USGIN
U.S. Geoscience Information Network

Use of ISO 19139 xml schema to describe geoscience information resources.

Version 1.0.0

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Use of ISO 19139 xml schema to describe geoscience information dataset, dataset series, and services resources

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This document is a profile for using ISO19139 xml schema for North American Profile of ISO 19115 and ISO 19119 metadata. The profile provides guidance for the population of ISO19139 dataset and dataset series documents to enable interoperability of catalog service clients with multiple servers conforming to this profile.

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1 Introduction

A key component of a distributed information network is a catalog system, a collection of resources that allow data and service providers to register resources, and data consumers to locate and use those resources. Currently, many online catalogs are web pages with collections of URLs for services, or services are discovered accidently or by word of mouth. The vision is to enable a web client (portal) to search across one or more metadata registries without having to configure the client individually for each of the registries that will be searched. Thus, metadata providers can focus on data development, without having to also develop web clients to enable search of that metadata.

The Open Geospatial Consortium (OGC) Catalog Service for the Web (CSW) specification defines a collection of basic operations for searching catalogs of metadata via the web. Engineering the desired interoperability requires adding additional constraints on CSW operation; one of the major constraints is selection of the xml schema that will be used to encode metadata for the service. The core CSW specification requires use of a basic xml schema that includes content defined by the Dublin Core Metadata specification. This document concerns use of the ISO19115/ISO19115 content models implemented using the ISO19139 xml schema for encoding of metadata content. Some more specific constraints on use of this implementation may be included in the separate document (planned) describing metadata constraints for different kinds of resources.

A set of other USGIN resource registry and discovery service profile documents discuss the other constraints and best practices to enable catalog interoperability. These include a profile for use of the CSW specification, providing details on how requests and search criteria should be encoded. A profile that describes metadata content required for different resources adds additional detail for specific resources. Finally vocabularies for categorizing resources and specifying other metadata properties are documented in a separate document; these vocabularies will need to be published in a web accessible registry to make them accessible.

1.1 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 19115 designates these two normative references:

- ISO 19115:2005, *Geographic information - Metadata*
- ISO 19115/Cor.1:2006, *Geographic information – Metadata, Technical Corrigendum*

ISO 19119 designates these normative references:

- ISO 19119:2005, *Geographic information - Services*
- ISO 19119:2005/Amd 1:2008, *Extensions of the service metadata model ISO 19108 designates*:
- ISO 19108:2005, *Geographic information – Temporal Schema*

ISO 639-2, Codes for the representation of names of languages - Part 2: Alpha-3 code control ISO 8601, Data elements and interchange formats - Information interchange - Representation of dates and times

ISO/TS 19139:2007, Geographic information - Metadata – XML Schema Implementation

OGC 07-006r1¸ OpenGIS Catalog Services Specification version 2.0.2, Corrigendum 2 release, 2007

OGC 07-045, OpenGIS Catalogue Services Specification 2.0.2 - ISO Metadata Application Profile, Version 1.0.0, 2007

INCITS 453-2009, North American Profile of ISO 19115:2003 – Geographic Information – Metadata (NAP-Metadata), 2009, American National Standards Institute, Inc.

ISO 10646-1, Information technology — Universal Multiple-Octet Coded Character Set (UCS) — Part 1: Architecture and Basic Multilingual Plane

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RFC 2119, Key words for use in RFCs to Indicate Requirement Levels, Network Working Group, 1997.

1.2 Purpose

The USGIN development team is proposing to use the North American Profile of ISO 19115/19119 metadata as the content model (INCITS 453-2009), and the ISO 19139 xml schema for encoding this content in xml documents that will be provided by USGIN CSW services. This profile document is meant to provide guidance on the use of the ISO19139 XML schema to encode metadata for geoscience resources, with sufficient guidance that developers of client or server applications using this service can produce interoperable implementations of the OGC Catalog Service for the Web (CSW).

1.3 Terminology

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

Application profile: a schema that consists of data elements drawn from one or more namespaces, combined together by implementers, and optimized for a particular local application. (Rachel Heery and Manjula Patel, 2000, http://www.ariadne.ac.uk/issue25/app-profiles/)

Catalog application: Software that implements a searchable metadata registry. The application must support the ability to register information resources, to search the registered metadata, to support the discovery and binding to registered information resources within an information community.

Code list: a controlled vocabulary that is used to populate values for an xml element. Codelists are distinguished by the fact that (in the context of this profile) they are built into xml schema, thus use of valid codelist values is verified by simple xml validation against the schema.

Data product specification: a definition of the data schema and value domains for a dataset. The data schema specifies entities (features), properties associated with each entity, the data type used to specify property values, cardinality for property values, and if applicable, other logical constraints that determine data validity. Value domains are specified for simple data types—strings or numbers, and may include controlled vocabularies for terminology required to specify some properties.

Dataset series: collection of datasets sharing the same product specification (ISO 19115). ISO 19115 does not define product specification. For the purposes of USGIN, a product specification defines a data schema, any required controlled vocabularies, and recommended practices for use of schema.

Dataset: an identifiable collection of data (ISO19115). USGIN refines this concept to represent a collection of data items in which individual data items are identified and accessible. DCMI definition is "Data encoded in a defined structure" with additional comment "Examples include lists, tables, and databases. A dataset may be useful for direct machine processing." The container may be a stand-alone digital file (mdb, spreadsheet, table in a word document), a web service, or an enterprise database. Metadata for the collection is a different type than metadata for individual items in the collection (dataset vs. features). Criteria for what unifies the collection are variable (topic, area, author...). Synonym: structured data collection. This resource type represents the intellectual artifact--the information content and organization (data schema); the dataset may have more than one manifestation (format)--as a list, a table, or one or more databases that use different software implementations.

Interoperability: "The capability to communicate, execute programs, or transfer data among various functional units in a manner that requires the user to have little or no knowledge of the unique characteristics of those units." ISO/IEC 2382-01 (SC36 Secretariat, 2003)

Metadata element: a discrete unit of metadata (ISO 19115), an attribute of a metadata entity. A metadata element contains some content specifying the value of the element; this content may be simple—a number or string, or may be another metadata entity.

Metadata entity: a named set of metadata elements describing some aspect of a resource.

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Metadata register: an information store that contains a collection of registered metadata records, maintained by a metadata registry. (ISO 11179)

Metadata registry: an information system for assignment of unambiguous identifiers to administered metadata records. (ISO 11179)

Metadata section: Part of a metadata document consisting of a collection of related metadata entities and metadata elements (ISO 191115).

Metadata: data about a resource in some context. Generalize from ISO 11179 definition of metadata, which constrains the scope to data about data. For USGIN purposes, metadata may describe any resource—including electronic, intellectual, and physical artifacts. Metadata represent resource characteristics that can be queried and presented for evaluation and further processing by both humans and software.

Profile: set of one or more base standards and - where applicable - the identification of chosen clauses, classes, subsets, options and parameters of those base standards that are necessary for accomplishing a particular function [ISO 19101, ISO 19106]

Resource: An identifiable thing that fulfills a requirement. Usage here is closer to definition used in RDF (www.w3.org/TR/REC-rdf-syntax*),* generalized from ISO19115, which defines resource as an 'asset or means that fulfills a requirement' without defining asset or means. "An object or artifact that is described by a record in the information model of a catalogue" (OGC 07-006r1)

Service metadata: metadata describing the operations and information available from a server.

Source Specification: The specification or standard that is being profiled.

User Community: A group of users, e.g. within a supply-chain industry, the members of which decide to make a similar usage of the source specification in order to be able to interoperate.

Note that throughout this document, the names of xml elements are shown in `this typecase`. Long X-paths have been broken with non-breaking hyphen characters. Note that hyphens are not used in any xml attribute or element name, so if they appear in the text, they are strictly for better text wrapping. In Xpath expressions `/../` indicates that some elements have been omitted from the path.

1.4 ISO Schemas Location

ISO I9139 xml schemas are in an online repository at http://schemas.opengis.net/iso/19139/. Two versions are posted: 20060504 and 20070417. Unfortunately, these two directories both contain schema with the same target namespace, so there is no clear way to distinguish applications that are based on one or the other. The medatadaEntity.xsd in the two directories is identical; other schema have not been compared (but see discussion paper gin2009-005 at http://lab.usgin.org/node/269). The 20070417 directory contains schema implementing ISO Technical Specification 19139:2007 (dated 2007 Apr 17), which appear to include the changes from ISO 19115:2003 Cor 1;2006(E), but this is not declared in any included documentation (need metadata on the metadata schema!).

The 20070417 version of the ISO 19139 schemas that references GML 3.2.1. However, there's no mention of the SRV namespace (http://www.isotc211.org/2005/srv) anywhere in this ISO 19139 version. The SRV namespace is where, in our metadata documents using the 2006 version, we specified all our information about dynamic, online services such as WFS and WMS, so the 20070417 version is not useful for metadata catalogs that register services.

In order to create metadata for both static datasets and dynamic, online services and for use with CSW, the OGC created an xml schema that merges the schema for ISO19115 (dataset metadata) and ISO19119 (service metadata) (see section D.1.5, page 105 in OGC 07-045). The way that was accomplished was by creating a schema located at http://schemas.opengis.net/csw/2.0.2/profiles/apiso/1.0.0/apiso.xsd. This schema simply imports .. iso/19139/20060504/gmd/gmd.xsd and .. iso/19139/20060504/srv/srv.xsd. Thus for CSW 2.0.2 implementations, the 20060504 versions of the ISO19139 schema must be used.

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2 Overview of the Profile

2.1 General Objectives

The Profile defines:

- mandatory and conditional metadata sections, metadata entities, and metadata elements
- the minimum set of metadata elements for any resource in order to conform to the Profile
- the core metadata for geographic datasets
- optional metadata elements that allow for a more extensive standard description of resources
- some recommended practices to increase the utility and interoperability of metadata.

2.2 Requirements

M (mandatory). Metadata element must have a valid value.

C (conditional). Metadata element is mandatory based on values of other metadata elements in the metadata record.

O (optional). Metadata element may be null in a valid document.

X (not used). Metadata element is not used by a Profile.

2.3 Use cases to be supported

This section includes a number of user scenarios that motivate development of a catalog application for the US Geoscience Information Network. At its heart, the problem is to find resources of interest via the internet, based on criteria of topic, place, or time, and learn how to access and use those resources.

Basic search — A user specifies a geographic bounding box and one or more text keywords to constrain the resources of interest, and searches a metadata catalog using these criteria. The user is presented with a web page containing a list of resources that meet the criteria, with links for each resource that provide additional detailed metadata, and direct access to the resource if an online version is accessible, e.g. as a web page, Adobe Acrobat document, or online application.

A portal application provides user with a map window that contains some simple base map information (political boundaries, major roads and rivers). User wishes to assemble a variety of other data layers for a particular area to view in the portal map view, e.g. slope steepness, geologic units, bedding orientation, and vegetation type for a hazard assessment. User centers map view on area of interest, then using an ‘add data’ tab, accesses a catalog application that allows them to search for web map services that display the desired datasets. After obtaining the results and reviewing the metadata for the located services, user selects one or more to add to the table of contents for the portal map viewer. Response from catalog has sufficient information to enable the portal application to load and display the resource (e.g. serviceType, ServiceOperation, OnlineResourceLinkage).

User searches for boreholes in an area. Returned metadata records have links to metadata for related information, like logs of different types, core, water quality data, etc. that the user can follow to browse related resources.

Complex search examples:

- Search based on related resources, for example a search for boreholes that have core for which photographs are available online.
- Boreholes that penetrate the Escabrosa formation.
- Sample locations for samples with uranium-lead geochronologic data.

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- Find links to pdf's of publications by Harold Drewes.
- Find geologic maps at scale < 100,000 in the Iron Mountains.
- Who has a physical copy of USGS I-427?

A catalog operator wishes to import and cache catalog records from a collaborating catalog that have been inserted or updated during the last month (harvest).

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2.4 Resources of interest

Table 1 summarizes the geoscience information resources of interest to the community that can be registered and discovered using this metadata profile. Note that this collection of resource types includes several kinds of resources that are not typically associated with ISO19115/ISO19119, which were created specifically for geospatial resources.

*Table 1. Summary of resource types described by metadata for US Geoscience Information Network catalogs. Resource type **names in bold** have been prioritized for implementation in version one catalogs. The Resource type names include the type hierarchy encoded with the broader (parent) resource type indicated in the Broader Resource Type column.*

Resource Type hierarchy	Broader Resource Type	Source	Definition
Collection		DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	An aggregation of resources. A collection is described as a group; its parts may also be separately described. (from http://www.ukoln.ac.uk/metadata/dcmi/collection-application-profile/): The term "collection" can be applied to any aggregation of physical or digital items. Those items may be of any type, so examples might include aggregations of natural objects, created objects, "born-digital" items, digital surrogates of physical items, and the catalogs of such collections (as aggregations of metadata records). The criteria for aggregation may vary: e.g. by location, by type or form of the items, by provenance of the items, by source or ownership, and so on. Collections may contain any number of items and may have varying levels of permanence. A "collection-level description" provides a description of the collection as a unit: the resource described by a collection-level description is the collection, rather than the individual items within that collection. Collection-level descriptions are referred to in Michael Heaney's *An Analytical Model of Collections and their Catalogues* as "unitary finding-aids" [AMCC].
Dataset	Collection	DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	A collection of data items in which individual data items are identified and accessible. DCMI definition is "Data encoded in a defined structure." with additional comment "Examples include lists, tables, and databases. A dataset may be useful for direct machine processing." The container may be a stand-alone digital file (mdb, spreadsheet, table in a Word document), a web service, or an enterprise database. Metadata for the collection is a different type than metadata for individual items in the collection. Criteria for what unifies the collection are variable (topic, area, author...). Synonym: structured data collection. This resource type represents the intellectual artifact -- the information content and organization; the dataset may have more than one manifestation (format) -- as a list, a table, databases, using different software implementations.

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Catalog	Dataset	USGIN	A collection of data items that index resources, as in metadata records; a metadata registry. The resource represents the information content and organization. Catalogs are accessed using other resources, like an interactiveResource or Service, and may have different formats.
Physical artifact collection	Collection	USGIN	A collection of identifiable physical objects, unified based on some criteria. Criteria for defining a collection may be who collected, where curated, why collected, kind of material…
Document		USGIN	A packaged body of intellectual work; has an author, title, some status with respect to Review/authority/quality. USGS peer reviewed would be a 'status property'. Have to account for gray literature, unpublished documents, etc. A document may have a variety of physical manifestations (pdf file, hard-bound book, tiff scan, Word processor document...), and versions may exist as the document is traced through some publication process. May be map, vector graphics, text. Sound, moving images are included as document types.
Image	Document	DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	A visual representation other than text. Comment: Examples include images and photographs of physical objects, paintings, prints, drawings, other images and graphics, animations and moving pictures, film, diagrams, maps, musical notation. Note that Image may include both electronic and physical representations.
StillImage	Image	DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	A static visual representation. Comment: Examples include paintings, drawings, graphic designs, plans and maps. Recommended best practice is to assign the type Text to images of textual materials if the intent of the image is to capture the textual content as opposed to the appearance of the medium containing the text. Instances of the type Still Image must also be describable as instances of the broader type Image. Subtype of Image.
Human-generated image	StillImage	USGIN	Image produced by human drawing or painting, using any media. May be entirely product of human imagination, human perception of the world, or a human-modified photographic image.
Photograph	StillImage	USGIN	Image produced by optical device with chemical or electronic image capture; represents things in the field of view directly as captured by the device. Photographs may be modified by human processing; there is a continuum between photographs and human-generated image. Distinction between the two is largely based on intention
Remote sensing Earth image	StillImage	USGIN	Image of earth surface acquired by an air born or earth-orbiting sensor. May be georeferenced such that location in the image directly corresponds to location on the earth.
Map	StillImage	USGIN	Human-generated depiction of some part of the earth using a mathematical system of correspondence between geometry in the image and location on the earth.

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MovingImage	Document	DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	A series of visual representations imparting an impression of motion when shown in succession. Comment: Examples include animations, movies, television programs, videos, zoetropes, or visual output from a simulation. Instances of the type Moving Image must also be describable as instances of the broader type Image. Subtype of Image. Commonly include sound
Sound	Document	DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	A resource primarily intended to be heard. Comment: Examples include a music playback file format, an audio compact disc, and recorded speech or sounds.
Text	Document	DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	A resource consisting primarily of words for reading. Comment: Examples include books, letters, dissertations, poems, newspapers, articles, archives of mailing lists. Note that facsimiles or images of texts are still of the genre Text.
Hypertext document collection	Text	USGIN	A collection of files that contains http hyperlinks between them. Links to documents or other resources outside of the collection are possible. The criteria for determining membership in the collection are somewhat arbitrary, but in general the 'site' should contain related documents authored and managed by the same agent.
Event		DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	A non-persistent, time-based occurrence. Metadata for an event provides descriptive information that is the basis for discovery of the purpose, location, duration, and responsible agents associated with an event. Examples include an exhibition, webcast, conference, workshop, open day, performance, battle, trial, wedding, tea party, and conflagration.
Project	Event	USGIN	Project represents a funded activity that has some purpose; projects have associated extents, which represent the area of interest for the project. This extent serves as a mechanism to filter descriptions and concepts in the information system for those that may be related to the project based on spatial relationships. Projects in a large organization will likely have hierarchical (part-whole) relationships.
Model		USGIN	Algorithm, workflow; an abstract representation of a collection of related processes, objects and relationships. A model resource may be related to various kinds of document that portray the model, or to software that implements the model, or with datasets as input or output. Not clear that there is a compelling use case for cataloging models separately from the software or documents that are manifestations of the model.
Physical artifact		DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	General category for physical resources that are indexed by metadata records; also root of an artifact type hierarchy. An identifiable physical object. Identification is always a function of some human intention, thus differentiating an artifact from other 'natural' things. Note that digital representations of, or surrogates for, these objects should use Image, Text or one of the other types.

