL deploy an independent instance of the Publishing Agent for testing that is disconnected from the production instance.

The Publishing Organization MAY deploy an independent test instance of the Publishing Agent on an as-needed basis.

The Publishing Organization SHALL fully test all changes, upgrades and modifications to the Publishing Agent and all ancillary software and systems on the test instance before deploying changes to the production instance.

The Publishing Organization SHALL NOT deploy to the production instance any changes, upgrades or modifications to the Publishing Agent and any ancillary software that have not been tested on the test instance.

The Publishing Organization SHALL NOT deploy to the production instance any changes, upgrades or modifications to the Publishing Agent and any ancillary software that fail testing on the test instance.

## Legal Requirements

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*Requirements for regulatory compliance.*

The Publishing Organization SHALL comply with regulatory compliance and legal regulations.

The Publishing Organization SHALL comply with all applicable Federal and State regulations, including, but not limited to: user tracking, privacy, data breach reporting, Digital Millennium Copyright Act (DMCA) takedown notices and Online Copyright Infringement Liability Limitation Act (OCILLA) safe harbor provisions.

The Publishing Organization SHALL provide and implement a publicly documented procedure for managing DMCA takedown notices for published statements that are claimed to violate copyright.

The Publishing Organization SHALL develop a response plan for data breaches.

## Intellectual Property Requirements

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*Requirements for licenses, rights and intellectual property.*

### Data Rights Requirements

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The Publishing Organization SHALL manage licenses and rights for standards statements.

The Publishing Organization SHALL conform to all license and intellectual property statements provided by the Statement Originator for any source standards statement submitted for publication.

The Publishing Organization SHALL NOT claim ownership or assert intellectual property rights to any standards statement or other data published through the Publishing Agent, except when the Publishing Organization is the Statement Originator.

The Publishing Organization SHALL NOT claim *sui generis* rights to any data collection, database, or data compilation available through the Publishing Agent or held in its data store, including, by not limited to: collections of standards statements, identifier data.

The Publishing Organization SHALL only use submitted statements for the purposes of the development, operations, 3<sup>rd</sup> party integration and testing of the Publishing Agent.

### Document and Code Rights Requirements

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The Publishing Organization SHALL license and distribute all material it develops using open access and open source licenses.

The Publishing Organization SHALL license its encoded digital representation of a standards statement using an Open Access license.

The Publishing Organization SHOULD license the digital representation of a standards statement under the Creative Commons Attribution 3.0 Unported: CC-BY-3.0 license (or subsequent versions), or the CC0 Public Domain Declaration.

The Publishing Organization SHALL NOT use a proprietary license for the digital representation of a standards statement.

*To Do:* Determine if this should be a specific required license. For 3<sup>rd</sup> parties, there could be a policy that allows them to pick the license, or they could have to go to a different PO.

The Publishing Organization SHALL license all software development and documentation material needed to operate the Publishing Agent using an Open Access license, including, but not limited to: specifications, documents and procedures, including all source assets.

The Publishing Organization SHOULD license software development and documentation material under the Creative Commons Attribution 3.0 Unported: CC-BY-3.0 license (or subsequent versions), or the CC0 Public Domain Declaration.

The Publishing Organization SHALL NOT use a proprietary license for software development and documentation material.

*To Do:* Determine if this should be a specific required license.

The Publishing Organization SHALL license any software products developed to operate and support the Publishing Agent and any ancillary software using an approved OSI open source license.

The Publishing Organization SHOULD license developed software under the Apache 2.0 license (or subsequent versions).

The Publishing Organization SHALL NOT assert any patent rights on any software products developed to operate and support the Publishing Agent.

The Publishing Organization SHALL distribute all software products developed to operate and support the Publishing Agent and any ancillary systems.

The Publishing Organization SHOULD distribute all software products developed to operate and support the Publishing Agent and any ancillary systems through an open source repository.

## Governance Requirements

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*Requirements for governance and operations of the Publishing Organization.*

The Publishing Organization SHALL establish and implement a governance procedure for the long-term operations, support and sustainment of the Publishing Agent.

The Publishing Organization SHOULD establish and implement a configuration/change control board for managing Publishing Agent evolution.

The Publishing Organization SHOULD include user community stakeholders in the configuration/change control board.

The Publishing Organization SHOULD publically disseminate the outcomes of the configuration/change control board.

The Publishing Organization MAY operate the configuration/change control board as a community-driven activity.

The Publishing Organization SHOULD establish and implement a release management process for updating components of the Publishing Agent.

The Publishing Organization SHOULD include user community stakeholders in the release management decision-making process.

The Publishing Organization SHOULD publically disseminate the outcomes of the release management decision-making process.

The Publishing Organization MAY operate the release management decision-making process as a community-driven activity.

The Publishing Organization SHALL produce and maintain complete technical documentation describing the Publishing Organization and Publishing Agent operations and management, including, but not limited to: development, hosting, deployment, operations, support, security, management, testing.