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Service		DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	A system that provides one or more functions via a network interface designed for machine interaction. An implementation of an interface to some sort of digital resource, using either a 'pull' model in which client requests some content from the service, and receives that content in a single 'response' package, or a 'push' model in which client establishes connection and monitors for change events (update, new data…) from service. Difficult to draw line on when a service provides 'files' and when it provides 'data', because responses are always in a form that could be considered a file. Also includes interfaces to digital resources that provide a continuous (with some sampling interval?) feed of some sort of data.
Software		USGIN	A computer program in source or compiled form. Comment: Examples include a C source file, MS-Windows .exe executable, or Perl script.
Stand-Alone-Application	Software	DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	Identifiable stand alone software application. Identity of resource is based on function performed, input and output requirements, and authorship. The same application may be packaged in different file formats to run in different software environments; thus an application will have one or more associated digital files. For the purposes of this catalog scheme, stand alone applications are software that can be packaged in a single file that can be transferred between machines, unpackaged and compiled or installed on a computer meeting specified hardware and software environment conditions, to execute the described function on that computer, independent of any network connection.
Interactive-Resource	Software	DCMI resource Types http://dublincore.org/documents/dcmi-type-vocabulary/	A resource requiring interaction from the user to be understood, executed, or experienced. Comment: Examples include forms on Web pages, applets, multimedia learning objects, chat services, or virtual reality environments. Interactive resources are software driven. From the point of view of the catalog, they are accessed by a URL to a web site that is the interface for operating the application. The application operates by interaction with one or more human participants. The application requires network connection to operate, is accessible via the internet, and requires human interaction.
Structured digital data item		USGIN	An individually identifiable item in a structured digital data collection. Characterized by a schema, and some particular values. In ISO11179 terms, this is an instance of a data element. Tagging, commenting, reviewing, rating community interaction with catalog will probably require metadata records about particular data items in cataloged datasets (including metadata items in catalogs.)
Sampling point, site, station	Structured digital data item	From ScienceBase item types, SMR redux	A resource that is a location-based container/base for observation data. Should this be generalized to OGC O&M samplingFrame to include other sampling geometry (borehole, image footprint)... Analogous in function to a keyword, but carries metadata on who located, when, why, how...

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3 USGIN profile of ISO 19115

3.1 USGIN Core Metadata Elements

3.1.1 Core spatial dataset, dataset series, and service elements

Table 2 is a listing of ISO19115 metadata elements used to describe datasets. These will be included in XML metadata documents that have the root element MD_Metadata. Elements are discussed in the order that they appear in the metadata document. Note that throughout this and the subsequent tables, the names of xml elements are shown in `this typecase`. Long X-paths have been broken with non-breaking hyphen characters. Hyphens are not used in any xml attribute or element name, so if they appear in the text, they are strictly for text wrapping.

Table 2. Description best practices for ISO19139 metadata element in USGIN profile. This table includes base elements.

ISO 19115 (M/C/O) xPath from MD_Metadata	**NAP-USGIN M/C/O**	**Comments**
Metadata file identifier (O) `fileIdentifier`	M-M	A unique File Identifier (GUID) must be included to allow CSW operations such as GetRecordById or harvest transactions. USGIN, ANZLIC, and the OGC CSW profiles for ISO metadata (OGC 07-045) recommend the use of the UUID (Universally Unique Identifier) for the `fileIdentifier`. The `fileIdentifier` is used to identify duplicate copies of metadata records, to reference one metadata record from another (via `MD_DataIdentification/aggregationInfo`), or to reference metadata from a described resource (e.g. `DS_Dataset/has/MD_Metadata`). If there is a difference between the two metadata records then one can determine the appropriate version by the content of other elements in the metadata record. The authoritative metadata record should be the only one made publicly available in metadata search systems such as a catalog service. To simplify catalogue mining each `MD_DataIdentification` instance being part of a `MD_Metadata` instance must have an identifier having a code value that is equal to the `fileIdentifier` of the owning `MD_Metadata` instance (OGC 07-045).
Metadata language (M) `language`	M-M	NAP specifies that language string is composed of a language code (ISO639-2/T) and an alpha3 country code (ISO3166-1). The syntax is "<ISO639-2/T three letter language code><;><blank space><ISO3166-1 three letter country code>" Language code is given in lowercase. Country code is given in uppercase, e.g. fra; CAN Currently, it appears that most CSW client and server applications only support the three letter language code; if testing reveals that this provision causes too much difficulty it will be changed. In the mean time, filtering for metadata in a particular language without a country localization may be done using a wildcard search for the three letter language code.

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ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments
Metadata character set (C) `characterSet`	M-M	NAP specifies default name is "`utf8`", with codeListValue = "RI_458", codelist = "http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_95". USGIN requires that a character set code is defined to facilitate CSW servers (deegree, GeoNetwork, etc.).
Parent metadata record (O) `parentIdentifier`	O-X	Not used in USGIN profile. Used in ISO19115 to inherit metadata properties from parent to child records; USGIN CSW service implementations do not require clients to be able to navigate parent links to obtain inherited metadata properties, or to process filters using parent links, so this element is not used. To represent relationships between described resources use `MD_Identification/aggregationInfo`.

Resource type (C)
`hierarchyLevel`
	M-M	Cardinality is 1...*. Default `hierarchyLevel.MD_ScopeCode@codeListValue` is "RI_622", codelist name "`dataset`"; for services use codeListValue "RI_631", codelist name "service".
		Mandatory for NAP and USGIN Metadata implementations.
		At least one napMD_ScopeCode codelist value is required. Codelist is {`attribute, attribute-Type, collectionHardware, collectionSession, dataset, series, nonGeographic-Dataset, dimensionGroup, feature, featureType, propertyType, fieldSession, software, service, model, tile`}
		This property essentially categorizes the indexed resource with types that determine the metadata content and the required behavior to access the indexed resource. See 4.16.3 Codelists for discussion of encoding of codelist values.
		Example – dataset metadata:
		`<gmd:hierarchyLevel>`
		`  <gmd:MD_ScopeCode`
		`  codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_108"`
		`  codeListValue="RI_622">dataset</gmd:MD_ScopeCode>`
		`</gmd:hierarchyLevel>`

Resource hierarchy level name (C)
`hierarchyLevelName`
	O-M	ISO 19115 assumes that the metadata hierarchy level name defaults to "dataset" if it is not documented. NAP does not use it, recognizing that it is redundant.
		USGIN makes this property mandatory to identify the USGIN resource type from Table 1 (above). Default USGIN `hierarchyLevelName.CharacterString` is "Dataset". Encode hierarchy by including `hierarchyLevelName` elements for all broader resource categories. E.g. default should also include a `hierarchyLevelName`="Collection" element. For services USGIN `hierarchyLevelName.CharacterString` is "Service". As use cases develop that provide rationale for definition of sub-categories of service, the resource category list will be expanded.
		Example – dataset metadata:
		`<gmd:hierarchyLevelName>`
		`  <gco:CharacterString>Dataset</gco:CharacterString>`
		`</gmd:hierarchyLevelName>`

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ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments
Metadata point of contact (M) `Contact/CI_ResponsibleParty`	M-M	Cardinality on contact is 1..*. USGIN requires at least one `CI_ResponsibleParty` with `role.CI_RoleCode@codeListValue` = "RI_413" (CI_RoleCode element value = "`originator`") that identifies the original source of the metadata record. If the point of contact for users to report errors, updates to metadata, etc. is different than the originator, an additional `contact/CI_ResponsibleParty` element may be included with `role.CI_RoleCode@codeListValue` = "RI_414" (CI_RoleCode element value="`pointOfContact`"). See 4.16.3 Codelists for discussion of encoding of codelist values. The point of contact information (either `originator` or `pointOfContact`) must include a contact e-mail address (`electronicMailAddress`). This is in addition to the NAP rule that count of (individualName + organisationName + positionName) > 0 for any `CI_ResponsibleParty` element. The `contactInfo/CI_Contact/onlineResource/CI_OnlineResource` element for the `CI_ResponsibleParty` with `role.CI_RoleCode@codeListValue` = "RI_413" has `CI_OnlineResource/name` = "icon", the `CI_OnlineResource/linkage/URL` will be assumed to points to an Icon image file (e.g. tif, png, jpg) for the metadata originator. This Icon will be displayed in search results to credit the metadata originator. Metadata harvesters should harvest and maintain all metadata point of contact information so that the origin of metadata records can be credited, and the point of contact information is not lost. If the service providing the metadata records wishes to identify itself in result records, this information should be included in an additional `MD_Metadata/contact/CI_ResponsibleParty` element, with `role.CI_RoleCode@codeListValue` = "RI_412" (CI_RoleCode element value ="`distributor`":").
Metadata date stamp (M) `dateStamp`	M-M	USGIN profile requires use of `dateStamp/gco:DateTime` (Note this contrasts with INSPIRE mandate to use `dateStamp/gco:Date`). This is the date and time when the metadata record was created or updated (following NAP). The `dateStamp` is assumed to be updated to reflect any change in the metadata record that the metadata publisher wishes to propagate through the USGIN catalog system. This is the time stamp that will be used by harvesters to determine if a metadata needs to be updated in a harvesting catalog.
Metadata standard name (O) `metadataStandardName`	M-M	NAP specifies "NAP - Metadata". USGIN profile conformant metadata is indicated by using " ISO-NAP-USGIN" Use is mandatory to indicate that the metadata record conforms to this profile.
Metadata standard version (O) `metadataStandardVersion`	O-M	For this version of the USGIN profile, use "1.0" Use is mandatory to specify the version of the profile used

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ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments
DataSet Identifier (O) `dataSetURI`	O-C	For USGIN, this is a string that uniquely identifies the described resource. If the resource has an identifier, it should be included here; if the resource will be referenced from other metadata, it must have an identifier here. Any kind of resource (not only datasets) may have an identifier. The protocol for the identifier is not specified, but some sort of documented scheme to assure uniqueness should be used (UUID, URN…). Some implementations place a URL for online access in the dataSetURI; for USGIN profile, the `MD_Distribution/transferOptions/MD_DigitalTransferOptions/online/CI_OnlineResource` is used to specify URLs for access to the resource. The dataSetURI should be considered an opaque identifier. This will avoid ambiguity about where to find URLs for online access to a described resource. If the dataset is coupled to a service, the value of the `MD_Metadata/dataSetURI` attribute is the unique resource identifier used by srv:coupledResource to link the service with the dataset.

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ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments

Other languages (C)
`locale`
	C-C	Other languages used in metadata free text description.
		If description in more than one language is provided, this property should indicate what those languages are. The primary language used for metadata description is identified with `MD_Metadata/language` and `characterSet` and any additional languages are identified by `MD_Metadata/locale/PT_locale` elements, in which the language is provided according to ISO 639-2/T three-letter terminology codes in lowercase, and an optional country is provided according to ISO 3166-1 three-letter codes in uppercase, and mandatory characterEncoding. See 4.16.3 Codelists for discussion of encoding of codelist values. NAP has a LanguageNameCodes codelist in their registry (http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_116), but this only points to ISO639-2. The a listing of codes in this codelist is available at http://www.loc.gov/standards/iso639-2/php/code_list.php. The ISO code list catalog at http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Codelist/ML_gmxCodelists.xml includes a LanguageCode codelist that includes the ISO 639-2 codes, in which the three letter codes are identifiers, and a gml:name, which is the English language name of the language is included. Unfortunately, only eng and fra are included in this codelist catalog. Go figure. Alternate names in other languages are also included in this catalogue. This catalogue should be referenced as the codeList for USGIN language elements as follows:
		Example – dataset metadata:
		`<gmd:locale>`
		`  <gmd:PT_Locale id="FR">`
		`    <gmd:languageCode>`
		`      <gmd:LanguageCode`
		`        codeList="http://www.loc.gov/standards/iso639-2/php/code_list.php"`
		`        codeListValue="fra">French</gmd:LanguageCode>`
		`      </gmd:languageCode>`
		`      <gmd:characterEncoding>`
		`        <gmd:MD_CharacterSetCode`
		`          codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_95"`
		`          codeListValue="RI_458">utf8</gmd:MD_CharacterSetCode>`
		`      </gmd:characterEncoding>`
		`  </gmd:PT_Locale>`
		`</gmd:locale>`
		The INSPIRE 19115/19 2009-02-18 guidelines use this codeList for language codes, but use the three letter abbreviation as the element value, not the gml:name from the codelist catalog. NAP examples (INCITES 453, 2009) reference the NAP codelist (IC_116), use the three letter code as the codeListValue, and the languageCode element value is the name of the language apparently using that language, e.g. codeListValue = 'fra', element value Français. Given these variations, it is recommended that search for a particular languageCode use the codeListValue as the criteria, with the three letter codes as the search value.

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ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments
[role] Resource spatial representation (O) `spatialRepresentationInfo`	O-O	Best practice is to include metadata for spatial representation if the described resource is a georeferenced dataset. Metadata for Spatial data representation are derived from ISO 19107. Metadata is instantiated as one or more of `MD_GridSpatialRepresentation`, `MD_VectorSpatialRepresentation`, `MD_Georectified`, or `MD_Georeferenceable` classes. USGIN profile follows NAP for spatial representation metadata. Vector Spatial Representation is required if point or vector objects exist in the dataset. If `MD_VectorSpatialRepresentation` is used, either `spatialRepresentationInfo/MD_VectorSpatialRepresentation/topologyLevel` or `spatialRepresentationInfo/MD_VectorSpatialRepresentation/geometricObjects` shall be provided, or both." (NAP) `MD_GridSpatialRepresentation` or one of its subtypes (`MD_Georectified`, or `MD_Georeferenceable`) is required if dataset objects are gridded. `MD_Georectified` should be used if the grid (image) is georeferenced, and `MD_Georeferenceable` is used if the grid (image) can be georeferenced. Follow NAP optionality if these elements are used.
Resource spatial representation vector topology (O) `spatialRepresentationInfo/MD_VectorSpatialRepresentation/topologyLevel`	C-C	Code that specifies the degree of complexity of spatial relationships between features in a dataset. Value is from codelist `topologyLevel/MD_TopologyLevelCode@napMD_TopologyLevelCode` (http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_111) Code names in this list include {`geometryOnly, topology1D, planarGraph, fullPlanarGraph, surfaceGraph, fullSurfaceGraph, topology3D, fullTopology3D, abstract`}. See 4.16.3 Codelists for discussion of encoding of codelist values. It is unclear precisely what these values mean in terms of the topology encoding. To be useful, assertion that topology is present should indicate that topological relationships that may be implicit in the encoded vector geometry are explicitly represented (e.g. by correlation tables—left poly, right poly for a polyline) in the data.
Resource spatial representation vector geometric objects (O) `spatialRepresentationInfo/MD_VectorSpatialRepresentation/geometricObjects`	C-C	"Identification of the objects used to represent features in the dataset." (NAP) Provides a geometry type and count for the number of objects of each type. Use `geometricObjects/MD_GeometricObjects/MD_GeometricObjectTypeCode@napMD_GeometricObjectTypeCode` codelist (http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_99). Code names in this list are: {`complex, composite, curve, point, solid, surface`}. See 4.16.3 Codelists for discussion of encoding of codelist values.
[role] Resource's spatial reference system (O) `referenceSystemInfo`	O-O?	Description of the spatial and/or temporal reference systems used in the dataset. NAP specifies { (`identificationInfo/spatialRepresentationType/MD_SpatialRepresentationTypeCode`= "`vector`") or (`../MD_SpatialRepresentationTypeCode` = "`grid`") or (`../MD_SpatialRepresentationTypeCode` = "`tin`") implies count `referenceSystemInfo` >= 1) }. See 4.16.3 Codelists for discussion of encoding of codelist values.

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ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments
Reference System identifier code (O) `referenceSystemInfo/MD_ReferenceSystem/referenceSystemIdentifier/RS_Identifier/code`	C-C	If `referenceSystemInfo` is included, then the `RS_Identifier` element must include at least a code value. For USGIN the code should be a value from the EPSG Geodetic Parameter Dataset register (http://www.epsg-registry.org/) in the form "EPSG:nnnn" where nnnn is the EPSG code number for the CRS. If the CRS is not defined in the EPSG registry, then the procedure specified in the NAP profile should be followed, e.g. the CRS shall be described according to ISO 19111 and ISO/TS 19127, assigned an identifier, and registered with an authority such that it may be referenced here. The `RS_Identifier/codespace` in this case should identify the registry authority where the CRS definition is registered, such that the definition can be located. Best Practice for USGIN purposes is to provide geo-referenced data using one of the EPSG defined coordinate reference systems if this is possible.
Metadata extension information (O) `metadataExtensionInfo`	X-X	Not used in this profile.
Resource identification information (M) `identificationInfo`	M-M	Cardinality 1..*. The content of this element identifies the described resource. For resources that are not services, use `MD_DataIdentification` (**see Table 3**), otherwise `SV_ServiceIdentification` is required (**see Table 4)**.
[role] Content information (O) `contentInfo`	O-O	Characteristics describing the feature catalog, coverage, or image data. `MD_ContentInformation` is an abstract class. One or more of `MD_FeatureCatalogueDescription` or `MD_CoverageDescription` or `MD_ImageDescription` elements may be used to specify this content. `MD_FeatureCatalogueDescription` describes content in a feature service or dataset like an ESRI geodatabase that may have more than one feature, e.g. geologic unit outcrop polygons, fault line features, and point observation locations for strike and dip data. The `MD_FeatureCatalogueDescription` only provides a `CI_Citation` link to the full feature catalog, which may use ISO19110 or ISO11179. `MD_CoverageDescription` is for datasets that are one of the types listed in napMD_CoverageContentTypeCode: image, thematicClassification, physicalMeasurement. A coverage is a data structure that acts as a function to return values from its range for any direct position within its spatiotemporal domain (OGC 07-067r5). Image coverages return values for light intensity in a given wavelength range, thematicClassification coverages return codes corresponding to some domain concept, and physicalMeasurement coverages return values representing some physical quantity like magnetic susceptibility, density, resistivity. USGIN currently makes no recommendation for use of contentInfo; follow NAP recommendations (see INCITS 453).
[role] Resource distribution information (O) `distributionInfo`	O-O	This element provides information to inform users how to obtain or access the described resource. Cardinality is 0..1. US GIN profile specifies that if distribution information is included (`MD_Distribution` is not null), then at least one `MD_Distribution/distributionFormat` and one `MD_Distribution/transferOptions` element is required, and the specified format is available via the specified transfer options. See section 4.12 '*Use of MD_Distribution and MD_Distributor*' for instructions for more complicated combinations of distributor, format, transfer options, and ordering instructions.

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ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments
Resource distribution format (O) `distributionInfo/MD_Distribution/distributionFormat`	O-O	Information on the format or physical manifestation of the resource. If the resource is a physical resource, like a book, rock sample, paper document, the `distributionFormat/MD_Format/name` is mandatory, and must be from the USGIN distribution format codelist (see 8.1 Online resource format).
Resource distributor information (O) `distributionInfo/MD_Distribution/distributor/MD_Distributor/`	O-C	*USGIN differs from NAP* in this case (but not with ISO19115) by allowing multiple distributors, and binding between distributors, transfer options, and formats. For USGIN profile, each `distributor/MD_Distributor` is a binding between one or more transfer options and the distributor formats that are available through that/those transfer options (`MD_DigitalTransferOptions/onLine/CI_OnlineResource` in particular). If different formats are available from the same distributor, or have different transfer options, these should be represented as different `distributor/MD_Distributor` instances. See section 4.12 '*Use of MD_Distribution and MD_Distributor*' for instructions on use of these elements.
Resource distributor responsible party (O) `distributionInfo/MD_Distribution/distributor/MD_Distributor/distributorContact/CI_ResponsibleParty`	C-C	If `distributionInfo` is not null, `MD_Distributor` is required, which requires one `CI_ResponsibleParty`. For responsible party, count of (`individualName` + `organisationName` + `positionName`) > 0, and nap-CI_RoleCode is required. Role codes applicable in this context include: {`resourceProvider, custodian, owner, distributor, pointOfContact, publisher, author, editor, rightsHolder`} See section 4.16.3 '*Codelists'* for details on codelist encoding.
Resource distributor order process (O) `distributionInfo/MD_Distribution/distributor/MD_Distributor/distributionOrderProcess/MD_StandardOrderProcess`	O-O	Information on the availability of the service which includes at least one of fees, available date and time, ordering instructions, or turnaround.
Resource distributor format (O) `distributionInfo/MD_Distribution/distributor/MD_Distributor/distributorFormat/MD_Format`	(O-C)	See section 4.12 '*Use of MD_Distribution and MD_Distributor*' for instructions on use of these elements. The USGIN profile mandates `distributorFormat/MD_Format/name` is a value from the USGIN distributionFormatCode list (see *Online resource format* 8.1). Format should indicate if it is a layer in a multi-layer WMS, single-layer WMS, features in a WFS.

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ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments
Resource distributor online distribution linkage (O) `distributionInfo/MD_Distribution/distributor/MD_Distributor/distributorTransferOptions/MD_DigitalTransferOptions/online/CI_OnlineResource/linkage`	M-M	Digital transfer options are "Technical means and media by which a dataset is obtained from the distributor." NAP requires `CI_OnlineResource/linkage` and `CI_OnlineResource/protocol` in `CI_OnlineResource`. The `CI_OnlineResource/linkage` element should contain the complete URL to access the resource directly (see section 4.12). `CI_OnlineResource` requires a `Linkage` element that is a `gmd:URL`.
Resource distributor online distribution linkage (O) `distributionInfo/MD_Distribution/distributor/MD_Distributor/distributorTransferOptions/MD_DigitalTransferOptions/online/CI_OnlineResource/protocol`	M-M	The `CI_OnlineResource/protocol` element defines a valid internet protocol used to access the resource. USGIN mandates use of protocol mnemonics from the Official Internet Protocol Standards registry published on the Web at http://www.rfc-editor.org/rfcxx00.html. 'ftp' or 'http' are common values. If no mnemonic has been assigned, use the rfc number.
Resource distributor online distribution linkage (O) `distributionInfo/MD_Distribution/distributor/MD_Distributor/distributorTransferOptions/MD_DigitalTransferOptions/online/CI_OnlineResource/name`	O-O	The `CI_OnlineResource/name` element may duplicate the file name if the URL is a link to a file, but it is recommended to provide a user-friendly label for the file that could be presented in a user interface.

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ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments
Resource distributor online distribution application profile (O) `distributionInfo/MD_Distribution/distributor/MD_Distributor/distributorTransferOptions/MD_DigitalTransferOptions/online/CI_OnlineResource/applicationProfile`	C-C	`applicationProfile` is required if the `CI_OnlineResource/linkage` does not connect to a web page, and another software application is needed to use the indicated file resource. The `applicationProfile` character string should specify the software using the following recommended syntax: "vendor:application name/application version", e.g. "Microsoft:Word/2007", or "ESRI:ArcGIS/9.3"
Resource distributor online distribution function (O) `distributionInfo/MD_Distribution/distributor/MD_Distributor/distributorTransferOptions/MD_DigitalTransferOptions/online/CI_OnlineResource/function`	O-C	`CI_OnlineResource/function` is required by USGIN to indicate how linkage is to be used. Valid values for napCI_OnlineFunctionCode in this role are summarized in Table 5. If the resource is accessible as a web service, the metadata for the service should be separate metadata record with the dataset(s) exposed through the service identified in the service metadata record as coupledResources.
Resource distribution transfer options (O) `distributionInfo/MD_Distribution/transferOptions/MD_DigitalTransferOptions`	C-C	`MD_DigitalTransferOptions` provides information on digital distribution of resource. See section 4.12 '*Use of MD_Distribution and MD_Distributor*' for instructions on use of this element. Details on encoding for MD_DigitalTransferOptions are above in the distributorTransferOptions elements description.
[role] Data quality information (O) `dataQualityInfo`	C-C	Either `dataQualityInfo/DQ_DataQuality/report` or `dataQualityInfo/DQ_DataQuality/lineage` is mandatory if a dataQualityInfo element is present. `dataQualityInfo/DQ_DataQuality/scope` is required, with NAP provision that value is from napMD_ScopeCode: {`attribute, attributeType, collectionHardware, collectionSession, dataset, series, nonGeographicDataset, dimensionGroup, feature, featureType, propertyType, fieldSession, software, service, model, tile`}. `dataQualityInfo` has cardinality 0..*. See section 4.18 *Data quality for individual parts of a resource* for discussion of data quality with resource parts.

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ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments
Data quality scope (O) `dataQualityInfo/DQ_DataQuality/scope`	C-C	Mandatory if `DQ_DataQuality` is not null. Specifies the extent of characteristics for which data quality information is reported. Value is from napMD_ScopeCode: {`attribute, attributeType, collectionHardware, collectionSession, dataset, series, nonGeographicDataset, dimensionGroup, feature, featureType, propertyType, fieldSession, software, service, model, tile`}.
Data quality scope level description (O) `dataQualityInfo/DQ_DataQuality/scope/levelDescription`	C-C	`DQ_DataQuality/scope/levelDescription` is mandatory if `../scope/DQ_Scope/level/MD_ScopeCode` = "`attributeType`" or "`featureType`". `levelDescription` specifies the aspect of the larger resource described by the containing `dataQualityInfo/DQ_DataQuality` element. The data type for the `levelDescription` child elements are reference only; the documentation in ISO19115 (2003, section B.4.4, p. 91) indicates that these are references to ISO19109 (Application Schema) elements describing attributes or features in the application scheme. For USGIN these will be xlink:href or uuidref URIs. Only the `features` and `attributes` child elements are used by the USGIN profile. See section 4.18 *Data quality for individual parts of a resource* for more discussion of levelDescription.
Data quality report (O) `dataQualityInfo/DQ_DataQuality/report`	C-C	If a `DQ_DataQuality/report` element is included, at least one of the 15 possible data quality elements must be present, and multiple report elements are allowed within each `DQ_DataQuality` element. Each of these *`AbstractDQ_element`* subtypes has optional `nameOfMeasure`, `measureIdentification`, `measureDescription`, `evaluationMethodType`, `evaluationMethodDescription`, `evaluationProcedure`, and `dateTime` elements, and one or two required result elements. The *`AbstractDQ_element`* `/result` is either a `DQ_ConformanceResult` or a `DQ_QuantitativeResult`, each of which has required and optional sub-elements. Inclusion of this report metadata should follow recommendations in NAP.
Data quality lineage (O) `dataQualityInfo/DQ_DataQuality/lineage`	C-C	USGIN follows NAP rule that count(`lineage/LI_Lineage/source` + `lineage/LI_Lineage/sourceStep` + `lineage/LI_Lineage/statement`) >0 for spatial dataset and spatial dataset series. Not applicable to services. USGIN recommended practice is described in section 4.18.
Data quality lineage statement (O) `dataQualityInfo/DQ_DataQuality/lineage/LI_Lineage/statement`	C-C	INSPIRE makes general `lineage/LI_Lineage/statement` mandatory. "General explanation of the data producer's knowledge of the dataset lineage" NAP. USGIN recommended practice is described in section 4.18.

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ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments
Data quality lineage source (O) `dataQualityInfo/DQ_DataQuality/lineage/LI_Lineage/source`	C-C	Each `source/LI_Source` element describes a source data resource that is input into a processStep. NAP provision is that `LI_Source/description` is mandatory if `LI_Source/sourceCitation` and `LI_Source/sourceExtent` are not provided. If used, the `LI_Source/description` includes the source medium name from the CodeList napMD_MediumNameCode, followed by <;><blank space> and a free text description, e.g. "dvd; source satellite image." If the source is part of a processing chain, the `LI_Source/processStep/LI_ProcessStep` provides "Information about an event related to the creation process for the source data." (INCITS 453). This is interpreted to mean that the link from a source to a process step is to a process step for which the described source is an output. USGIN recommended practice is described in section 4.18.
Data quality lineage process step (O) `dataQualityInfo/DQ_DataQuality/lineage/LI_Lineage/processStep`	C-C	An event in the development of the dataset. Each step requires a free text description, and may have a free text `rationale`, `dateTime` stamp when process was complete, 0 to many `CI_ResponsibleParty` elements identifying parties involved in the process, and finally 0 to many `source/LI_Source` associations to identify data that is input into the process step. Best practice recommended for USGIN is that source association from a process step is to inputs to a process, and `processStep` associations from a source element link an output resource to a process step that produced it. See USGIN recommended practice is described in section 4.18.
[role] Portrayal catalog information (O) `portrayalCatalogueInfo`	O-O	`portrayalCatalogueInfo/MD_PortrayalCatalogReference/portrayalCatalogueCitation/CI_Citation` element identifying a catalogue that contains symbols and rules to depict a resource. A portrayal catalog is a collection of defined symbols used to depict, to humans, features on a map. No documentation in ISO19115 about how this is supposed to work. ISO 19117 defines the structure of a Portrayal Catalogue. No USGIN recommended practices here yet.
[role] Metadata constraint information (O) `metadataConstraints`	O-O	This element specifies use constraints for access to the metadata record. Use constraints for accessing the describe resource are in `resourceConstraint/MD_Constraint` in `MD_DatasetIdentification` or `MD_ServiceIdentification`. Follow NAP for specification of access constraints. NAP provision is that `metadataConstraints/MD_Constraints/useLimitation` is mandatory when `MD_Constraints` is used to specify `metadataConstraints`. When one of the subtypes `MD_LegalConstraints` or `MD_SecurityConstraints` is used, `useLimitation` is optional. `MD_LegalConstraints` are specified by napMD_RestrictionCode, with values {`copyright, patent, patentPending, trademark, license, intellectualPropertyRights, restricted, otherRestrictions, licenseUnrestricted, licenseEndUser, licenseDistributor, privacy, statutory, confidential, sensitivity`}. `otherConstraints` is a free text element required by NAP if `accessConstraints` or `useConstraints` is set to "otherRestrictions." For an example: "Data only to be used for the purposes for which they were collected." `MD_SecurtyConstraints` has various optional free text values, and a required `MD_SecurityConstraints/classification` from napMD_ClassificationCode: {`unclassified, restricted, confidential, secret, topSecret, sensitive, forOfficialUseOnly`}

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ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments
[role] Application schema information (O) `applicationSchemaInfo`	O-O	Information about the information schema of the resource `applicationSchemaInfo/MD_ApplicationSchemaInformation` element has mandatory `name/CI_Citation`, `schemaLanguage` free text, and `constraintLanguage` free text. The `MD_ApplicationSchemaInformation` element also allows inclusion of an actual schema document as ASCII, or a binary `graphicsFile` or `softwareDevelopmentFile`. Multiple applicationSchemaInfo elements may be used for different presentations of a single schema, or for different kinds of schema (e.g. physical, logical, conceptual).
[role] Metadata maintenance information (O) `metadataMaintenance`	O-O	This element provides information about the maintenance schedule or history of the metadata record. Only one `MD_MaintenanceInformation` element may be included, with a required napMD_MaintenanceFrequencyCode: <continual, daily, weekly, fortnightly, monthly, quarterly, biannually, annually, asNeeded, irregular, notPlanned, unknown, semimonthly>
[role] Series information (O) `series`	X-X	The `MD_Metadata/series` element that appears in the ISO19139 schema appears to implement the metadata application model in ISO19115:2003 Figure 3, which is a UML class diagram defining the classes of geographic information to which metadata applies. The series role appears to allow modeling aggregation of datasets into various kinds of aggregation classes like DS_Series, DS_StereoMate, DS_Initiave … NAP does not mention it. Use case appears for bundling collections of related metadata records to allow simpler cross referencing and resolution of inherited property values. … Not Used by USGIN.
[role] Described resource (O) `describes`	X-X	The `MD_Metadata/describes` element that appears in the ISO19139 schema appears to implement the metadata application model in ISO19115:2003 Figure 3, which is a UML class diagram defining the classes of geographic information to which metadata applies. The `describes` association models the link from a metadata record to the described resource. … Not used by USGIN.
[role] Property type description (O) `propertyType`	X-X	The `MD_Metadata/propertyType` element that appears in the ISO19139 schema appears to implement the metadata application model in ISO19115:2003 Figure 3, which is a UML class diagram defining the classes of geographic information to which metadata applies. The `propertyType` association apparently models the fact that a metadata record might be attribute-level metadata—that is describing an individual property value assignment. … Not used by USGIN.
[role] Feature type description (O) `featureType`	X-X	Although an `MD_Metadata/featureType` element that appears in the ISO19139 schema appears to implement the metadata application model in ISO19115:2003 Figure 3, which is a UML class diagram defining the classes of geographic information to which metadata applies. The `featureType` association apparently models the fact that a metadata record might describe an individual feature. … Not used by USGIN.
[role] Feature attributes (O) `featureAttribute`	X-X	Although an `MD_Metadata/featureAttribute` element that appears in the ISO19139 schema appears to implement the metadata application model in ISO19115:2003 Figure 3, which is a UML class diagram defining the classes of geographic information to which metadata applies. The `featureAttribute` association apparently models the fact that a metadata record might be attribute-level metadata—that is describing an individual property value assignment; distinction between propertyType and featureAttribute is not explained. … Not used by USGIN.

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3.1.2 Dataset Identification properties (MD_DataIdentification)

The difference between metadata for services, and metadata for other resources is in the `identificationInfo` part of the ISO19139 xml schema. Service metadata utilizes the `SV_ServiceIdentification` element to provide a description and identification of a service (see 3.1.3 Service identification elements (SV_ServiceIdentification). This section documents usi of `MD_DataIdentification` for metadata describing other resources of interest in the geoscience information network.

Table 3. Dataset Identification properties (MD_DataIdentification)

ISO 19115 (M/C/O) xPath from MD_Metadata	**NAP-USGIN M/C/O**	**Comments on MD_DataIdentification**
Resource citation (M) `identificationInfo[1]/MD_DataIdentification/citation/CI_Citation`	M-M	The citation attribute provides information for citing the described resource. Citation is defined by Webster as "an act of quoting". The precise semantics of what an identification/citation is supposed to be are not very well articulated in ISO19115. For USGIN purposes, this should be viewed as information to identify the intellectual origin of the content in the described resource, along the lines of a citation in a scientific journal. Required content for a `CI_Citation` element are `title`, `date`, and '`responsibleParty`'.
Resource title (M) `identificationInfo[1]/MD_DataIdentification/citation/CI_Citation/title`	M-M	USGIN recommends using titles that inform the human reader about the dataset's content as well as its context.
Resource reference date (M) `identificationInfo/MD_DataIdentification/citation/CI_Citation/date/CI_Date/date/`	M-M	Best practice is to include at least the date of publication or creation of the resource. The date of the resource reported in the citation corresponds to the resource's last update version according to its update frequency. `CI_Date` content includes a `date` and `dateType`. Date for USGIN profile uses xs:date data type, defined thus "date uses the date/timeSevenPropertyModel, with hour, minute, and second required to be ***absent***. `timezoneOffset`· remains optional" (http://www.w3.org/TR/xmlschema11-2). Example date encoding: 2000-12-12+13:00, 2006-10-01. If the month or day is not known, encode as '00', for example '2006-00-00'. `DateType` is from napCI_DateTypeCode which identifies the event used for the temporal aspect of the resource. This date is distinct from the `dateStamp` for the metadata record, or the `EX_Extent/temporalElement` that specifies the time period to which the resource content is applicable.

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ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments on MD_DataIdentification
Unique resource identifier (O) `identificationInfo/MD_DataIdentification/citation/CI_Citation/identifier/MD_Identifier`	C-C	NAP makes `MD_Identifier` mandatory for dataset and dataset series. For USGIN, if the Citation has an identifier that is different from the identifier for the described resource (`MD_Metadata/dataSetURI`), it must be included here. For USGIN purposes, this element content value should be only considered an identifier for the citation, without any assumption that it will use http protocol. The identifier may be resolvable to a URL, if a protocol prefix specifies an identifier scheme that is resolvable (e.g. http, urn…), but this is not necessary for a valid document, and should not be assumed when processing metadata documents. The USGIN profile requires the use of MD_Identifier element to identify resources. RS_Identifier may substitute for MD_Identifier in the ISO19139 schema, but the USGIN profile requires use of MD_Identifer. If additional codespace and version content is associated with the identifier, it should be encoded as `MD_Identifier/authority/CI_Citation/alternateTitle` and `MD_Identifier/authority/CI_Citation/edition`
Resource responsible party (O) `identificationInfo/MD_DataIdentification/citation/CI_Citation/citedResponsibleParty`	M-M	CI_Citation cardinality exactly one required. USGIN requires at least one `CI_ResponsibleParty` following the NAP rule that count of (individualName + organisationName + positionName) > 0. The `CI_ResponsibleParty/role/CI_RoleCode@codeListValue` is from napCI_RoleCode. For most intellectual content, the responsible party is what would normally be considered the author of a work. Best practice is to include point of contact information for the resource in `MD_DataIdentification/pointOfContact/CI_ResponsibleParty`. Guidance on use of role codes would be helpful for consistency, but has not been developed as yet.
Resource presentation form (O) `identificationInfo/MD_DataIdentification/citation/CI_Citation/presentationForm`	O-C	The form in which the cited resource is available. Note that the citation is to the original source of intellectual content in the described resource, and its presentation may be different from the format for distribution described in the metadata. USGIN recommends that this element is required if there is a difference between the cited resource presentation format and the distribution format(s) listed in the `distributionInfo/MD_Distribution` section of the metadata record. `presentationForm` uses CodeList = napCI_PresentationFormCode, with code names {`documentDigital, documentHardcopy, imageDigital, imageHardcopy, mapDigital, mapHardcopy, modelDigital, modelHardcopy, profileDigital, profileHardcopy, tableDigital, tableHardcopy, videoDigital, videoHardcopy, audioDigital, audioHardcopy, multimediaDigital, multimediaHardcopy, diagramDigital, diagramHardcopy`}. See section 4.16.3 Codelists for details on codelist encoding.
Resource series (O) `identificationInfo/MD_DataIdentification/citation/CI_Citation/series`	O-O	Information about the (publication) series or collection of which the resource is a part. NAP rule: (name + issueIdentification) > 0.