The Publishing Organization SHOULD distribute the complete technical documentation describing the Publishing Organization and Publishing Agent operations and management, including, but not limited to: development, hosting, deployment, operations, support, security, management, testing.

## Design Decisions

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*Note:* This section is informative.

*Discussion of choices and rationale for the requirements, design and operations of the Publishing Agent and Publishing Organization.*

Learning standards statements from a Statement Originator need to be encoded in the digital representation, stored, and accessible. This yields the core technical requirements that govern the conceptual design.

The solution is part of a larger ad hoc ecosystem of education technology components and systems. There are implicit expectations that it integrates with these other components and it provides a reliable core educational technology service to a broad community of diverse users.

In support of a diverse ecosystem, the solution permits multiple Publishing Agents, and uses the Learning Registry and Learning Registry Index to provide integration and discovery.

As a core educational technology service, the solution needs to be a managed, sustainable system. The Publishing Agent as the technology part of the solution is placed within the Publishing Organization as the managing, sustaining entity.

Being a core service yields operational and management requirements for security (data, infrastructure), hosting, monitoring, backup/restoration, disaster management, operations, user support, etc. These are augmented by requirements that the solution should be available, stable and tested. All management and operations should meet industry standard practices. Developing, documenting and following industry standard procedures improves management and operations, but the target solutions should be as lightweight as possible to meet expected use.

Being a sustained core service also yields expectations for ongoing operations, support and maintenance that are met in part through adopting technical governance procedures.

The solution needs to accommodate current and future use cases and users. Thus the design supports the full technical model and APIs. The design is modular to encourage component reuse, ease of modification and future extensions. Additionally, the design favors proven, modern and forward-facing Internet technologies and data representations, e.g., REST, JSON.

The solution needs to support common interoperability, exchange and data representation standards.

Access to statements is via the Internet using standard technologies. Thus the solution interfaces need to accommodate universal design principles, with minimal technical constraints, to support a wide range of users.

The solution needs to acknowledge and support key IP and regulatory requirements to avoid potential legal issues.

There are community expectations of open access to data and systems. All data must be open and declared so. The design favors open source solutions, open standards and technologies. Note, open sources does not imply “free”; cost-effective commercial supported product versions are encouraged.

There are community expectations that the development processes, operations and management are transparent.

*To Do:* Add any specific design decisions. Possibly split section into two subcategories (general, specific).

## Glossary

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*Association Data:* *Association data* presents the association between the *name* and the *thing* identified in an *identifier*. [PILIN]

*Context:* A *context* differentiates *labels* used for distinct purposes and with different authorities. The combination of a *label* and a *context* for the label gives a *name*, and the same label can be used in different contexts to give different names; any label is necessarily *unique* in its context. Contexts impose *policies*. Contexts may be identified by one or more *context identifiers*. The identifier for a context has a name in a context of context identifiers. There is a defined context instance of “known naming systems”, preventing infinite recursion of contexts. [PILIN]

*Data Store:* A *data store* is a tool for the storage and management of data. The data store exposes services allowing access to that data by other parties. [PILIN]

*Digital Representation:* The *digital representation* is the digital form of a *standards statement*, including both *provenance metadata* and the description of all other characteristics of the statement.

*Granular Identifier:* This concept does not exist within the technical approach. All identifiers are equal; none is more or less granular than any other.

*Granular Statement:* A *standards statement* derived from the decomposition of an existing standards statement to identify existing concepts within the statement for the purpose of aligning learning resources and assessment items to part of a statement.

*Identifier:* An identifier is the association of a *name* with a *thing*. A name may only be associated with one thing at any time, and the name is said to *identify* the thing. [PILIN]

*Identifier Management System:* An *identifier management system* is a collection of definitions, *information models*, *policies*, and *data stores*, used to manage *identifiers*. An identifier management system has a defined operating scope, and an *authority* acting as its owner. [PILIN]

*Identify:* A *thing* is *identified* by a *name* if the name and the thing together form an *identifier*. The name is associated with the thing identified, although that is not the only form of association possible in an *identifier management system*. [PILIN]

*Information Model:* An *information model* is a model of *things* in a domain, their properties, and the relations between them. The choice of what things to *identify* in an *identifier management system* is informed by an information model. [PILIN]

*Label:* A *label* is a symbol that can potentially be used as a *name*. In an *identifier management system*, labels are typically strings. [PILIN]

*Locator:* A locator is a string giving the location of a digital object in a *data store*, and can be used as a retrieval key to gain access to the object. A URL is an example of a locator, although not all http: URIs are locators. A locator is specific to a *data store*, and cannot be used to access an instance of the digital object in a different *data store*. A locator can be used as an *identifier*; but it will usually not be *persistent*. Persistent identifiers often *resolve* to the current locator(s) of the *thing identified*. This uncouples the persistent identification of a resource from the current retrieval key for the resource. [PILIN]

*Metadata:* *Metadata* is the descriptive cataloging and provenance information about a *standards statement*. The type of information is not unique to a standards statement.