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ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments on MD_DataIdentification
Resource other citation details (O) `identificationInfo/MD_DataIdentification/citation/CI_Citation/otherCitationDetails`	O-O	"Other information to complete a citation." NAP
Resource collective title (O) `identificationInfo/MD_DataIdentification/citation/CI_Citation/collectiveTitle`	O-C	Title of the combined resource that the cited resource is part of, for example the cited resource may be a paper in an anthology, in which case the anthology title would be the collective title. Required if the cited resource is part of such a collective work.
Resource abstract (M) `identificationInfo/MD_DataIdentification/abstract`	M-M	A free text summary of the content, significance, purpose, scope, etc. of the resource. Exactly one value.
Resource purpose (O) `identificationInfo/MD_DataIdentification/purpose`	O-O	"Summary of the intentions for which the dataset was developed. Purpose includes objectives for creating the dataset and what the dataset is to support." NAP
Resource status (O) `identificationInfo/MD_DataIdentification/status`	M-M	Value is from napMD_ProgressCode codelist: {`completed, historicalArchive, obsolete, onGoing, planned, required, underDevelopment, proposed`}. Obsolete is synonymous with deprecated. See section 4.16.3 *Codelists* for details on codelist usage.
Resource point of contact (O) `identificationInfo/MD_DataIdentification/pointOfContact`	O-C	CI_ResponsibleParty element here would contain information for point of contact to access the resource. This information is mandatory for physical resources such as core, cuttings, samples, manuscripts. USGIN rule that count of (individualName + organisationName + positionName) > 0. The `CI_ResponsibleParty/role/CI_RoleCode` is from napCI_RoleCode.

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ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments on MD_DataIdentification
Resource maintenance (O) `identificationInfo/MD_DataIdentification/resourceMaintenance`	O-O	This element provides information about the maintenance schedule or history of the resource (or some subset/part of the resource specified by the scope and scope description) described by the metadata record. 0 to many `MD_MaintenanceInformation` elements may be included. Different `MD_MaintenanceInformation` elements are required to have different napMD_ScopeCode or `MD_ScopeDescription`. Usage of `MD_ScopeDescription` is poorly described, and no actual examples of usage could be found; it would appear to allow identification of a set of attribute or features (by name?), or feature instances or attribute instances (identified how?), or a dataset, to which the maintenance information applies. napMD_MaintenanceFrequencyCode codelist: {`continual, daily, weekly, fortnightly, monthly, quarterly, biannually, annually, asNeeded, irregular, notPlanned, unknown, semimonthly`}. See section 4.16.3 *Codelists* for details on codelist usage.
Graphic overview of resource (O) `identificationInfo/MD_DataIdentification/graphicOverview`	O-O	Highly recommended to include a URL providing a web-accessible visual representation of the resource if it is applicable to the described resource, particularly for geographic datasets that may be represented by maps. If `MD_BrowseGraphic` is included, `MD_BrowseGraphic/filename` character string is mandatory. USGIN Recommended practice is to provide a complete URL as a gco:characterString value for the `filename` property. Use napMD_FileFormatCode code values (http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_115) in `fileType/CharacterString`. See section 4.16.3 *Codelists* for details on codelist usage. Repeatable element; multiple values may present different resolutions, or different parts of resource. Names associated with overview should provide sufficient information for user to distinguish these.
Resource format (O) `identificationInfo/MD_DataIdentification/resourceFormat`	X-X	This element is not used by NAP or USGIN; this information is encoded in `MD_Metadata/distributionInfo/MD_Distribution/` in USGIN metadata (see 4.12 Use of MD_Distribution and MD_Distributor).
Resource keywords (O) `identificationInfo/MD_DataIdentification/descriptiveKeywords/MD_Keyword`	O-O	Best Practice for USGIN profile metadata is to supply keywords to facilitate the discovery of metadata records relevant to the user. **USGIN Keywords**: USGIN keyword vocabularies are in development. Future versions of this profile may include required keyword vocabularies. **Other Keywords**: Keyword Type - allowed values from napMD_KeywordTypeCode: {`discipline, place, stratum, temporal, theme, product, subTopicCategory`}. See section 4.16.3 Codelists for details on codelist usage. NAP MD_Keyword only requires that the keyword string be included. USGIN requires that `MD_Keyword/keyword` contain a `CharacterString` (see section 4.15). USGIN best practice is to include keywords in English.

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ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments on MD_DataIdentification
Condition applying to access and use of resource (O) `identificationInfo/MD_DataIdentification/resourceConstraints/`	O-O	Restrictions on the access and use of a resource or metadata. Follow NAP for specification of `resourceConstraints`. This attribute provides information for access control to the described resource itself. In some situations, the `metadataConstraints` may allow a user to learn of the existence of a resource that they may not actually be able to access without further clearance. Constraints may be represented by `MD_Constraint`, `MD_LegalConstraint`, or `MD_SecurityConstraint`.
Aggregation information (O) `identificationInfo/MD_DataIdentification/aggregationInfo/MD_AggregateInformation`	O-O	This element includes either a citation for or identifier of an associated dataset, along with the type of association between the datasets, and optionally the activity that produced the dataset. `MD_AggregateInformation` requires either `aggregateDataSetName/CI_Citation` or `aggregateDataSetIdentifier/MD_Identifier`. `MD_AggregateInformation/associationType` is mandatory, from napDS_AssociationTypeCode: {`crossReference, largerWorkCitation, partOfSeamlessDatabase, source, stereoMate, isComposedOf`}. See section 4.16.3 *Codelists* for details on codelist usage. If the related resource has an associated metadata record, USGIN recommended practice is to include the identifier for that metadata record in `aggregateDataSetIdentifier/MD_Identifier`. For related resources that do not have a metadata record, `aggregateDataSetName/CI_Citation` may be used; this element is optional if `aggregateDataSetIdentifier` has a value. For USGIN profile, this property, rather than `MD_Metadata/parentIdentifier`, should be used to indicate relationships between described resources.
Spatial Representation Type (O) `MD_DataIdentification/spatialRepresentationType/`	O-O	value from napMD_SpatialRepresentationTypeCode list {`vector, grid, textTable, tin, stereoModel, video`}. See section 4.16.3 *Codelists* for details on codelist usage.
Resource spatial resolution (O) `MD_DataIdentification/spatialResolution/MD_resolution/equivalentScale/MD_RepresentativeFraction/denominator`	C-C	USGIN requires use of `equivalentScale/../denominator` to express spatial resolution, in order to be more easily interoperable. ISO19139 schema requires `MD_resolution` to be specified by an `equivalentScale/MD_RepresentativeFraction/denominator` or a `distance` (or both), so if a `distance` is available, that should be supplied as well. The resolution distance represents the smallest length between two resolvable points in the dataset. To calculate `equivalentScale` given a resolution distance, recommended practice is to divide the resolution distance in meters by 0.0005. This assumes that the smallest distance resolvable in a map display for human usage is 0.5 mm.
Resource language (O) `identificationInfo/MD_DataIdentification/language`	M-M	Language for content of described resource. The mandatory optionality is inherited from NAP, although it does not make sense for non-language based content like images or physical samples. Default value is 'eng'. If language is not applicable to the described resource use 'zxx'. Multiple instances of this element indicate that the linguistic content of the resource is available in multiple languages. Three-letter language code followed by an optional three-letter country code: {ISO 639-2/T three letter language code>{<;><blank space><ISO 3166-1 three letter country code} Language code is given in lowercase. Country code is given in uppercase. ISO 639 codelists are available at http://www.loc.gov/standards/iso639-2/php/code_list.php. ISO 3166-1 codelists are at http://www.iso.org/iso/english_country_names_and_code_elements.

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ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments on MD_DataIdentification
Topic category `identificationInfo/MD_DataIdentification/topicCategory`	C-C	NAP specifies that topicCategory code shall be provided when hierarchyLevel is set to "dataset" or "dataset series". Codes are from napMD_TopicCategoryCode: {`farming, biota, boundaries, climatologyMeterologyAtmosphere, economy, elevation, environment, geoscientificInformation, health, imageryBaseMapsEarthCover, intelligenceMilitary, inlandWater, location, oceans, planningCadastre, society, structure, transportation, utilitiesCommunication`}. See section 4.16.3 *Codelists* for details on codelist usage.Most USGIN resources will have MD_TopicCategoryCode = "`geoscientificInformation`", which is the default value for this profile. More specific topic categorization should be done using keywords. NAP declares not applicable to services.
Resource content extent `identificationInfo/MD_DataIdentification/extent/EX_Extent`	C-C	Defines the spatial (horizontal and vertical) and temporal region to which the content of the resource applies. For USGIN, the spatial extent is a rectangle that bounds the geographic extent to which resource content applies. NAP specifies required when `hierarchyLevel` is set to 'dataset'. Best Practice for USGIN is to include an extent for any resource with content related to some geographic or temporal location. For geoscience resources, the temporal extent may be expressed using time ordinal eras from a geologic time scale if the resource is related to some particular geologic time. USGIN specifies count(`description` + `geographicElement` + `temporalElement`) >0
Resource content extent description `identificationInfo/MD_DataIdentification/extent/EX_Extent/description`	C-C	Free text that describes the spatial and temporal extent of the dataset. USGIN specifies that `description` is mandatory if a `geographicElement` or `temporalElement` is not provided. Note that if geographic place names are used to express the geographic extent, USGIN profile specifies that these should be encoded using keyword with keyword type code = '`place`.' Geographic names may be duplicated in the `EX_Extent/description`.
Resource content extent bounding box `identificationInfo/MD_DataIdentification/extent/EX_Extent/geographicElement/EX_GeographicBoundingBox`	O-C	USGIN profile requires that if an `EX_Extent/geographicElement` is supplied, it include a geographic bounding box with bounding latitude and longitude expressed using World Geodesic System WGS 84 decimal degrees. The corner coordinates for the geographic bounding box must not coincide in one point, because this may result in fatal errors with some CSW implementations. Point locations must thus be represented as tiny rectangles. USGIN recommended practice is to place the actual point location in the lower left corner of the rectangle.
Resource content extent geographic description `identificationInfo/MD_DataIdentification/extent/EX_Extent/geographicElement/EX_GeographicDescription`	C-X	Not used by USGIN profile, use keyword with type code = '`place`'. This ISO19115 element provides an `MD_Identifier` element that identifies a geographic location by name. `MD_Identifier` provides an `authority/CI_Citation` that specifies the `authority` for a location name, and a `code`, which is a text string identifying the location. For the purposes of USGIN metadata, this information should be encoded using keywords, for which the napMD_KeywordTypeCode = '`place`'; the `thesaurus/CI_Citation` has the same content as `EX_GeographicDescription/authority/CI_Citation`, and the keyword is the same as the `EX_GeographicDescription/code`.

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ISO 19115 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments on MD_DataIdentification
Resource content extent bounding polygon `identificationInfo/MD_DataIdentification/extent/EX_Extent/geographicElement/EX_BoundingPolygon`	C-X	Not used by USGIN profile. To improve interoperability, USGIN mandates the use of Geographic Bounding Box instead of bounding polygon. "An element which describes inclusions or exclusions in a resource. The enclosed boundary of the dataset expressed in x-y coordinates."

Resource temporal extent (O)
`identificationInfo/MD_DataIdentification/extent/EX_Extent/temporalElement/EX_TemporalExtent/extent/TimePeriod`
	O-O	Property contains information about temporal extent to which resource is applicable. For many geoscience resources, this would be the geologic time period(s) to which the resource applies. USGIN mandates use of `TimePeriod` for all temporal extents. For geologic time extents, USGIN requires the values for `beginPosition@frame` and `endPosition@frame` to be populated using numeric time coordinates in Ma, measured positive increasing older with an origin at 1950 CE (see Temporal extents). The default frame attribute value for geologic time coordinates is "urn:cgi:trs:CGI:StandardGeologicTimeMa"
		Example:
		`<gml:TimePeriod gml:id="IdJurassic">`
		`<gml:name>Jurassic</gml:name>`
		`<gml:beginPosition`
		`frame=" urn:cgi:trs:CGI:StandardGeologicTimeMa">203</gml:beginPosition>`
		`<gml:endPosition`
		`frame=" urn:cgi:trs:CGI:StandardGeologicTimeMa ">135</gml:endPosition>`
		`</gml:TimePeriod>`

Resource spatio-temporal extent (O) `identificationInfo/MD_DataIdentification/extent/EX_Extent/temporalElement/EX_SpatialTemporalExtent/`	O-X	Not used. Although use of `EX_SpatialTemporalExtent` is allowed by ISO19139 and NAP, USGIN mandates encoding space time location with `EX_TemporalExtent` and `EX_GeographicBoundingBox`.
Resource vertical extent (O) `identificationInfo/MD_DataIdentification/extent/EX_Extent/verticalElement/EX_VerticalExtent`	O-O	Vertical extent is used to provide elevation location for resources that have an explicit vertical location. Most common example will be samples related to vertical location in a borehole. The borehole trace is the vertical CRS within which the sample will be located, typically using coordinates measured in linear distance from the collar (or ground level, or Kelly bushing) of the borehole. `EX_VerticalExtent` has `minimumValue`, `maximumValue` that are real numbers, and a `verticalCRS` `verticalCRS` has (minimally) an xlink:href attribute which references an EPSG registry code (http://www.epsg-registry.org/). For interoperability, USGIN mandates use of a VerticalCRS with origin at World mean sea level (MSL), with elevations measured up positive in meters; the URI for this VerticalCRS is "urn:ogc:def:crs:EPSG::5714"

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3.1.3 Service identification elements (SV_ServiceIdentification)

Table 4. Service Identification properties (SV_ServiceIdentification)

ISO 19115 and 19119 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments on SV_ServiceIdentification
Resource service citation (M) `identificationInfo[1]/SV_ServiceIdentification/citation/CI_Citation`	M-M	The citation attribute provides information for citing the described service. Note that for scientific citation purposes, a citation for the intellectual content of the information presented by the service would be found in the `MD_DataIdentification/citation/CI_Citation` for datasets identified in the `operatesOn` section of `SV_ServiceIdentification`. Citation is defined by Webster as "an act of quoting". For USGIN purposes, this should be viewed as information to identify the intellectual origin or authority for the content in the described resource, along the lines of a citation in a scientific journal. The purpose of the citation for the service is to identify a particular service instance as a unique entity. Required content for a `CI_Citation` element are `title`, `date`, and `responsibleParty`.
Resource title (M) `identificationInfo[1]/SV_ServiceIdentification/citation/CI_Citation/title`	M-M	USGIN recommends that the title in a service identification citation should uniquely identify the particular service instance, and inform the human reader about the service content, function, and context.
Resource reference date (M) `identificationInfo/SV_ServiceIdentification/citation/CI_Citation/date/CI_Date/date/`	M-M	The citation date for a service may indicate the creation date, when the service first became operational, the publication date, when the service first became public, or the revision date, which specifies the date of most recent update. If the service is no longer online, a notAvailable or superseded date may be specified. These are differentiated by the `DateType`. `CI_Date` content includes a `date` and `dateType`. Date for USGIN profile uses xs:date data type, defined thus "date uses the date/timeSevenPropertyModel, with *hour*, *minute*, and *second* required to be ***absent***. *timezoneOffset* remains optional" (http://www.w3.org/TR/xmlschema11-2). Example date encoding: 2000-12-12+13:00, 2006-10-01. If the month or day is not known, encode as '01', for example '2006-01-01'. `DateType` is from napCI_DateTypeCode which identifies the event used for the temporal aspect of the resource. This date is distinct from the `dateStamp` for the metadata record, or the `EX_Extent/temporalElement` that specifies the time period to which the resource content is applicable. napCI_DateTypeCode names that apply to services include {`creation, publication, revision, notAvailable, superseded`}. See section 4.16.3 *Codelists* for details on codelist usage.

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ISO 19115 and 19119 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments on SV_ServiceIdentification
Unique resource identifier (O) `identificationInfo/SV_ServiceIdentification/citation/CI_Citation/identifier/MD_Identifier`	C-O	For USGIN, because the Citation is for the service, this identifier should be identical to `MD_Metadta/dataSetURI`, and is therefore optional. For USGIN purposes, this element content value is only an identifier for the citation; it is not a URL for accessing the service. The USGIN profile requires the use of MD_Identifier element to identify resources. RS_Identifier may substitute for MD_Identifier in the ISO19139 schema, but the USGIN profile requires use of MD_Identifer. If additional codespace and version content is associated with the identifier, it should be encoded as `MD_Identifier/authority/CI_Citation/alternateTitle` and `MD_Identifier/authority/CI_Citation/edition`
Resource responsible party (O) `identificationInfo/SV_ServiceIdentification/citation/CI_Citation/citedResponsibleParty`	M-M	USGIN requires at least one `CI_ResponsibleParty` following the NAP rule that count of (individualName + organisationName + positionName) > 0. The `CI_ResponsibleParty/role/CI_RoleCode` is from napCI_RoleCode. For a service, the point of contact information for questions or reporting problems should be in `SV_ServiceIdentification/pointOfContact/CI_ResponsibleParty`. The service citation responsible party would logically identify the parties responsible for creating (implementing) and publishing the service. NAP Role code names applicable to a service citation include {`originator, principalInvestigator, processor, author, publisher, collaborator`}. {`resourceProvider, custodian, owner, rightsHolder, mediator`} would logically be specified in the `SV_ServiceIdentification/pointOfContact` element. See section 4.16.3 Codelists for details on codelist usage.
Resource presentation form (O) `identificationInfo/SV_ServiceIdentification/citation/CI_Citation/presentationForm`	O-O	The form in which the service is available, which in the case of a service is only through the service implementation described by the metadata record, so the information here is not generally very useful. Note that the citation is to the original source of intellectual content in the described resource should be in `MD_DataIdentification/citation/CI_Citation` that describes the datasets operated on by the service. `presentationForm` uses the napCI_PresentationFormCode codelist; code names that are applicable to a service citation include {`documentDigital, imageDigital, mapDigital, modelDigital, profileDigital, tableDigital, videoDigital, audioDigital, multimediaDigital, diagramDigital`}. See section 4.16.3 Codelists for details on codelist usage.
Resource series (O) `identificationInfo/SV_ServiceIdentification/citation/CI_Citation/series`	O-O	Information about the series or collection of which the cited service is a part. NAP rule: (name + issueIdentification) > 0. At this point there is not much precedent for aggregating services into a formal series, so in general this element is probably not applicable to services.