*Name:* A *name* is the association of a *label* with a *context*. [PILIN]

*Opaque*: An *identifier* is *opaque* if there is a direct relationship between the *name* and a relevant fact about the *thing identified*, but the relationship cannot be inferred by inspection. [PILIN]

*Persistent*: A component is *persistent* if it is managed and maintained for a defined timespan. Normally when an identifier is called persistent, persistence of association is meant. [PILIN]

*Publish*: *Publishing* is the process of making the digital representation of a *standards statement* available on the Internet for others to use.

*Publishing Agent*: The *Publishing Agent* is the deployed computing environment used to *publish* standards statements.

*Publishing Organization*: The *Publishing Organization* is the organization or entity that operates the *Publishing Agent*.

*Provenance*: *Provenance* is the history of how a thing has been managed over time. Data documenting the provenance of a digital object are part of the metadata for that object. [PILIN]

*Provenance Metadata*: See *Metadata*. Provenance metadata is used in the project documents to identify a subset of information about a *standards statement*, since its entire description could be considered metadata.

*Resolve*: An identifier is *resolved* by providing information on how to access the *thing* it identifies. This information is the *resolution* of the identifier. An identifier is Internet-Resolvable if the information on how to access the thing identified can be requested and consumed through a well-defined Internet application protocol, and Web-Resolvable if that protocol is a defined web application layer protocol. Resolution in general operates on *association data*, stored, managed and maintained with the identifier in an *identifier management system*. [PILIN]

*Source Statement*: An original *standards statement*, in natural language form.

*Standards Statement*: The narrative statement for a single educational standard that defines “what students should understand and be able to do.” Within CCSS, a standards statement or the components of a standards statement are the most granular statements.

*Statement*: See *Standards Statement*.

*Statement Originator*: The *Statement Originator* is the organization or entity responsible for the development of a *standards statement*. Statement originators include CCSSO, SETDA and states.

*Thing*: A *thing* is what anything that can be talked about is; in particular, it includes whatever can be *identified* with an *identifier*. [PILIN]

*Transparent*: An *identifier* is semantically *transparent* if there is a direct relationship between the *name* and a relevant fact about the *thing identified*, and the relationship can be inferred by inspection. [PILIN]

*Unique*: A component is *unique* if there exists one and only one instance of the component within a given scope. [PILIN]

*Note*: Some terms come from the PILIN Glossary, as noted. Some PILIN definitions have been simplified. Words in italics in a gloss are defined elsewhere in the glossary.



## Normative References

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For dated references, only the edition cited applies. For undated references, the most recent edition applies.

- [Apache] *Apache License, Version 2.0*  
[<http://opensource.org/licenses/Apache-2.0>]
- [CC0] *Creative Commons CC0 1.0 Universal (CC0 1.0) Public Domain Dedication*  
[<http://creativecommons.org/publicdomain/zero/1.0/>]
- [CC-BY] *Creative Commons Attribution 3.0 Unported License (CC BY 3.0)*  
[<http://creativecommons.org/licenses/by/3.0/>]
- [CCSSO XML] *Common Core State Standards Official Identifiers and XML Representation*  
[<http://www.corestandards.org/common-core-state-standards-official-identifiers-and-xml-representation>]
- [CEDS 3.0] *Common Educational Data Standards, CEDS Elements, Version 3 (Draft)*  
[<https://ceds.ed.gov/elements.aspx?v=3&ex=%28Draft%29>]
- [DC] *DCMI Specifications, Dublin Core Metadata Initiative*  
[<http://dublincore.org/specifications/>]
- [DC ED] *DC-Education Application Profile, Dublin Core Metadata Initiative*  
[[http://dublincore.org/educationwiki/DC\\_2dEducation\\_20Application\\_20Profile](http://dublincore.org/educationwiki/DC_2dEducation_20Application_20Profile)]
- [ECMA 262] *ECMAScript Language Specification*  
[<http://www.ecma-international.org/publications/standards/Ecma-262.htm>]
- [GIM CCSS API] *Learning Standards Digital Representation Specification: RESTful API*
- [GIM CCSS JSON] *Learning Standards Digital Representation Specification: JSON Serialization Schemata*
- [GIM CCSS Scope] *Scope, Technical Requirements, Approaches, and Recommendations*
- [GIM CCSS XML] *Learning Standards Digital Representation Specification: XML Serialization Schemata*
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*W3C Candidate Recommendation*, December 2012  
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July 2006  
[<http://tools.ietf.org/html/rfc4627>]
- [Learning Registry Specification] *Learning Registry Technical Specification*  
[[https://docs.google.com/document/d/1zD0PUvQB0g-JpdbcioDL7WZByGtP79jbf0OoyQLISDM/edit?hl=en\\_US](https://docs.google.com/document/d/1zD0PUvQB0g-JpdbcioDL7WZByGtP79jbf0OoyQLISDM/edit?hl=en_US)]
- [Learning Registry Paradata] *Learning Registry Paradata Specification*  
[[https://docs.google.com/document/d/1IrOYXd3S0FUwNozaEG5tM7Ki4\\_AZPrBn-pbyVUz-Bh0/edit](https://docs.google.com/document/d/1IrOYXd3S0FUwNozaEG5tM7Ki4_AZPrBn-pbyVUz-Bh0/edit)]
- [Learning Registry TOS] *Learning Registry Terms of Service*

[LRMI] *Learning Resource Metadata Initiative, The Specification*  
[<http://www.lrmi.net/the-specification>]

[PILIN] *PILIN Ontology for Identifiers and Identifier Services*  
[<http://resolver.net.au/hdl/102.100.272/G9JR4TLQH>]

[PILIN Glossary] *PILIN Glossary*  
[<http://resolver.net.au/hdl/102.100.272/HHYMV8JQH>]

[RFC 2119] Bradner, S., “Key words for use in RFCs to Indicate Requirement Levels”, IETF RFC 2119, March 1997  
[<http://tools.ietf.org/html/rfc2119>]

[Schema] *Schema.org*  
[<http://schema.org/>]

[SNMP] Case, J., “Introduction and Applicability Statements for Internet Standard Management Framework”, IETF RFC 3410, December 2002  
[<http://tools.ietf.org/html/rfc3410>]

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[<http://tools.ietf.org/html/rfc6101>]

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[<http://www.w3.org/TR/xml11/>]

[XSD 1] Thompson, H., et al., “XML Schema Definition Language (XSD) 1.1 Part 1: Structures”, *W3C Recommendation*, April 2012  
[<http://www.w3.org/TR/xmlschema11-1/>]

[XSD 2] Peterson, D., et al., “XML Schema Definition Language (XSD) 1.1 Part 2: Data Types”, *W3C Recommendation*, April 2012  
[<http://www.w3.org/TR/xmlschema11-2/>]

## Informative References

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*Note:* This section is informative.

[OSI] *Open Source Licenses*, Open Source Initiative.  
[<http://opensource.org/licenses/index.html>]

[REST] Representational State Transfer (REST).  
[<http://en.wikipedia.org/wiki/REST>]

*To Do:* Review if any others are needed.

## GIM CCSS Project Documentation

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*Note:* This section is informative.

*Scope, Technical Requirements, Approaches, and Recommendations*

*Learning Standards Digital Representation Specification: JSON Serialization Schemata*

*Learning Standards Digital Representation Specification: XML Serialization Schemata*

*Learning Standards Digital Representation Specification: RESTful API*

*Learning Standards Digital Representation Specification: Publishing Agent Design and Requirements [this document]*

## Annex: Learning Registry Resource Data Description Document Requirements

*Requirements for representing and encoding statements and statement data in Learning Registry Resource Data Description Documents,*

### JSON Payload Statement Encoding Requirements

The Publishing Agent SHALL use the following attributes and attribute values for a Resource Data Description for a statement with the statement encoded in payload in JSON:

- The "doc\_type" attribute value SHALL be "resource\_data"
- The "doc\_version" attribute value SHALL be the current version of the Resource Data Description model [Learning Registry Specification]
- The "doc\_ID" attribute SHALL be omitted
- The "resource\_data\_type" attribute value SHALL be "learning standards statement"
- The "identity" "submitter\_type" attribute value SHALL be "agent"
- The "identity" "submitter" attribute value SHALL be the identity of the Publishing Organization
- The "identity" "curator" attribute value SHALL be the identity of the Publishing Organization
- The "identity" "owner" attribute value SHALL be the identity of the Statement Originator
- The "identity" "signer" attribute value SHALL be the identity of the Statement Originator
- The "TOS" "submission\_TOS" attribute value SHALL be the URL of the current version of the Learning Registry Terms of Service [Learning Registry TOS]
- The "TOS" "submission\_attribution" attribute SHALL be omitted
- The "digital\_signature" "signature" attribute value SHALL be the computed digital signature of the Resource Data Description [Learning Registry Specification]
- If the Publishing Agent holds the private key of the Statement Originator, the Resource Data Description SHALL be signed with the private key of the Statement Originator assigned to the Publishing Organization as the Statement Originator proxy
- If the Publishing Agent does not hold the private key of the Statement Originator, the Resource Data Description SHALL be signed with the private key of Publishing Organization
- If the Resource Data Description is signed using the proxy key from the Statement Originator, the "digital\_signature" "key\_location" attribute value SHALL be an array of public key location(s) for the public key of the Statement Originator that is used to sign the Resource Data Description
- If the Resource Data Description is signed using the key from the Publishing Organization, the "digital\_signature" "key\_location" attribute value SHALL be an array of public key location(s) for the public key of the Publishing Organization that is used to sign the Resource Data Description
- The "digital\_signature" "signing\_method" attribute value SHALL be "LR-PGP.1.0"
- The "resource\_locator" attribute value SHALL be one of the Web-resolvable identifiers homed or assigned to the statement by the Publishing Agent
- The "keys" attribute value SHALL be the array of taxon path classifiers for the statement
- The "resource\_TTL" attribute SHALL be omitted
- The "payload\_placement" attribute value SHALL be "inline"
- The "payload\_schema" attribute value SHALL be TBD
- The "payload\_schema\_locator" attribute value SHALL be the URL (TBD) of the JSON schemata for learning standards statements [GIM CCSS JSON]
- The "payload\_schema\_format" attribute value SHALL be "application/vnd.learningregistry.standardstatement+json"
- The "payload\_locator" attribute SHALL be omitted
- The "resource\_data" attribute value SHALL be the JSON serialization of the complete standards statement
- The "resource\_data" JSON serialization SHALL conform to learning standards statements JSON serialization [GIM CCSS JSON]