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ISO 19115 and 19119 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments on SV_ServiceIdentification
Resource other citation details (O) `identificationInfo/SV_ServiceIdentification/citation/CI_Citation/otherCitationDetails`	O-O	"Free text information useful to identify and cite the described service instance, usage is not specified by this profile.
Resource collective title (O) `identificationInfo/SV_ServiceIdentification/citation/CI_Citation/collectiveTitle`	O-O	Free text title of a" combined resource of which the service is a part." At this point there is not much precedent for aggregating services into a collections, so in general this element is probably not applicable to services. Use aggregation info to link layer-specific service metadata records to a metadata record for the aggregate service that serves the layer.
Resource abstract (M) `identificationInfo/SV_ServiceIdentification/abstract`	M-M	A free text summary of the content, significance, purpose, scope, etc. of the service described by this metadata. Exactly one value.
Resource purpose (O) `identificationInfo/SV_ServiceIdentification/purpose`	O-O	Text summary of the intentions for which the service was developed, including objectives for creating the service and use cases it is designed to support. One value optional.
Resource status (O) `identificationInfo/SV_ServiceIdentification/status`	M-M	Value is from napMD_ProgressCode codelist. Code names applicable to services include {`completed, obsolete, onGoing, planned, required, underDevelopment, proposed`}. Obsolete is synonymous with deprecated. See section 4.16.3 *Codelists* for details on codelist usage.
Resource point of contact (O) `identificationInfo/SV_ServiceIdentification/pointOfContact`	O-O	`pointOfContact/CI_ResponsibleParty` element for service metadata should contain information for a point of contact to report problems with the service. Element is optional but highly recommended! USGIN rule that count of (individualName + organisationName + positionName) > 0. The `CI_ResponsibleParty/role/CI_RoleCode@codeListValue` is from napCI_RoleCode; applicable name for the point of contact party are {`resourceProvider, custodian, owner`}. See section 4.16.3 *Codelists* for details on codelist usage.

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ISO 19115 and 19119 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments on SV_ServiceIdentification
Resource maintenance (O) `identificationInfo/SV_ServiceIdentification/resourceMaintenance`	O-O	This element provides information about the maintenance schedule or history of the service described by the metadata record. For a service, only one `MD_MaintenanceInformation` elements may be included; for which the `MD_ScopeDescription` napMD_ScopeCode will be 'service'. If `MD_MaintenanceInformation` is present, then `maintenanceAndUpdateFrequency` is mandatatory, populated by a MantenanceFrequency-Code; names in this code list are {`continual, daily, weekly, fortnightly, monthly, quarterly, biannually, annually, asNeeded, irregular, notPlanned, unknown, semimonthly`}. See section 4.16.3 *Codelists* for details on codelist usage. NAP specified best practice is that when `SV_ServiceIdentification/status` is set to "onGoing," either the attribute `MD_MaintenanceInformation/dateOfNextUpdate` or `MD_MaintenanceInformation/userDefinedMaintenanceFrequency` must be provided. Maintenance information for data the service presents should be included in the dataset metadata for coupleResources associated with the service.
Graphic overview of resource (O) `identificationInfo/SV_ServiceIdentification/graphicOverview`	O-O	Highly recommended to include a small image visual representation of the resource provided by a map or image service. For geographic feature or data services, a graphic overview might show the geographic distribution of available data. If `MD_BrowseGraphic` is included, `MD_BrowseGraphic/filename` character string is mandatory. USGIN Recommended practice is to provide a complete URL as a gco:characterString value for the `filename` property. Use napMD_FileFormatCode code values (http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_115) in `fileType/CharacterString`. See section 4.16.3 *Codelists* for details on encoding of the file format code, which is special because this is a NAP extension to the ISO base specification. Repeatable element; multiple values may present different resolutions, or different parts of resource. Names associated with overview should provide sufficient information for user to distinguish these.
Resource format (O) `identificationInfo/SV_ServiceIdentification/resourceFormat`	O-X	The format of service response documents varies at the operation level, and for a particular operation, different output formats may be requested. A listing of all possible options here without bindings to the operations that respond with that format is not useful. NAP does not include this role in the list of properties associated with `SV_ServiceIdentification`

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ISO 19115 and 19119 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments on SV_ServiceIdentification
Resource keywords (O) `identificationInfo/SV_ServiceIdentification/descriptiveKeywords/MD_Keyword`	O-O	Best Practice for USGIN profile metadata is to supply keywords to facilitate the discovery of metadata records relevant to the user. **USGIN Keywords**: USGIN keyword vocabularies are in development. Future versions of this profile may include required keyword vocabularies. **Other Keywords**: Keyword Type - allowed values from napMD_KeywordTypeCode: {`discipline, place, stratum, temporal, theme, product, subTopicCategory`}. See section 4.16.3 Codelists for details on codelist usage. NAP MD_Keyword only requires that the keyword string be included. USGIN requires that `MD_Keyword/keyword` contain a `CharacterString` (see section 4.15). USGIN best practice is to include keywords in English.
Resource specific usage (O) `identificationInfo/SV_ServiceIdentification/resourceSpecificUsage/`	O-X	NAP excludes this property in INCITS 453, figure 64 p.175, but it is schema valid under http://schemas.opengis.net/iso/19139/20060504/serviceMetadata.xsd, which is the service metadata schema imported by apiso.xsd for the OGC CSW profile for ISO19115/19 metadata. Property not used by USGIN.
Condition applying to access and use of resource (O) `identificationInfo/SV_ServiceIdentification/resourceConstraints/`	O-O	Restrictions on the access and use of a service. Follow NAP for specification of `resourceConstraints`. This attribute provides information for access control to the described service. In some situations, the `metadataConstraints` may allow a user to learn of the existence of a resource that they may not actually be able to access without further clearance. Follow NAP for specification of resourceConstraints. Constraints may be represented by `MD_Constraint`, `MD_LegalConstraint`, or `MD_SecurityConstraint`. The attribute `MD_Constraint/useLimitation` is mandatory unless `MD_LegalConstraint` or `MD_SecurityConstraint` is provided. Condition applying to access and use of resource - ISO19119 duplicates this property as `SV_ServiceIdentification/restrictions`. NAP specifies that `SV_ServiceIdentification/resourceConstraints` is to be used, and `SV_ServiceIdentification/restrictions` is not to be used; USGIN profile follows this provision.

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ISO 19115 and 19119 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments on SV_ServiceIdentification
Aggregation information (O) `identificationInfo/SV_ServiceIdentification/aggregationInfo/MD_AggregateInformation`	O-O	This element includes either a citation for or identifier of an associated service or dataset, along with the type of association, and optionally the activity that produced the dataset. `MD_AggregateInformation` requires either `aggregateDataSetName/CI_Citation` or `aggregateDataSetIdentifier/MD_Identifier`. `associationType` is mandatory, from napDS_AssociationTypeCode. Code names in this list include {`crossReference, largerWorkCitation, partOfSeamlessDatabase, source, stereoMate, isComposedOf`}. See section 4.16.3 *Codelists* for details on codelist usage. The only currently recognized use for this aggregation would be to associate metadata for individual layers with metadata for a service that provides a collection of layers. If the related resource has an associated metadata record, USGIN recommended practice is to include the identifier for that metadata record in `aggregateDataSetIdentifier/MD_Identifier`. For related resources that do not have a metadata record, `aggregateDataSetName/CI_Citation` may be used; this element is optional if `aggregateDataSetIdentifier` has a value. For USGIN profile, this property, rather than `MD_Metadata/parentIdentifier`, should be used to indicate relationships between described resources.

Resource service type (M)
`identificationInfo/SV_ServiceIdentification/serviceType`
	M-M	Exactly one value required. USGIN mandates use of a `LocalName` value (http://schemas.opengis.net/iso/19139/20060504/srv/serviceMetadata.xsd allows either localName or ScopedName). There is not as yet a standard registry of service types and identifiers that can serve as an authority for serviceTypes. An interim list of service types and identifiers is included in section 8.2 ServiceType (with the ad hoc codespace URI 'http://resources.usgin.org/registry/serviceType201001'). ""Valid values for OGC services are {`WMS, WFS, WCS, CSW, …`}
		Example:
		`<srv:serviceType>`
		`  <gco:LocalName codeSpace=`
		`"http://resources.usgin.org/registry/serviceType201001">WMS</gco:LocalName>`
		`</srv:serviceType>`

Resource service type version (O) `identificationInfo/SV_ServiceIdentification/serviceTypeVersion`	O-C	Multiple serviceTypeVersion tags may not be implemented in some harvesting server applications - USGIN recommends a reverse chronological order for supported versions. Constraint: if various versions are available, it is mandatory to list versions that are supported. Default is oldest version of service.
Resource service access properties (O) `identificationInfo/SV_ServiceIdentification/accessProperties`	O-O	Optional MD_StandardOrderProcess element to provide information on the availability of the service which include: fees, available date and time, ordering instructions, turnaround. Ordering instructions and turnaround are not applicable to web services.

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ISO 19115 and 19119 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments on SV_ServiceIdentification
Resource service restrictions (O) `identificationInfo/SV_ServiceIdentification/restrictions`	O-X	Not used by USGIN; use `resourceConstraints` as per NAP.
Keywords (O) `identificationInfo/SV_ServiceIdentification/keywords`	O-X	Not used by USGIN; use `descriptiveKeywords` as per NAP
Resource service content extent (O) `identificationInfo/SV_ServiceIdentification/extent/EX_Extent`	C-C	Defines the spatial (horizontal and vertical) and temporal region to which the content of the resource applies. For USGIN, the spatial extent is a rectangle that bounds the geographic extent to which resource content applies. Best Practice for USGIN is to include an extent for any resource with content related to some geographic or temporal location. For geoscience resources, the temporal extent may be expressed using time ordinal eras from a geologic time scale if the resource is related to some particular geologic time. USGIN specifies count(`description` + `geographicElement` + `temporalElement`) >0
Resource service content extent description ( ) `identificationInfo/SV_ServiceIdentification/extent/EX_Extent/description`	C-C	Free text that describes the spatial and temporal extent of the dataset. USGIN specifies that `description` is mandatory if a `geographicElement` or `temporalElement` is not provided. Note that if geographic place names are used to express the geographic extent, USGIN profile specifies that these should be encoded using keyword with keyword type code = '`place`'. Geographic names may be duplicated in the `EX_Extent/description`.
Resource service content extent bounding box ( ) `identificationInfo/SV_ServiceIdentification/extent/EX_Extent/geographicElement/EX_GeographicBoundingBox`	O-C	USGIN profile requires that if an `EX_Extent/geographicElement` is supplied, it include a geographic bounding box with bounding latitude and longitude expressed using WGS 84 decimal degrees. The corner coordinates for the geographic bounding box must not coincide in one point, because this may result in fatal errors with some CSW implementations. Point locations must thus be represented as tiny rectangles. USGIN recommended practice is to place the actual point location in the lower left corner of the rectangle.

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ISO 19115 and 19119 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments on SV_ServiceIdentification
Resource service content extent geographic description ( ) `identificationInfo/SV_ServiceIdentification/extent/EX_Extent/geographicElement/EX_GeographicDescription`	C-X	Not used by USGIN profile, use keyword with type code = 'place'. This ISO19115 element provides an `MD_Identifier` element that identifies a geographic location by name. `MD_Identifier` provides an `authority/CI_Citation` that specifies the `authority` for a location name, and a `code`, which is a text string identifying the location. For the purposes of USGIN metadata, this information should be encoded using keywords, for which the napMD_KeywordTypeCode = 'place'; the `thesaurus/CI_Citation` has the same content as `EX_GeographicDescription/authority/CI_Citation`, and the keyword is the same as the `EX_GeographicDescription/code`.
Resource service content extent bounding polygon ( ) `identificationInfo/SV_ServiceIdentification/extent/EX_Extent/geographicElement/EX_BoundingPolygon`	C-X	To improve interoperability, USGIN mandates use of Geographic Bounding Box; bounding polygons may be present, but may be ignored by harvesters.
Resource service temporal extent (O) `identificationInfo/SV_ServiceIdentification/extent/EX_Extent/temporalElement/EX_TemporalExtent/extent/TimePeriod`	O-O	Property contains information about temporal extent to which resource is applicable. For many geoscience resources, this would be the geologic time period(s) to which the resource applies. Although the ISO19139 xml schema allows temporal extents to be instants, intervals, or ordered eras, USGIN mandates use of only `TimePeriod` for temporal extent in order to make metadata interoperable. USGIN mandates that values for `beginPosition@frame` and `endPosition@frame` must be populated. The default frame property value is "#ISO-8601", for standard calendar date and time. For geologic time extents, USGIN requires the values for `beginPosition@frame` and `endPosition@frame` to be populated using numeric time coordinates in Ma, measured positive increasing older with an origin at 1950 CE (see *Temporal extents*). The default frame attribute value for geologic time coordinates is "urn:cgi:trs:CGI:StandardGeologicTimeMa". See section 4.20, below.
Resource service spatio-temporal extent (O) `identificationInfo/SV_ServiceIdentification/extent/EX_Extent/temporalElement/EX_SpatialTemporalExtent/`	O-X	Although use of `EX_SpatialTemporalExtent` is allowed by ISO19139 and NAP, USGIN best practice is to encode space time location with `EX_TemporalExtent` and `EX_GeographicBoundingBox`. Other optional extent elements may be included, but they may be ignored by client implementations processing the metadata document.

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ISO 19115 and 19119 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments on SV_ServiceIdentification
Resource service vertical extent (O) `identificationInfo/SV_ServiceIdentification/extent/EX_Extent/verticalElement/EX_VerticalExtent`	O-O	Vertical extent is used to provide elevation location for resources that have an explicit vertical location. Most common example will be samples related to vertical location in a borehole. The borehole trace is the vertical CRS within which the sample will be located, typically using coordinates measured in linear distance from the collar (or ground level, or Kelly bushing) of the borehole. `EX_VerticalExtent` has `minimumValue`, `maximumValue` that are real numbers, and a `verticalCRS` `verticalCRS` has (minimally) an xlink:href attribute which references an EPSG registry code (http://www.epsg-registry.org/). The default VerticalCRS code is for the World mean sea level (MSL) in meters: "urn:ogc:def:crs:EPSG::5714"
Coupled Resource ( ) `identificationInfo/SV_ServiceIdentification/coupledResource`	O-O	This element correlates operations (identified by `operationName`) with datasets (identified by `identifier`). For logical consistenty, and `SV_coupledResource/identifier` values should be equal to `MD_DataIdentification/citation/CI_Citation/identifier/MD_Identifier/code` for a dataset that is the target of a `SV_ServiceIdentification/operatesOn` element (either in an inline `MD_DataIdentification/citation../code` element, or a `@uuidref` attribute). This element is necessary to implement the many-to-many relationship between data sources and operations in a single service.
Coupled Resource operation name (M) `identificationInfo/SV_ServiceIdentification/coupledResource/SV_CoupledResource/operationName`	M-M	String, the name of the service operation: GetMap, GetFeature, etc. There is no internal check in the metadata record that the given operation name is valid.
Coupled Resource identifier (M) `identificationInfo/SV_ServiceIdentification/coupledResource/SV_CoupledResource/identifier`	M-M	Identifier of a given tightly coupled dataset. Equal to `MD_DataIdentification/citation/CI_Citation/identifier/MD_Identifier/code` for a dataset that is the target of a `SV_ServiceIdentification/operatesOn` element (either in an inline `MD_DataIdentification/citation../code` element, or a `@uuidref` attribute).
Coupled Resource scoped name (X) `identificationInfo/SV_ServiceIdentification/coupledResource/SV_CoupledResource/ScopedName`	X-O	OGC 07-045 application profile for ISO metadata using CSW 2.0.2 extends SV_CoupledResource with a ScopedName, defined as a scoped identifier of the resource in the context of the given service instance (e.g. layer name or featureTypeName). This is necessary for users to generate service requests (like GetMap or GetFeature) based on ISO service metadata.

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ISO 19115 and 19119 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments on SV_ServiceIdentification
Service coupling type (M) `identificationInfo/SV_ServiceIdentification/couplingType`	M-M	Type of coupling between service and associated data (if exists) - "Qualitative information on the tightness with which the service and the associated data are coupled." NAP. NAP uses the napSV_CouplingType codelist. According to ISO: • loose - service instance is loosely coupled with a data instance, i.e. no MD_DataIdentification class has to be described (ISO 19119). • mixed - service instance is mixed coupled with a data instance, i.e. MD_DataIdentification describes the associated data instance and additionally the service instance might work with other external data instances (ISO 19119 / ISO 19115). • tight - service instance is tightly coupled with a data instance, i.e. MD_DataIdentification class MUST be described. (ISO 19119 / ISO 19115) According to OGC: • loose - A service instance that is not associated with a specific dataset or datasetcollection. Looselycoupled services may have an association with data types through the service type definition. Dataset metadata need not be provided in the service metadata. • mixed - A service that is associated with a specific dataset or datasetcollection. Service metadata shall describe both the service and the geographic dataset, the latter being defined in accordance with ISO 19115. But this service instance can also be used with external data (i.e. data that is not described by the operatesOn association). • tight - An information resource that is hosted on a specific set of hardware and accessible over a network.
Service operations (M) `identificationInfo/SV_ServiceIdentification/containsOperations`	M-M	"This element is intended for use to describe the operations performed by the service". However, the ISO19119 model includes insufficient detail to completely describe all parameters necessary to automate connection to a service. Widely used xml formats exist to describe service function, including OGC getCapabilities.xml and W3C Web Service Description Language (WSDL). Following INSPIRE guidelines, USGIN does not use the srv:containsOperations. It is a required element in the ISO19139 (20060504) srv.xsd xml schema, so it should be populated with the attribute gco:nilReason='Missing'. Although this is xml schema valid, it may break some existing client implementations; we need to work with developers to correct these problems. For information describing function of the service see distributionInfo/../transferOptions/../online/../linkage where online/../name = 'serviceDescription'; this should provide a URL for getCapabilities or a WSDL document, depending on the service type.

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ISO 19115 and 19119 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments on SV_ServiceIdentification
Service operation name (M) `identificationInfo/SV_ServiceIdentification/containsOperations/SV_OperationMetadata/operationName`	M-X	not used by this profile
Service operation distributed computing platforms (M) `identificationInfo/SV_ServiceIdentification/containsOperations/SV_OperationMetadata/DCP`	M-X	""not used by this profile
Service operation description (O) `identificationInfo/SV_ServiceIdentification/containsOperations/SV_OperationMetadata/operationDescription`	O-X	"not used by this profile
Service operation invocation name (O) `identificationInfo/SV_ServiceIdentification/containsOperations/SV_OperationMetadata/invocationName`	O-X	"not used by this profile
Service operation online resource (M) `identificationInfo/SV_ServiceIdentification/containsOperations/SV_OperationMetadata/connectpoint`	M-X	not used by this profile; see `distributionInfo/../transferOptions/../onLine`

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ISO 19115 and 19119 (M/C/O) xPath from MD_Metadata	NAP-USGIN M/C/O	Comments on SV_ServiceIdentification
Service operates on (O) `identificationInfo/SV_ServiceIdentification/operatesOn`	O-C	"Provides information on the datasets that the service operates on." ISO 19119. With tightly coupled references, `operatesOn` must include a map or feature layer's valid `MD_DataIdentification` element inline or a `@uuidref` attribute value that explicitly links to an existing dataset metadata record that describes the same layer. Mandatory if metadata for datasets on which the service operates are available. The value of `SV_ServiceIdentification/operatesOn@uuidref` or `SV_ServiceIdentification/operatesOn/MD_DataIdentification/citation/CI_Citation/identifier/MD_Identifier/code` must correspond to one of the `SV_ServiceIdentification/coupledResource/MD_CoupledResource/identifier` values. If the metadata record for the coupled dataset is a separate gmd:MD_Metadata record, the service described in the service metadata record should be identified as a distribution for the dataset. Explicitly linked reference example: `<srv:operatesOn uuidref="13ce1e84-c887-4fd8-b888-8d021b1fa4c2" xlink:href="http://resources.azgs.org/geonetwork/srv/en/metadata.show?id=8717" xlink:title="azgs:azgeochron"/>`

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3.1.4 USGIN specification constraints

Summary of constraints to ISO19115, ISO119, ISO19139, and NAP (INCITS 453) introduced by USGIN profile. See Table 2. These may be summarized here in a later version as a convenience for implementers.

3.1.5 USGIN specification extensions

Summary of extensions to ISO19115, ISO119, ISO19139, and NAP (INCITS 453) introduced by USGIN profile.

USGIN `distributionFormatCode` list for `distributionFormat/name` introduced for categorization of resource types outside scope of ISO19115, mostly physical resources, like a book, rock sample, paper document.

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4 Usage notes

Currently in no particular order… Additional information and discussion to supplement that in Table 1. This will need to be expanded to discuss each resource type and any recommended practices for metadata content specific to particular resources.

4.1 Metadata file identifier

`MD_Metadata/fileIdentifier` is unique identifier for the metadata file. Some metadata profiles suggest that the metadata field UUID should be the same as the UUID for the described resource. This seems problematic. In the USGIN scheme, the metadata record is considered an independently identified resource from the resource it describes. The described resource identifier is the Unique resource identifier (4.7, below).

4.2 Metadata hierarchy

The ISO19115 specification (especially Annex H) discusses the use of metadata hierarchy, in which a resource that is for example a `dataset` in a dataset series, or a `featureType` in a dataset may inherit metadata properties from parent metadata records in the hierarchy. Apparently the intention is that this linkage would be made through `MD_Metadata/parentIdentifier`. This kind of nesting seems problematic in a CSW environment in terms of how queries could be constructed, and the kind of client behavior that would be required to navigate the parent links to acquire 'inherited' properties from 'parent' records. For USGIN CSW purposes it is recommended that for metadata records returned by services, all inherited properties in such a hierarchy should be included explicitly (by xlink where that is allowed by schema) in the metadata document, as opposed to implicitly through the `parentIdentifier` link.

4.3 Resource title

Resource titles should provide sufficient information to distinguish the resource for other similar resources. They are not required to be globally unique, but users will be presented only with the resource title in CSW brief response documents. It is thus a disservice to have significant duplication of title strings.

4.4 Resource Abstract

Ideally the resource abstract provides a succinct summary of the content of the resource, the purpose for which it was originally created, some indication of important quality parameters to help evaluate fitness for other purposes, any significant constraints on use of the resource, and a list of distribution options.

4.5 Resource Type

The ISO 19115 `MD_Metadata/hierarchyLevel` property provides a high level categorization of resource types. The European INSPIRE Implementing Rules (MD_IR_and_ISO_20090218) proscribes the code list for the first hierarchyLevel xml element in an MD_Metadata document to be one of {dataset, service, series}, or the metadata set will be considered out of scope for the directive. Thus, metadata meant to be utilized by INSPIRE catalogs must follow this rule. The napMD_ScopeCode list has a wider (and more useful) variety of resource categories; one or more hierarchyLevel elements using these codes could follow the first one with an INSPIRE-valid code to maintain INSPIRE compliance.

Table 1 in this document includes a more domain-specific list of resource types, and values from this list should be used in one or more `hierarchyLevelName` elements. The hierarchical categorization of the resources is encoded using a syntax <broader category><:><narrower category>, that is colons separate category names, the broadest category is first, with progressively narrower categories listed subsequently. For example: "Document:Image:StillImage:Photograph". This approach allows category type searches to find narrower subcategories without complex query processing.

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4.6 Resource locator

URL's for online access to resources are encoded in USGIN ISO 19139 metadata documents in the element `MD_Distribution/transferOptions/MD_DigitalTransferOptions/online/CI_OnlineResource.` Consistent use of this rule eliminates ambiguity on where to locate the URL to access a resource.

4.7 Unique resource identifier

The `MD_Metadata/DataSetURI` property should be a globally unique identifier for the described resource. The protocol used for this identifier is not proscribed by the USGIN Profile, but if it does not have a know resolution service, the capabilities document for a CSW service providing the metadata should have at least a text explanation of how to resolve URI's used by the service. Protocols with available resolvers include http (use the WWW DNS system) and doi (http://dx.doi.org/). Some authorities using urn: protocols are also implementing or have resolver services in place.

4.8 Browse graphics

NAP profile (INCITS 453-2009) suggests adding codespace and codeListValue to the gmd:fileType element, but this does not appear to be valid under the ISO-19139 xml schema. USGIN recommends use of napMD_FileFormatCode list (http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_115), and using the xsi:type attribute on fileType to indicate if an napMD_FileFormatCode is used to specify the file type (see following example). The ISO19139 schema specifies a gco:CharacterString, with its many possible substitutions as the data type for the file type.

```
<gmd:MD_BrowseGraphic>
  <gmd:fileName>
    <gco:CharacterString>http://publicdocs.mnr.gov.on.ca/View.asp?-
            Document_ID=9632&Attachment_ID=18204</gco:CharacterString>
  </gmd:fileName>
  <gmd:fileDescription>
    <gco:CharacterString>Base Map from OMNR</gco:CharacterString>
  </gmd:fileDescription>
    <gmd:fileType
      xsi:type="napm:napMD_FileFormatCode_PropertyType"
      codeList="http://www.fgdc.gov/nap/metadata/register/registerItemClasses.html#IC_115"
      codeListValue="RI_711">
    <gco:CharacterString>jpg</gco:CharacterString>
  </gmd:fileType>
</gmd:MD_BrowseGraphic>
```

Code example 1. Encoding url, display name and file type for browse graphic. Note that napm: namespace must be declared in the root element of the document.

4.9 Resolution and equivalentScale

For spatial datasets, some indication of the resolution of the data is very useful for evaluating fitness for use. From a data perspective, resolution is specified by a distance that represents the smallest length between two resolvable points in the dataset. For a grid or coverage, this would be the average distance between sample points. From data portrayal perspective, an `equivalentScale` is reported, representing the scale at which the portrayal was intended to be viewed. To calculate `equivalentScale` given a resolution distance, recommended practice is to divide the resolution distance in meters by 0.0005. This assumes that the smallest distance resolvable in a map display for human usage is 0.5 mm.

4.10 Resource language

USGIN metadata is assumed to use American English and by default documents should be returned. Other localizations may be implemented, but in order to avoid complexity with `PT_Text` and `LocalizedCharacterString`, USGIN recommended practice is to implement services for different languages as different

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services, each of which serves CharacterStrings in the language specified by the MD_Metadata/language element.

4.11 Encoding of vertical extents

A vertical extent must specify the vertical CRS, which will typically be defined relative to a borehole trace. For interoperability, vertical extents should be converted to meters measured vertically positive from mean sea level. This puts the onus to convert down hole coordinates for deviated holes on the metadata provider. Users searching for resources specific to some depth below the surface will have to convert this to an elevation relative to sea level in order to query the CSW providing this metadata.

EX_VerticalElement has minimumValue, maximumValue that are real numbers, and a verticalCRS/-SC_VerticalCRS. SC_VerticalCRS has (minimally):

a name/RS_Identifier,

a scope characterString,

exactly one datum/CD_VerticalDatum, which requires a scope CharacterString, and for USGIN an anchor-Definition character string

exactly one coordinateSystem/CS_VerticalCS, which has a name/RS_Identifier, and one axis with axi-sAbbrev, axisDirection/CS_AxisDirection, and axisUnitID/UnitOfMeasure.

4.12 Use of MD_Distribution and MD_Distributor

The ISO19115 model provides two possible paths for specifying information about how a resource is distributed, i.e. how a user can access the resource. The MD_Distribution element may have 0 to many distributionFormat, distributor, and transferOptions child elements (see Figure 1). On the other hand, each of the distributor child elements may have 0 to many distributorFormat and distributor-TransferOption elements. Several major existing applications that consume ISO19139 xml metadata files (ESRI GeoPortal Toolkit and GeoNetwork) are configured out of the box to expect format and transfer option information to be at the MD_Distribution/distributionFormat and MD_Distribution/transferOptions path. This works fine as long as there are not different format or transfer options from different distributors, or different transferOptions for different formats. In these cases, a binding between distributor, format, and transfer options necessitates use of the MD_Distribution/distributor/MD_Distributor path to distributorFormat and distributorTransferOptions (and distributionOrderProcess) information that works together.

In order to accommodate both existing applications that utilize content in the MD_Distribution/dis-tributionFormat and MD_Distribution/transferOptions elements, and situations that require binding between distributor, order process, format, and transfer options, the USGIN profile mandates that if multiple MD_Distribution/distributionFormat or MD_Distribution/transferOptions elements are included in a document, all formats must be available via all the specified transfer options, and the content of these elements should be included in line. If multiple MD_Distribution/distributor elements are present, without child MD_Distributor/distributorFormat or MD_Distributor/distributorTransferOptions elements, then all formats and transfer options are available from all distributors.

To specify different bindings between distributor, order process, format, and transfer options, a separate MD_Distribution/distributor/MD_Distributor instance is included for each binding. One MD_Distributor/distributorFormat and one MD_Distributor/distributorTransferOptions element should be included for applications that expect content in these elements, and the format and transfer options specified by these elements should apply to the first distributor/MD_Distributor element. Repeated CI_ResponsibleParty, MD_StandardOrderProcess, MD_Format or MD_DigitalTransferOption elements in the distributor/MD_Distributor elements should be specified by reference (xlink:href to gml:id of first occurrence of the element within the document). The implication is that the distributionOrderPro-cess/ MD_StandardOrderProcess, distributorFormat/MD_Format, and distributorTransferOptions/-MD_DigitalTransferOptions child elements of a single MD_Distributor are all compatible with each other.

USGIN differs from NAP by allowing multiple distributor elements, but since this is schema valid under ISO19139 xml schema, and the extra elements can be ignored by applications expecting only a single distributor element, this should not cause incompatibility.

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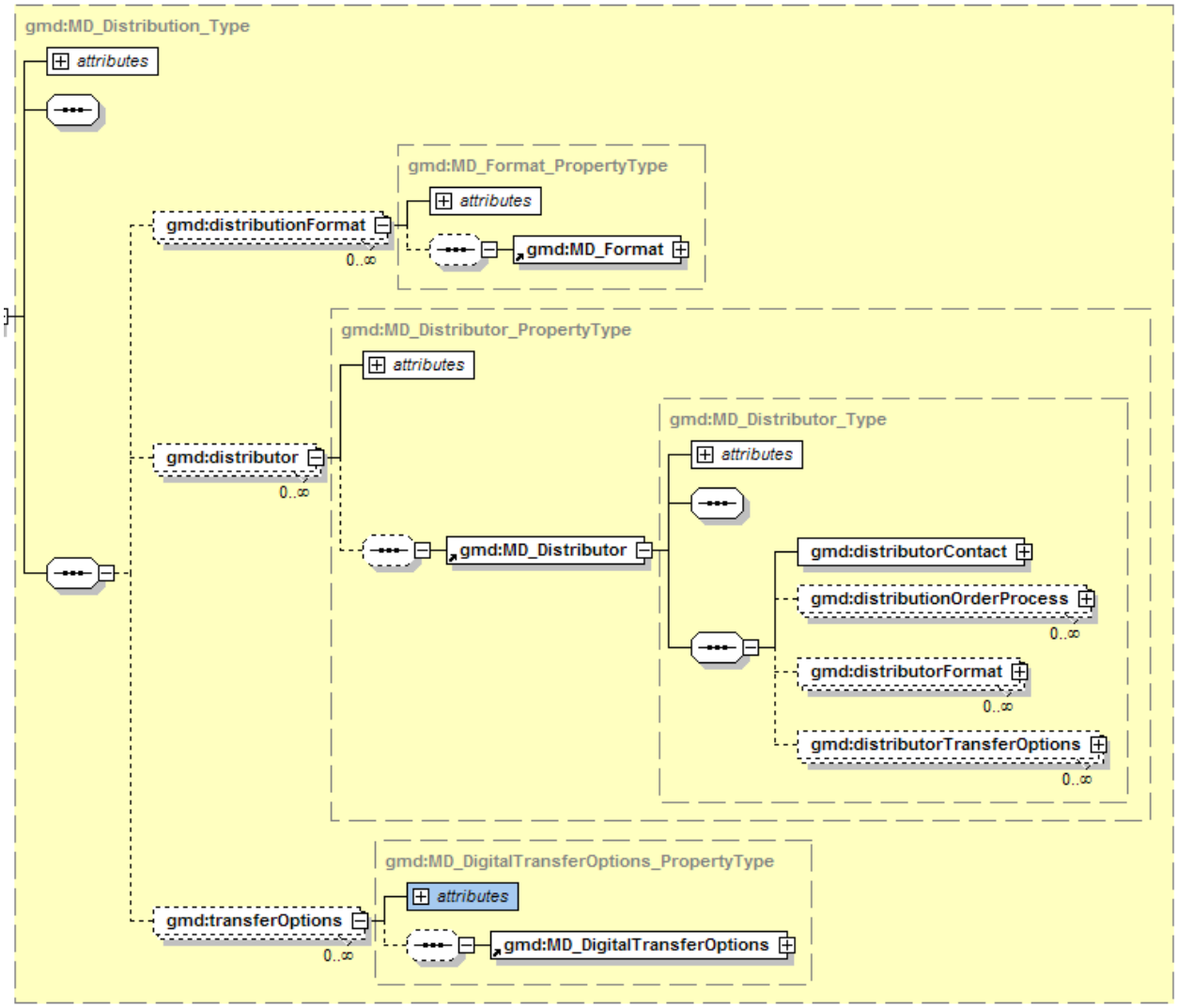

Figure 1. gmd:MD_Distribution_Type diagram

4.13 Distribution format

If the resource is a physical resource, like a book, rock sample, paper document, the `distributionFormat/name` is mandatory, and must be from the USGIN distribution format codelist. Examples in INCITS 453, INSPIRE 19115/19, and ANZLIC 2007 populate `MD_Format/name` with values like 'ESRI ARC/INFO Coverage', 'ESRI shapefile', 'ESRI ARC/INFO Export e00', and 'MapInfo MID/MIF' all pertain to digital resources.Use of distribution format for digital resources should specify the file format using a pattern that includes vendor, application name, and file extension; see list in section 8.1 *Online resource format names*.

4.14 CI_OnlineResource

For USGIN profile, each `distributor/MD_Distributor` is a binding between one or more transfer options and the distributor formats that are available through that/those transfer options (`MD_DigitalTransferOptions/onLine/CI_OnlineResource` in particular). If different formats are available from the same distributor, but have different transfer options, these should be represented as different `distributor/MD_Distributor` instances.

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In order to enable client applications to determine how to directly connect to a resource, there needs to be agreement on what content is required in the `CI_OnlineResource` element, and how it will be encoded. The linkage property provides a URL for accessing the resource. The role of the `protocol`, `applicationProfile`, `name` and `function` properties is to provide sufficient additional information for a client application to automatically connect a user with the online resource. The description property may be used to provide information about the online resource, and more usefully, explanation of how the other content of the `CI_OnlineResource` element is to be used to access the resource.