- Resource Data Description extension attributes SHALL NOT be included
- All other Resource Data Description attributes SHOULD NOT be included

*To Do:* Assign the Learning Registry "payload\_schema"

*To Do:* Assign the JSON schemata for learning standards statements as the "payload\_locator\_schema"

## XML Payload Statement Encoding Requirements

The Publishing Agent SHALL use the following attributes and attribute values for a Resource Data Description for a statement with the statement encoded in payload in XML:

- The "doc\_type" attribute value SHALL be "resource\_data"
- The "doc\_version" attribute value SHALL be the current version of the Resource Data Description model [Learning Registry Specification]
- The "doc\_ID" attribute SHALL be omitted
- The "resource\_data\_type" attribute value SHALL be "learning standards statement"
- The "identity" "submitter\_type" attribute value SHALL be "agent"
- The "identity" "submitter" attribute value SHALL be the identity of the Publishing Organization
- The "identity" "curator" attribute value SHALL be the identity of the Publishing Organization
- If the relationship was created by the Statement Originator, the "identity" "owner" attribute value SHALL be the identity of the Statement Originator
- If the relationship was created by the Publishing Organization, the "identity" "owner" attribute value SHALL be the identity of the Publishing Organization
- If the relationship was created by the Statement Originator, the "identity" "signer" attribute value SHALL be the identity of the Statement Originator
- If the relationship was created by the Publishing Organization, the "identity" "signer" attribute value SHALL be the identity of the Publishing Organization
- The "TOS" "submission\_TOS" attribute value SHALL be the URL of the current version of the Learning Registry Terms of Service [Learning Registry TOS]
- The "TOS" "submission\_attribution" attribute SHALL be omitted
- The "digital\_signature" "signature" attribute value SHALL be the computed digital signature of the Resource Data Description [Learning Registry Specification]
- If the Publishing Agent holds the private key of the Statement Originator, the Resource Data Description SHALL be signed with the private key of the Statement Originator assigned to the Publishing Organization as the Statement Originator proxy
- If the Publishing Agent does not hold the private key of the Statement Originator, the Resource Data Description SHALL be signed with the private key of Publishing Organization
- If the Resource Data Description is signed using the proxy key from the Statement Originator, the "digital\_signature" "key\_location" attribute value SHALL be an array of public key location(s) for the public key of the Statement Originator that is used to sign the Resource Data Description
- If the Resource Data Description is signed using the key from the Publishing Organization, the "digital\_signature" "key\_location" attribute value SHALL be an array of public key location(s) for the public key of the Publishing Organization that is used to sign the Resource Data Description
- The "digital\_signature" "signing\_method" attribute value SHALL be "LR-PGP.1.0"
- The "resource\_locator" attribute value SHALL be one of the Web-resolvable identifiers homed or assigned to the statement by the Publishing Agent
- The "keys" attribute value SHALL be the array of taxon path classifiers for the statement
- The "resource\_TTL" attribute SHALL be omitted
- The "payload\_placement" attribute value SHALL be "inline"
- The "payload\_schema" attribute value SHALL be TBD

- The "payload\_schema\_locator" attribute value SHALL be the URL (TBD) of the XML schemata for learning standards statements [GIM CCSS XML]
- The "payload\_schema\_format" attribute value SHALL be "application/vnd.learningregistry.standardstatement+xml"
- The "payload\_locator" attribute SHALL be omitted
- The "resource\_data" attribute value SHALL be the XML serialization of the complete standards statement
- The "resource\_data" XML serialization value SHALL conform to learning standards statements XML serialization [GIM CCSS XML]
- Resource Data Description extension attributes SHALL NOT be included
- All other Resource Data Description attributes SHOULD NOT be included

*To Do:* Assign the Learning Registry "payload\_schema"

*To Do:* Assign the XML schemata for learning standards statements as the "payload\_locator\_schema"

## Relationship Paradata Assertion Encoding Requirements

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The Publishing Agent SHALL use the following attributes and attribute values for a Resource Data Description for a relationship Paradata Assertion:

- The "doc\_type" attribute value SHALL be "resource\_data"
- The "doc\_version" attribute value SHALL be the current version of the Resource Data Description model [Learning Registry Specification]
- The "doc\_ID" attribute SHALL be omitted
- The "resource\_data\_type" attribute value SHALL be "paradata"
- The "identity" "submitter\_type" attribute value SHALL be "agent"
- The "identity" "submitter" attribute value SHALL be the identity of the Publishing Organization
- The "identity" "curator" attribute value SHALL be the identity of the Publishing Organization
- If the relationship was created by the Statement Originator, the "identity" "owner" attribute value SHALL be the identity of the Statement Originator
- If the relationship was created by the Publishing Organization, the "identity" "owner" attribute value SHALL be the identity of the Publishing Organization
- If the relationship was created by the Statement Originator, the "identity" "signer" attribute value SHALL be the identity of the Statement Originator
- If the relationship was created by the Publishing Organization, the "identity" "signer" attribute value SHALL be the identity of the Publishing Organization
- The "TOS" "submission\_TOS" attribute value SHALL be the URL of the current version of the Learning Registry Terms of Service [Learning Registry TOS]
- The "TOS" "submission\_attribution" attribute SHALL be omitted
- The "digital\_signature" "signature" attribute value SHALL be the computed digital signature of the Resource Data Description [Learning Registry Specification]
- If the relationship was created by the Statement Originator and the Publishing Agent holds the private key of the Statement Originator, the Resource Data Description SHALL be signed with the private key of the Statement Originator assigned to the Publishing Organization as the Statement Originator proxy
- If the relationship was created by the Statement Originator and the Publishing Agent does not hold the private key of the Statement Originator, the Resource Data Description SHALL be signed with the private key of Publishing Organization
- If the relationship was created by the Publishing Organization, the Resource Data Description SHALL be signed with the private key of the Publishing Organization
- If the relationship was created by the Statement Originator and the Resource Data Description is signed using the proxy key from the Statement Originator, the "digital\_signature" "key\_location" attribute value

SHALL be an array of public key location(s) for the public key of the Statement Originator that is used to sign the Resource Data Description

- If the relationship was created by the Statement Originator and the Resource Data Description is signed using the key from the Publishing Organization, the "digital\_signature" "key\_location" attribute value SHALL be an array of public key location(s) for the public key of the Publishing Organization that is used to sign the Resource Data Description
- If the relationship was created by the Publishing Organization, the "digital\_signature" "key\_location" attribute value SHALL be an array of public key location(s) for the public key of the Publishing Organization that is used to sign the Resource Data Description
- The "digital\_signature" "signing\_method" attribute value SHALL be "LR-PGP.1.0"
- The "resource\_locator" attribute value SHALL be one of the Web-resolvable identifiers homed or assigned to the statement by the Publishing Agent
- The "keys" attribute SHALL be omitted
- The "resource\_TTL" attribute SHALL be omitted
- The "payload\_placement" attribute value SHALL be "inline"
- The "payload\_schema" attribute value SHALL be TBD
- The "payload\_schema\_locator" attribute value SHALL be the URL (TBD) of the JSON schemata for Learning Registry Paradata [Learning Registry Paradata]
- The "payload\_schema\_format" attribute value SHALL be "application/vnd.learningregistry.paradata+json"
- The "payload\_locator" attribute SHALL be omitted
- The "resource\_data" attribute value SHALL be the JSON serialization of the paradata assertion
- The "resource\_data" JSON serialization SHALL conform to the Learning Registry Paradata Specification [Learning Registry Paradata]
- For the "resource\_data" the Publishing Agent SHALL submit a paradata "activity" object with the following attribute values:
  - The "actor" attribute MAY be omitted
  - If the "actor" attribute is present and the relationship was created by the Statement Originator, the "actor" attribute value SHALL be the identity of the Statement Originator
  - If the "actor" attribute is present and the relationship was created by the Publishing Agent, the "actor" attribute value SHALL be the identity of the Publishing Organization
  - Other "actor" attributes SHOULD be omitted
  - The "verb" attribute value SHALL be the value of the "relationType" attribute from the "relationship" attribute in the statement
  - Other "verb" attributes SHOULD be omitted
  - The "object" attribute value SHALL be the value of "resource\_locator"
  - Other "object" attributes SHOULD be omitted
  - The "related" attribute value SHALL be an array with the value of the "relatedStatement" attribute in the statement
  - Other "related" attributes SHOULD be omitted
  - "activity" extension attributes SHALL NOT be included
  - Other "activity" attributes MAY be omitted
- Resource Data Description extension attributes SHALL NOT be included
- All other Resource Data Description attributes SHOULD NOT be included

*To Do:* Assign the Learning Registry "payload\_schema"

*To Do:* Assign the JSON schemata for learning standards statements as the "payload\_locator\_schema"



## Version Paradata Assertion Encoding Requirements

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The Publishing Agent SHALL use the following attributes and attribute values for a Resource Data Description for a version Paradata Assertion:

- The "doc\_type" attribute value SHALL be "resource\_data"
- The "doc\_version" attribute value SHALL be the current version of the Resource Data Description model [Learning Registry Specification]
- The "doc\_ID" attribute SHALL be omitted
- The "resource\_data\_type" attribute value SHALL be "paradata"
- The "identity" "submitter\_type" attribute value SHALL be "agent"
- The "identity" "submitter" attribute value SHALL be the identity of the Publishing Organization
- The "identity" "curator" attribute value SHALL be the identity of the Publishing Organization
- If the version was created by the Statement Originator, the "identity" "owner" attribute value SHALL be the identity of the Statement Originator
- If the version was created by the Publishing Organization, the "identity" "owner" attribute value SHALL be the identity of the Publishing Organization
- If the version was created by the Statement Originator, the "identity" "signer" attribute value SHALL be the identity of the Statement Originator
- If the version was created by the Publishing Organization, the "identity" "signer" attribute value SHALL be the identity of the Publishing Organization
- The "TOS" "submission\_TOS" attribute value SHALL be the URL of the current version of the Learning Registry Terms of Service [Learning Registry TOS]
- The "TOS" "submission\_attribution" attribute SHALL be omitted
- The "digital\_signature" "signature" attribute value SHALL be the computed digital signature of the Resource Data Description [Learning Registry Specification]
- If the version was created by the Statement Originator and the Publishing Agent holds the private key of the Statement Originator, the Resource Data Description SHALL be signed with the private key of the Statement Originator assigned to the Publishing Organization as the Statement Originator proxy
- If the version was created by the Statement Originator and the Publishing Agent does not hold the private key of the Statement Originator, the Resource Data Description SHALL be signed with the private key of Publishing Organization
- If the version was created by the Publishing Organization, the Resource Data Description SHALL be signed with the private key of the Publishing Organization
- If the version was created by the Statement Originator and the Resource Data Description is signed using the proxy key from the Statement Originator, the "digital\_signature" "key\_location" attribute value SHALL be an array of public key location(s) for the public key of the Statement Originator that is used to sign the Resource Data Description
- If the version was created by the Statement Originator and the Resource Data Description is signed using the key from the Publishing Organization, the "digital\_signature" "key\_location" attribute value SHALL be an array of public key location(s) for the public key of the Publishing Organization that is used to sign the Resource Data Description
- If the version was created by the Publishing Organization, the "digital\_signature" "key\_location" attribute value SHALL be an array of public key location(s) for the public key of the Publishing Organization that is used to sign the Resource Data Description
- The "digital\_signature" "signing\_method" attribute value SHALL be "LR-PGP.1.0"
- The "resource\_locator" attribute value SHALL be one of the Web-resolvable identifiers homed or assigned to the statement by the Publishing Agent
- The "keys" attribute SHALL be omitted
- The "resource\_TTL" attribute SHALL be omitted
- The "payload\_placement" attribute value SHALL be "inline"
- The "payload\_schema" attribute value SHALL be TBD

- The "payload\_schema\_locator" attribute value SHALL be the URL (TBD) of the JSON schemata for Learning Registry Paradata [Learning Registry Paradata]
- The "payload\_schema\_format" attribute value SHALL be "application/vnd.learningregistry.paradata+json"
- The "payload\_locator" attribute SHALL be omitted
- The "resource\_data" attribute value SHALL be the JSON serialization of the paradata assertion
- The "resource\_data" JSON serialization SHALL conform to the Learning Registry Paradata Specification [Learning Registry Paradata]
- For the "resource\_data" the Publishing Agent SHALL submit a paradata "activity" object with the following attribute values:
  - The "actor" attribute MAY be omitted
  - If the "actor" attribute is present and the version was created by the Statement Originator, the "actor" attribute value SHALL be the identity of the Statement Originator
  - If the "actor" attribute is present and the version was created by the Publishing Agent, the "actor" attribute value SHALL be the identity of the Publishing Organization
  - Other "actor" attributes SHOULD be omitted
  - The "verb" attribute value SHALL be "isVersionOf"
  - Other "verb" attributes SHOULD be omitted
  - The "object" attribute value SHALL be the value of "resource\_locator"
  - Other "object" attributes SHOULD be omitted
  - The "related" attribute value SHALL be an array with the value of a Web-resolvable identifier homed or assigned to the prior version of the statement by the Publishing Agent
  - Other "related" attributes SHOULD be omitted
  - "activity" extension attributes SHALL NOT be included
  - Other "activity" attributes MAY be omitted
- Resource Data Description extension attributes SHALL NOT be included
- All other Resource Data Description attributes SHOULD NOT be included

*To Do:* Assign the Learning Registry "payload\_schema"

*To Do:* Assign the JSON schemata for learning standards statements as the "payload\_locator\_schema"

## Deletion Paradata Assertion Encoding Requirements

The Publishing Agent SHALL use the following attributes and attribute values for a Resource Data Description for a deletion Paradata Assertion:

- The "doc\_type" attribute value SHALL be "resource\_data"
- The "doc\_version" attribute value SHALL be the current version of the Resource Data Description model [Learning Registry Specification]
- The "doc\_ID" attribute SHALL be omitted
- The "resource\_data\_type" attribute value SHALL be "paradata"
- The "identity" "submitter\_type" attribute value SHALL be "agent"
- The "identity" "submitter" attribute value SHALL be the identity of the Publishing Organization
- The "identity" "curator" attribute value SHALL be the identity of the Publishing Organization
- If the statement was deleted by the Statement Originator, the "identity" "owner" attribute value SHALL be the identity of the Statement Originator
- If the statement was deleted by the Publishing Organization, the "identity" "owner" attribute value SHALL be the identity of the Publishing Organization
- If the statement was deleted by the Statement Originator, the "identity" "signer" attribute value SHALL be the identity of the Statement Originator
- If the statement was deleted by the Publishing Organization, the "identity" "signer" attribute value SHALL be the identity of the Publishing Organization

- The "TOS" "submission\_TOS" attribute value SHALL be the URL of the current version of the Learning Registry Terms of Service [Learning Registry TOS]
- The "TOS" "submission\_attribution" attribute SHALL be omitted
- The "digital\_signature" "signature" attribute value SHALL be the computed digital signature of the Resource Data Description [Learning Registry Specification]
- If the statement was deleted by the Statement Originator and the Publishing Agent holds the private key of the Statement Originator, the Resource Data Description SHALL be signed with the private key of the Statement Originator assigned to the Publishing Organization as the Statement Originator proxy
- If the statement was deleted by the Statement Originator and the Publishing Agent does not hold the private key of the Statement Originator, the Resource Data Description SHALL be signed with the private key of Publishing Organization
- If the statement was deleted by the Publishing Organization, the Resource Data Description SHALL be signed with the private key of the Publishing Organization
- If the statement was deleted by the Statement Originator and the Resource Data Description is signed using the proxy key from the Statement Originator, the "digital\_signature" "key\_location" attribute value SHALL be an array of public key location(s) for the public key of the Statement Originator that is used to sign the Resource Data Description
- If the statement was deleted by the Statement Originator and the Resource Data Description is signed using the key from the Publishing Organization, the "digital\_signature" "key\_location" attribute value SHALL be an array of public key location(s) for the public key of the Publishing Organization that is used to sign the Resource Data Description
- If the statement was deleted by the Publishing Organization, the "digital\_signature" "key\_location" attribute value SHALL be an array of public key location(s) for the public key of the Publishing Organization that is used to sign the Resource Data Description
- The "digital\_signature" "signing\_method" attribute value SHALL be "LR-PGP.1.0"
- The "resource\_locator" attribute value SHALL be one of the Web-resolvable identifiers homed or assigned to the statement by the Publishing Agent
- The "keys" attribute SHALL be omitted
- The "resource\_TTL" attribute SHALL be omitted
- The "payload\_placement" attribute value SHALL be "inline"
- The "payload\_schema" attribute value SHALL be TBD
- The "payload\_schema\_locator" attribute value SHALL be the URL (TBD) of the JSON schemata for Learning Registry Paradata [Learning Registry Paradata]
- The "payload\_schema\_format" attribute value SHALL be "application/vnd.learningregistry.paradata+json"
- The "payload\_locator" attribute SHALL be omitted
- The "resource\_data" attribute value SHALL be the JSON serialization of the paradata assertion
- The "resource\_data" JSON serialization SHALL conform to the Learning Registry Paradata Specification [Learning Registry Paradata]
- For the "resource\_data" the Publishing Agent SHALL submit a paradata "activity" object with the following attribute values:
  - The "actor" attribute MAY be omitted
  - If the "actor" attribute is present and the statement was deleted by the Statement Originator, the "actor" attribute value SHALL be the identity of the Statement Originator
  - If the "actor" attribute present and the statement was deleted by the Publishing Agent, the "actor" attribute value SHALL be the identity of the Publishing Organization
  - Other "actor" attributes SHOULD be omitted
  - The "verb" attribute value SHALL be "isDeleted"
  - Other "verb" attributes SHOULD be omitted
  - The "object" attribute value SHALL be the value of "resource\_locator"
  - Other "object" attributes SHOULD be omitted
  - "activity" extension attributes SHALL NOT be included
  - Other "activity" attributes MAY be omitted
- Resource Data Description extension attributes SHALL NOT be included

- All other Resource Data Description attributes SHOULD NOT be included

*To Do:* Assign the Learning Registry "payload\_schema"

*To Do:* Assign the JSON schemata for learning standards statements as the "payload\_locator\_schema"

## Change Log

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Date	Version	Author	Notes
20130127	0.4	DR	Initial draft for management team.
20130206	0.5	DR	Draft for discussion. Minor editorial changes.
20130303	0.6	DR	Editorial changes. Internal working draft.
20130912	1.0	DR	V1.0 Public release.