The ESRI GeoPortal toolkit looks for the presence of `MD_Metadata/distributionInfo/MD_Distribution/transferOptions/MD_DigitalTransferOptions/online/CI_OnlineResource/function/CI_OnlineFunctionCode/@codeListValue` attribute with a non-null value. Only one content type is allowed for each resource. The values must either be an integer between 1 and 10, or a string from the codelist (see Table 5). The value is made lower case, stripped of white space, and then converted to a numeric value ranging from 001 to 010 if its numeric, or compared to see if it starts with a value from the codelist. Thus 'live data', 'llVe data', 'livE DataAnd maps ArcIMS image service' are all valid and would match 'livedata'. Note that this use of the codeListValue attribute is not consistent with its definition as an identifier for the codelist entry (see section 4.16.3 *Codelists*).

Table 5. OnlineFunctionCode values from NAP (INCITS 453) and ESRI Geoportal toolkit v. 3.1. ISO codelist terms are indicated by '(ISO)' after the code in column 1. ESRI content types and codes are from the GeoPortal Toolkit v3.1 User Guide (2007); correlation of these with NAP OnlineFunctionCodes is based on the user guide and interpretation by this profile.

OnLineFunctionCode	**USGIN profile usage**	**ESRI resource types**	**ESRI code**
	Use case not documented	application	006
download?	Use case not documented	mapfile	009
browsing?	Use case not documented	geographicactivity	010
browsing	CI_OnlineResource/linkage is a valid URL for a web application that enables user to explore and seek information about the resource from a Web browser		
download (ISO)	CI_OnlineResource/linkage is a valid URL that will initiate transfer of data to the local system. ESRI GPT requires that file extension for file is one of .zip, .e00, .gz, .tgz, .dbf, .tar, .shp, .rar, .xls, .txt, .dwg, .dxf, .dgn	download, downloadabledata	002
Download (ISO)	ESRI GPT requires one of following file extensions: .gif, .jpg, .jpeg, .bmp, .pdf, .pmf, .tif, .tiff, .cal, .pct, .pict, .eps, .mxd, .av, .mpg, .mpeg, .wmv, .img, .rm.	staticmapimage	004
emailService	CI_OnlineResource/linkage is a valid URL that accesses instructions for connection to an email service providing the described resource content via emails		
fileAccess	CI_OnlineResource/linkage is a valid URL for direct retrieval of a file containing the described resource, typically through the use of http or ftp protocol (or their secure variants)		

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OnLineFunctionCode	USGIN profile usage	ESRI resource types	ESRI code
information (ISO)	CI_OnlineResource/linkage is a valid URL that will access a web page providing information about the resource content.	Information, otherdocument, document	005
offlineAccess (ISO)	CI_OnlineResource/linkage is a valid URL that will access a web page providing instructions for requesting the resource from the provider.	offlinedata, offlineAccess	003
order (ISO)	CI_OnlineResource/linkage is a valid URL that will access a web page to initiate an ordering process for obtaining the resource.	order, geographicservice	007
search (ISO)	CI_OnlineResource/linkage is a valid URL that will access a search interface for seeking out specific information content contained by resource, e.g. the metadata describes a database, and this linkage accesses a search interface to search the database	search, clearinghouse	008
upload	CI_OnlineResource/linkage is a valid URL for a web interface to transfer data from a local storage device or system to be included in the described resource.		
webMapService	CI_OnlineResource/linkage is a valid URL for Web -based map request service, which may return custom georeferenced map images, streamed features, raster data, or surface data to a mapping client, e.g. ArcIMS, OCG WMS, WFS, WCS service	livedata	001
webService	CI_OnlineResource/linkage is a valid URL that accesses a standard web service description document with instructions for the connection to a Web service (other than a Web map service) providing direct online access to the described resource. Example description document may be a Web Services Description Language (WSDL) file or OGC getCapabilities file.		001

4.14.1 URLs for services

ArcIMS Image Service: http://<server>/image/<service_name>

ArcIMS Feature service: http://<server>/feature/<service_name>

ArcIMS OGC WxS: http://<Server>/.../com.esri.wxs<Servlet Path>

OGC service: http://<server>/WxS/<virtual path>

OGC service, embedded key-value pair for service: http://<service root>?version=n.n.n&Service=WxS

OGC WMS service with complete getMap request

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URL specified as value of a key. Supported keys server=<Server name>, service=<name of ArcIMS service, not required for OGC service>, servicename=<same as service>, servicetype=<'image' or 'feature' for ArcIMS, not required for OGC>

If web service is one of the distribution formats available for a resource, it is expected that there is a corresponding metadata record for the web service that has an operatesOn element that points to this metadata record.

4.15 Responsible parties and logos

Metadata should include a URL that locates a thumbnail logo for organizations related to the metadata origination, the organization hosting the catalog that returned the metadata, the organization that originated the data, and the organization hosting online services that provide access to the data. The standard place to put URL's in ISO19139 metadata is in the `CI_Contact/onlineResource/CI_OnlineResource/linkage` attribute. For URL's that indicate icon thumbnails, the `CI_OnlineResource/name` should be 'icon'.

The metadata originator information should be in a `MD_Metadata/contact/CI_ResponsibleParty` element with role code 'originator' to identify the original source of the metadata record, for which the CI_Contact/../CI_OnlineResource/linkage is a URL that points to an Icon for the metadata originator. This Icon will be displayed in search results to credit the metadata originator. Metadata harvesters should harvest and maintain this information so that the origin of metadata records can be credited.

The organization hosting the catalog that returned the metadata record should specified in a `MD_Metadata/contact/CI_ResponsibleParty` element with role code 'distributor', for which the `CI_Contact//CI_OnlineResource/linkage` is a URL that points to an Icon for the metadata server hosting organization. This information need not be harvested, because it will be replaced by information describing the harvesting catalog service.

The organization that originated the data is specified by `MD_Metadata/identificationInfo/MD_DataIdentification/citation/../CI_ResponsibleParty` with RoleCode ='`originator`', and `/CI_OnlineResource/name`='icon'. This will distinguish the citation responsible party element containing the icon linkage from `CI_ResponsibleParty` elements with RoleCode='author' or 'editor', which would provide an online linkage directly to the responsible party as specified by `CI_OnlineResource` `protocol`, `applicationProfile`, `name`, `function`, and `description` elements.

The organization hosting a service providing online access to described data is specified by `MD_Metadata/distributionInfo/MD_Distribution/distributor/MD_Distributor/distributorContact/CI_ResponsibleParty` with RoleCode ='`resourceProvider`' or '`distributor`', and `../CI_OnlineResource/name`='icon'. Because the cardinality of distributorContact responsible party and online resources is 1, only one linkage can be provided for a distributor, and the metadata author must decide whether that will be a link to an icon, or a link to a web site or other resource related to the distributor.

4.16 Extensions to CharacterString

4.16.1 Web extensions

ISO 19139 defines several extensions to `gco:CharacterString` in the gmx namespace. These are defined as members of an xml substitution group for `gco:CharacterString`, and include `gmx:Anchor`, `gmx:FileName`, and `gmx:MimeFileType`. `gmx:Anchor` is used for URL's linking to online web resources, and include a URI attribute associated with the character string that is the human-readable label for the link. `gmx:FileName` adds a filename URI attribute that specifies a machine-readable absolute path to the location of the file, the human readable file name specified by the character string. `gmx:MimeFileType` adds a MIME type/subtype attribute to a character string that specifies a human readable file type. The gmx namespace is not imported into other ISO19139 schema in the normative schema. In order to create schema-valid documents that use these extensions, explicit namespace-declaration must be made to the gmx schema in instance documents. At the present time, use of these elements does not seem widespread. The current version of GeoNetwork, a commonly used catalog service implementation, does not support use of `gmx:Anchor`. Thus, in this version of the USGIN profile, these extension classes are not used.

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4.16.2 Language localization

Another extension to `gco:CharacterString` allows substitution by `PT_FreeText` or `LocalisedCharacterString`. `LocalisedCharacterString` adds a `locale/PT_Locale` property to the `CharacterSTring` element that can specify the language, country, and character encoding for the string. `PT_FreeText` allow substitution of a collection of `LocalisedCharacterString` elements for any `CharacterString`, each localized to a different language/country.

These various possibilities create potential to break interoperability. To avoid this problem, Other localizations may be implemented, but in order to avoid complexity with PT_Text and LocalizedCharacterString, USGIN recommended practice is to implement services for different languages as different services, each of which serves CharacterStrings in the language specified by the `MD_Metadata/language` element.

4.16.3 Codelists

ISO 19139 defines a "CodeListValue_Type" XML Class Type with three attributes:

```
<xs:complexType name="CodeListValue_Type">
  <xs:simpleContent>
    <xs:extension base="xs:string">
      <xs:attribute name="codeList" type="xs:anyURI" use="required"/>
      <xs:attribute name="codeListValue" type="xs:anyURI" use="required"/>
      <xs:attribute name="codeSpace" type="xs:anyURI"/>
    </xs:extension>
  </xs:simpleContent>
</xs:complexType>
```

The `codeList` attribute contains a URL that references a codeList definition within a registry or a codelist catalogue.

The `codeListValue` attribute carries the identifier of the codelist value definition. This identifier is the value expressed in the name column of the tables in ISO 19115, Annex B. The codelist catalogue (or registry) is expected to contain an explicit name and definition of the value in the default language of the metadata, as well as alternate expressions in different code spaces, some of them corresponding to the different locales supported by the metadata.

The `codeSpace` attribute is an optional identifier (URI); when present it refers to the alternative expression of the codelist value definition in the ‘domainCode’ column of the tables in ISO 19115, Annex B. The codeSpace URI for the domain code is the string "domainCode". According to the example in ISO19139, section 8.5.5.1 (p. 30), the value from the domainCode column in the codespace definition table is included as the value of the xml CodeList element in this case.

Codelist elements in the ISO19139 XML schema are assigned to type CodeListValue_Type, and also included in a substitution group for gco:CharacterString. These codeList elements are thus substitutable for elements typed gco:CharacterString. Consequently, any CodeList instance is an XML element that takes a string value and has three XML attributes defined by the CodeListValue_Type XML Class Type. A corresponding XML Class Property Type is defined for each of these CodeList elements, and this property type is used to restrict the values in XML CharacterString attributes to the code list.

The ISO specification uses an unfortunate choice of name for the ‘codeListValue’ attribute that is defined to be a identifier, apparently with the intention that it is a language-neutral concept identifier that might be associated with various language-localized labels for the concept. NAP CodeList registries (http://www.fgdc.gov/nap/metadata/register) contrast with the codelists defined in the tables in ISO 19115 Annex B in that the identifier (the ‘name’ column the ISO19115 Annex B tables) is an integer identifier with the prefix ‘RI_’. This would appear to correspond functionally to the ‘domainCode’ values in the ISO19115 Annex B tables, which ISO19139 indicates should be the codeListValue when the codeSpace="domainCode".

NAP and INSPIRE usage is consistent with the ISO19139 definition of codeListValue as an identifier, with the name or label for the codeList concept included as the value of the CodeList element. The ‘name’ column in ISO 19115, Annex B tables, which is described as the content for the codeListValue by ISO19139, contains English words that are the same as the labels one would use in English. In the

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CT_CodeListCatalogues in the ISO publicly available standards registry for ISO 19139 (http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources), which one would think are normative, the CodeListDictionary/codeEntry/CodeDefinition elements only include gml:description and gml:identifier elements, but no gml:name elements. So based on this ISO guidance, it appears that one would have to encode CodeList element thus:

```
<gmd:CI_DateTypeCode
      codeList="http://asdd.ga.gov.au/asdd/profileInfo/gmxCodelists.xml#CI_DateTypeCode"
      codeListValue="creation"/>
```

or

```
<MD_CharacterSetCode
      codeList="http://wis.wmo.int/2006/catalogues/gmxCodelists.xml#MD_CharacterSetCode"
      codeListValue="utf8"/>.
```

Extensions to ISO codelists are implemented in two ways. If new values are added to an ISO codelist, the CodeListProperty_Type still points at the ISO CodeList_Type, but the codeList attribute on instances of this element points to the extended codelist. The following example shows use of a DateTypeCode added to the ISO19115 date type code list in the North American Profile:

```
<gmd:CI_DateTypeCode
      codeList="http://www.fgdc.gov/nap/metadata/register/registerItemClasses.html#IC_87"
      codeListValue="RI_373">superseded</gmd:CI_DateTypeCode>
```

Note that the ISO codelists use the codeListValue name as the codeList identifier, creating ambiguity between the human-readable label/name for the codeListValue concept, and its opaque/language-neutral identifier. USGIN NAP codeList usage follows the example metadata encoding in Appendix E of NAP profile document (INCITS 453, 2009). In these examples the codeListValue is the identifier from the NAP registry specified by the codeList, with the prefix 'RI_' added, and the code name/label is the value of the codeList xml element. NAP provides names and identifiers for codes.

INSPIRE guidelines (INSPIRE ISO19115/119, 2009-02-18) recommend a similar approach, using the ISO identifier string for the code list element value, which appears to match the intention of ISO19139.

```
<gmd:CI_DateTypeCode
      codeL-
      ist="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resource
      s/Codelist/ML_gmxCodelists.xml#CI_DateTypeCode"
      codeListValue="publication">publication</gmd:CI_DateTypeCode>
```

In order to avoid interoperability problems, USGIN profile mandates that elements with a data type that is a CodeList_PropertyType use the following encoding, following the NAP and INSPIRE pattern:

For elements that use ISO codelists:

```
<gmd:CI_DateTypeCode
      codeList="
      http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Code
      list/gmxCodelists.xml#CI_DateTypeCode"
      codeListValue="creation">creation</gmd:CI_DateTypeCode>
```

For elements that use NAP codelists:

```
<gmd:CI_DateTypeCode
      codeList="http://www.fgdc.gov/nap/metadata/register/registerItemClasses.html#IC_87"
      codeListValue="RI_366">creation</gmd:CI_DateTypeCode>
```

USGIN mandates use of NAP codelists, but if the above convention is followed, and the NAP name is equivalent to the ISO identifier for codelists that are the same, which is generally the case, then the two approaches are interoperable if search criteria for a particular value look for the element value (e.g. 'creation' in the example above), not the codeListValue attribute value (e.g. 'creation' or 'RI_366').

If a new codelist is created to restrict text in an ISO element whose type is simply CharacterString (e.g. HierarchyLevelName), then characterString values are encoded by soft-typing the element that takes the character string using the xsi:type attribute. The following example uses the FileFormatCodeList, which is the only code list vocabulary added to the collection of codelists defined by ISO 19115 by the North American Profile. A NAP-defined codelist property type is defined in a napm namespace, defined in an xml schema made available by the profile developers.

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```
<gmd:fileType xsi:type="napm:napMD_FileFormatCode_PropertyType"
      codeList="http://www.fgdc.gov/nap/metadata/register/registerItemClasses.html#IC_115"
      codeListValue="RI_711">
  <gco:CharacterString>jpg</gco:CharacterString>
</gmd:fileType>
```

Schema fragment from the XML schema defining the napm namespace (http://www.cits.rncan.gc.ca/html/brodeurj/.protege/.napMetadata/tools/napXsd/napm/napm.xsd). This fragment defines the property type used to restrict a value domain to the new code list in the xml fragment above:

```
<xs:complexType name="napMD_FileFormatCode_PropertyType">
  <xs:complexContent>
    <xs:extension base="gco:CharacterString_PropertyType">
      <xs:attribute name="codeList" type="xs:anyURI" use="required"/>
      <xs:attribute name="codeSpace" type="xs:anyURI" use="optional"/>
      <xs:attribute name="codeListValue" type="xs:anyURI" use="required"/>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
```

4.17 Geographic bounding box

USGIN profile requires that if an `EX_Extent/geographicElement` is supplied, it include a geographic bounding box with bounding latitude and longitude expressed using WGS 84 decimal degrees.

The corner coordinates for the geographic bounding box must not coincide in one point, because this may result in fatal errors with some CSW implementations. Point locations must thus be represented as tiny rectangles. USGIN recommended practice is to place the actual point location in the lower left corner of the rectangle.

4.18 Data quality for individual parts of a resource

The use of `dataQualityInfo/DQ_DataQuality/scope` presents challenges for determining how to represent metadata with finer granularity about particular feature or attribute instances, some attribute in the scope of a single dataset, some particular dataset within a series.

Determining best practices for finer-granularity metadata requires consideration of likely use cases. Note that data quality statements may provide information on lineage, completeness, logical consistency, thematic accuracy, temporal accuracy, or positional accuracy. Note also that the USGIN profile is designed for use in a geoscience domain-wide resource catalog meant to enable discovery, evaluation, and access to information resources. Use cases involve filtering metadata records based on data quality statements, or using those statement to evaluate datasets or feature instances for fitness to a user's purpose. These might include:

1) data quality statements for individual datasets in a series, to determine if a dataset in the series might be appropriate for the desired use.
2) data quality statements associated with different attributes of a feature on the dataset series level, e.g. all structure orientations (the attribute) have some standard quantitative attribute accuracy for all features in all datasets in a series, to determine if any data in the series might be appropriate for the desired use.
3) data quality statements associated with different attributes of a feature on the dataset level, e.g. all structure orientations have some standard quantitative attribute accuracy for all features in a particularly subset of datasets in a series. This may be assigned on an individual dataset level, or to subsets, e.g. a measurement procedure changed at some point during development of the series that changes the attribute accuracy for all subsequently acquired data. These quality statements might be used to determine which dataset in a series might be appropriate for the desired use, or if a particular dataset is useful.

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4) data quality statements for one or more particular features that are contained in a dataset. These statements might be used to select particular feature instances to download or use for an analysis.

5) data quality statements for particular attribute value assignments on particular features in a dataset. These statements might be used to select particular feature instances to download or use for an analysis.

In a dataspace environment of the sort envisioned for a community data network (Franklin et al, 2005), the ISO19115 hierarchy level 'series' is useful for high-level data discovery and evaluation, but actual data acquisition and usage occur at the dataset level. Attribute- and feature-scoped data quality information would be useful in dataset and series level metadata for discovery and evaluation, but featureInstance and attributeInstance data quality information only come in to play for the data acquisition and usage in the context of a dataset.

In the architecture of the system as currently envisioned, only the lineage and accuracy aspects (not the completeness and logical consistency, which apply at a dataset level) of data quality make sense for feature and attribute instance level metadata, and this information is better accounted for by an observation and measurement view of the data (e.g. ISO 19156) through a feature service, not a metadata service. Inclusion of instance level dataQuality statements might make sense in metadata that is bundled with a data collection in a data delivery package, but this is out of scope for this profile. In the CSW environment, if a data provider wishes to enable search using feature- or attribute-instance data quality criteria, these should be exposed by presentation metadata records for each feature- or attribute-instance.

The ISO19115 content model provides several possible approaches to fine-granularity metadata:

1) using `MD_Metadata/hierarchyLevel` and `MD_Metadata/parentIdentifier`

2) using `MD_Metadata/identificationInfo/MD_DataIdentification/aggregationInfo` associations

3) using `MD_Metadata/ dataQualityInfo/DQ_DataQuality/scope/levelDescription` elements to bind data quality assertions to parts of the larger resource that are identified by object references from the metadata document.

The USGIN profile does not use approach 1, with parentIdentifier links associating MD_Metadata records with parent metadata. This approach is useful for metadata that is packaged with data collections in order to reduce duplication of metadata information that is inherited from series to datasets in that series, and perhaps to individual features and attributes in the application schema for the series, or feature and attribute instances in particular datasets. In the context of resource discovery using a CSW service, queries cannot be posed in terms of these kinds of inheritance relationships, and result sets should be complete metadata records for the resources located by a search.

The USGIN profile uses approach 2, aggregationInfo associations between metadata records for related resources. In a data discovery environment, links to related resources may be very useful to lead users to other resources that their search criteria did not directly uncover. The `associationType` property on these links provides additional useful information for assessing whether the related resources might be useful. Given this approach, data quality information for datasets in a series would not be accessed through `DQ_DataQuality` elements in the series metadata, with `levelDescription/MD_ScopeDescription/Dataset` elements providing DataSetURI's for each described component dataset. Under the USGIN profile, identification of datasets in a series that meet some data quality criteria would search for datasets that have `MD_Metadata/identificationInfo/MD_DataIdentification/aggregationInfo/MD_AggregateInformation/-aggregateDataSetIdentifier` equal to the dataSetURI for the series, with `../AggregateInformation/-associationType/DS_AssociationTypeCode` equal to 'largerWorkCitation', along with whatever quality criteria were required.

USGIN profile uses multiple `dataQualityInfo/DQ_DataQuality` elements to provide optional data quality statements for individual attributes and features in a dataset, with one `dataQualityInfo` element for each attribute on each feature about which the data quality is described. According to the ISO19139 (20060504) schema implementing ISO19115, each of these `dataQualityInfo` elements has exactly one `../DQ_Scope`, which in turn may have 0 to many `levelDescription/MD_ScopeDescription` elements. Each `levelDescription/MD_ScopeDescription` contain only one of `attributes`, `features`, `featureInstances`, `attributeInstances`, `dataset` or `other` elements. An individual `MD_ScopeDescription` may specify multiple `attributes`, `features`, `featureInstances`, or `attributeInstances`. `MD_ScopeDescription/other` is not used in the USGIN profile at this time. `MD_ScopeDescription/dataset` is not used because data quality

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statements about a dataset are indicated by `dataQualityInfo/../DQ_Scope/level/MD_ScopeCode` = 'dataset', in which case `DQ_Scope/levelDescription/MD_ScopeDescription` elements will be ignored; data quality statements about a dataset in a series are included in a metadata record for the dataset that is associated with the series through `MD_Metadata/MD_DataIdentification../MD_AggregateInformation/-aggregateDataSetIdentifier`.

`DQ_Scope/levelDescription/MD_ScopeDescription/attributes` and `../features` are specified using object references to GF_AttributeType and GF_FeatureType elements according to section B.4.4 of ISO19115(2003). These are metaclasses defined in ISO19109, and their implementation is out of scope for this profile. Table 6 presents recommendations for use of `../DQ_DataQuality/scope/-levelDescription/MD_ScopeDescription` child elements based on consideration of the above use cases, interpretation of the UML diagrams for ISO19109 and the sketchy text in section B.4.4 of ISO19115(2003).

Table 6. Usage of data quality scope description elements

scopeDescription type (and cardinality)	Reference target	USGIN profile provisions
`attributes` (1..*)	Identifier for an attribute type defined in the application schema identified by `MD_Metadata/application-SchemaInfo/../CI_Citation`	Use for specifying attribute level data quality for all attributes of a particular type in a particular feature in a dataset or series. `levelDescription/MD_ScopeDescription/attributes` elements are allowed only when `DQ_Scope/-level/MD_ScopeCode` = 'attributeType'. The element value is an xlink:href or uuidref to an attribute defined in the application schema for the dataset. The xlink:title may be used to give the name of the attribute as it appears in the dataset if this is useful. To be useful, the `MD_Metadata/-applicationSchemaInfo` element must provide sufficient information to resolve the attribute identifier.
`features` (1..*)	Identifier for an feature type defined in the application schema identified by `MD_Metadata/application-SchemaInfo/../CI_Citation`	Use for specifying feature level data quality for all features of a particular type in a dataset or series. `levelDescription/MD_ScopeDescription/-attributes` elements are allowed only when `DQ_Scope/level/MD_ScopeCode` = 'featureType' or 'attributeType'. The identified feature type is the target of the data quality statement if `MD_ScopeCode` is 'featureType', else it identifies the feature that contains the described attribute. The element value is an xlink:href or uuidref to a feature defined in the application schema for the dataset. The xlink:title may be used to give the name of the feature as it appears in the dataset if this is useful. To be useful, the `MD_Metadata/-applicationSchemaInfo` element must provide sufficient information to resolve the featureType identifier.
`featureInstances` (1..*)	A resolvable identifier for a particular featureInstance within the scope of the resource identified by `MD_Metadata/DataSetURI`	Out of scope, not used by USGIN. Instance level quality statements are provided via a feature service.

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attributeInstaces (1..*)	A resolvable identifier for a particular attributeInstance within the scope of the resource identified by MD_Metadata/DataSetURI	Out of scope, not used by USGIN. Instance level quality statements are provided via a feature service.
dataset (1)	A resolvable identifier for a particular dataset within the scope of the resource identified by MD_Metadata/-DataSetURI	Not used by USGIN. Dataset data quality is described in records with DQ_Scope/-level/MD_ScopeCode = 'dataset', and metadata for datasets in a series is represented by separate dataset records for CSW purposes.
other (1)	A resolvable identifier for some other resource within the scope of the resource identified by MD_Metadata/-DataSetURI	Not used by USGIN, undefined semantics.

4.19 Lineage

Lineage in data quality section has to do with processing steps that have altered the resource in some fashion. Each step has some input resources, identified by source citations associated with the process step. The LI_ProcessStep element does not directly identify its output resource, so in a lineage that involves a chain of steps with intermediate resources, the sourceStep association from LI_Source links a resource to a processing step that it is output from.

If a resource has simply been downloaded from some online repository, or copied from some physical media (CD, DVD), with no modification, then it is considered an identical resource, and no lineage is implied. The MD_DataIdentification/citation/CI_Citation should identify this source; the MD_Metadata/distributionInfo should report information on how the data were obtained. Based on this approach, a LI_Lineage that reports no processSteps, only a source link, does not make sense. LI_Lineage/source/LI_Source is thus not used by USGIN metadata.

A GIS dataset originally digitized from a published geologic map, put online, obtained by an online download, and reprojected would report one processStep (reprojection) with source/LI_Source that has a CI_Citation for the downloaded data. This LI_Source would have a sourceStep pointing to an LI_ProcessStep for the original digital conversion from the paper map, and the LI_ProcessStep/source/LI_Source would contain the citation for the original paper map.

In order to enable xpath queries for any of the sources or processSteps in a processing chain, all related LI_Source and LI_ProcessStep elements should be directly nested within the LI_Lineage element, and the processStep/source and LI_Source/sourceStep associations should be by reference.

Code example 1: Simplified example of a complex processing and source history using LI_Lineage.

```
<?xml version="1.0" encoding="UTF-8"?>
<LI_Lineage
  xmlns="http://www.isotc211.org/2005/gmd"
  xmlns:gco="http://www.isotc211.org/2005/gco"
  xmlns:xlink="http://www.w3.org/1999/xlink"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.isotc211.org/2005/gmd
http://schemas.opengis.net/iso/19139/20070417/gmd/dataQuality.xsd">
  <statement>
    <LocalisedCharacterString>The digital data described by this metadata was
originally compiled digitally from two published maps; this digital dataset
```


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```
was then reprojected to produce the described re-
source.</LocalisedCharacterString>
  </statement>
  <processStep>
    <LI_ProcessStep id="1">
      <description>
        <LocalisedCharacterString>digital compilation of 2
maps</LocalisedCharacterString>
      </description>
      <source xlink:href="#10"/>
      <source xlink:href="#20"/>
    </LI_ProcessStep>
  </processStep>
  <processStep>
    <LI_ProcessStep id="2">
      <description>
        <LocalisedCharacterString>digital map compilation reprojected, should
have some way to specify projection parameters?, output is LI_Source id=70
</LocalisedCharacterString>
      </description>
      <source xlink:href="#40"/>
    </LI_ProcessStep>
  </processStep>
  <source>
    <LI_Source id="40">
      <description>
        <LocalisedCharacterString>a digital compilation of 2 maps, output of
processStep ID=1, input into reprojection process</LocalisedCharacterString>
      description>
      <sourceStep xlink:href="1"/>
    </LI_Source>
  </source>
  <source>
    <LI_Source id="10">
      <description>
        <LocalisedCharacterString>ultimate source--some published
map</LocalisedCharacterString>
      </description>
<!--no source processing recorded for production of paper map so no sourceS-
tep-->
    </LI_Source>
  </source>
  <source>
    <LI_Source id="20">
      <description>
        <LocalisedCharacterString>another published
map</LocalisedCharacterString>
      </description>
    </LI_Source>
  </source>
  <source>
    <LI_Source id="70">
      <description>
        <LocalisedCharacterString>a reprojected version of the digital compi-
lation</LocalisedCharacterString>
      </description>
      <sourceStep xlink:href="2"/>
    </LI_Source>
```


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```
    </source>
  </LI_Lineage>
```

An `LI_Lineage` may be constructed that involves a number or resources and processing steps, and this lineage may be referenced by metadata for all the resources involved in the processing. The `LI_Lineage/source/LI_Source/sourceCitation/CI_Citation/identifier/MD_Identifier` is a reference to the `MD_Metadata/fileIdentifier` for the metadata for each resource in the chain. This approach allows the metadata record to record relationships through process steps between resources.

4.20 Temporal extents

Resource temporal extent (identificationInfo/MD_DataIdentification/extent/EX_Extent/-temporalElement/EX_TemporalExtent/extent/ TimePeriod) is used to specify the temporal interval to which the content of a resource applies.

<gml:endPosition indeterminatePosition="now"/> is the correct way to represent "Present" in ISO or GML as one of the boundaries of a timePeriod.

The ISO 19139 xml schema allows TM_PeriodTimePeriod to be quantified by a gml:TimeInstant or gml:TimePeriod element. In order to promote interoperability, the USGIN profile mandates use of gml:TimePeriod for specifying temporal for a resource. The time coordinates for the beginPosition and endPosition should be expressed numerically in Ma. This convention allows search for resources pertinent to intervals of geologic time using simple numeric comparisons instead of the complex hierarchical concept expansions that would be necessary to use named eras from a stratigraphic time scale. Encoding example:

```
<EX_TemporalExtent>
  <extent>
    <gml:TimePeriod gml:id="y34096">
      <gml:beginPosition
        frame="urn:CGI:TemporalCRS:cgi:standardGeologyMa">220
</gml:beginPosition>
      <gml:endPosition
        frame="urn:CGI:TemporalCRS:cgi:standardGeologyMa"
        >140</gml:endPosition>
    </gml:TimePeriod>
  </extent>
</EX_TemporalExtent>
```

The frame for the beginPosition and endPosition is a URI for standard geologic time, measured positive getting older, with an origin at 1950 CE, in units of millions of years.

4.21 Operation metadata

The srv namespace elements based on ISO 19119 are inadequate to provide the content necessary to automate connection to a generic service. This is due in part to poorly defined semantics and use cases for the elements that are there (DCP, applicationProfile, protocol, MD_Format, serviceType, operationName vs. invocationName, connectPoint), and partly due to incomplete content model (where to put allowed outputFormat parameter values or supported query operations for CSW or WMS). The ISO 19119 model for service metadata does not include a mechanism to specify valid values for operation parameters. For instance, OGC WMS and CSW services both support an output format parameter, and OGC capabilities documents provide a listing of the supported output formats, but where do these go in ISO19139 xml documents? Does the described service support http POST or GET method? This information is necessary in order to compose valid service requests.

USGIN proposes to follow the INSPIRE (INSPIRE 19115/119, 2009) guideline to use a `distributionInfo/../transferOptions/../online/../linkage` element point to a WSDL or OGC getCapabilities document (see xml files at http://www.webservice-energy.org/metadata/), and make `srv:SV_OperationMetadata` nil. WSDL and getCapabilities were designed to describe service operation, and it seems counterproductive to invent another scheme to do the same thing. Because of the difficulty in creating usable

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abstract model that accounts for any and all possible services, it makes more sense to allow service description documents specific to different service frameworks.

In order to identify the linkage element that locates the service description document, USGIN mandates using `CI_OnlineResource/name` = "serviceDescription" (from the table in section 8.3) as the in the CI_OnlineResource element with the linkage to the service description. It may also be useful to provide a mapping between ServiceType and a guidance for the kind of document the `CI_OnlineResource/linkage` URL locates.

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5 Abbreviations

CSW	Metadata Catalog for the Web. Also abbreviated as CS-W and CS/W
GeoSciML	
GML	Geographic Markup Language
GUID	Global Unique Identifier
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
UML	Unified Modeling Language
URI	Universal Resource Identifier
USGIN	U.S. Geoscience Information Network
WCS	Web coverage Service
WFS	Web Feature Service
XML	eXtensible Markup Language
XSD	XML Schema Definition
XSL	eXtensible Stylesheet Language
XSLT	XSL Transformations
XLink	XML Linking Language

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6 References

6.1 Normative References

[ISO 19115]

[ISO 19119]

[ISO 19139]

[ISO 639-2] Bibliographic code for the representation of names of languages (http://www.loc.gov/standards/iso639-2/php/code_list.php)

[AP ISO 1.0]

[OGC CSW 2.0.2]

6.2 Cited literature

Franklin, Michael, Halevy, Alon, and Maier, David, 2005, From databases to dataspaces: a new abstraction for information management: ACM SIGMOD Record, V. 34, No. 4, ISSN:0163-5808.

[ANZLIC, 2007] ANZLIC Metadata Profile Guidelines, Version 1.0: Turner, ACT, ANZLIC - the Spatial Information Council, ISBN: 978-0-646-46940-9, 372 p.

[INSPIRE ISO19115/119] Drafting Team Metadata and European Commision Joint Research Centre, 2009-02-18, INSPIRE Metadata Implementing Rules: Technical Guidelines based on EN ISO 19115 and EN ISO 19119,v. 1.1: European Commission Joint Research Centre, MD_IR_and_ISO_20090218.

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7 Examples

7.1 USGIN ISO 19139 Dataset Metadata

In the following listing, text in Green is comments; XML elements are in blue, XML attributes are in black, and attribute values are in purple.

```
<?xml version="1.0" encoding="UTF-8"?>
<!--
*******************************************************************************************
*** Example ISO 19139 Geospatial Dataset Metadata based on the USGIN v1 Profile
*** by USGIN Standards and Protocols Drafting Team
*** U.S. Geoscience Information System (USGIN) - http://lab.usgin.org
*** Contributors: Wolfgang Grunberg, Stephen M Richard
*** 01/11/2010
***
*** DISCLAIMER: this is not an authoritative metadata example but an aide to get started.
*** Scope notes are mostly from NAP or ISO documentation; refer to
*** the USGIN profile document for more specific and reliable guidelines.
***
*** Validated against http://www.isotc211.org/2005/gmd (ISO 19115, CSW 2.0.2 AP ISO 1.0).
*** Follows the USGIN ISO 19139 Dataset Metadata Profile v1.
*** a derivative of the North American Profile (NAP)
***
*** Key: (NAP-USGIN) - M/C/O/X (Mandatory, Conditional, Optional, Not Used)
*******************************************************************************************-->

<!-- USGIN ISO 19139 geospatial dataset metadata record -->
<!-- Note:
http://www.cits.rncan.gc.ca/html/brodeurj/.protege/.napMetadata/napMetadataWebsite/napMetadataToo
ls/napXsd/napm is the namespace for NAP extensions in napm namespace. Its schema is located at
http://www.cits.rncan.gc.ca/html/brodeurj/.protege/.napMetadata/tools/napXsd/napm/napm.xsd
However, that schema does not resolve properly because it also refernces gmd. -->
<gmd:MD_Metadata
  xmlns:gmd="http://www.isotc211.org/2005/gmd"
  xmlns:gco="http://www.isotc211.org/2005/gco"
  xmlns:gml="http://www.opengis.net/gml"
  xmlns:napm="http://www.cits.rncan.gc.ca/html/brodeurj/.protege/.napMetadata/napMetadataWebsite/
napMetadataTools/napXsd/napm"
  xmlns:xlink="http://www.w3.org/1999/xlink"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.isotc211.org/2005/gmd
http://schemas.opengis.net/csw/2.0.2/profiles/apiso/1.0.0/apiso.xsd">
  <!-- (M-M) Metadata file identifier - A unique File Identifier (GUID) - USGIN recommends using
a valid Universally Unique Identifier (UUID) -->
  <gmd:fileIdentifier>
    <gco:CharacterString>00C02E67-F1ED-473D-A240-068CCB041A73</gco:CharacterString>
  </gmd:fileIdentifier>
  <!-- (M-M) Metadata language - <ISO639-2/T three letter language code - lower case><;><blank
space><ISO3166-1 three letter country code - upper case> -->
  <gmd:language>
    <gco:CharacterString>eng; USA</gco:CharacterString>
  </gmd:language>
  <!-- (M-M) Metadata character set  - NAP specifies default is "utf8", codelist =
napMD_CharacterSetCode. USGIN requires that a character set code is defined to facilitate CSW
servers (deegree, GeoNetwork, etc.). -->
  <gmd:characterSet>
    <!-- napMD_CharacterSetCode names: {ucs2, ucs4, utf7, utf8, utf16, 8859part1, 8859part2,
8859part3, 8859part4, 8859part5, 8859part6, 8859part7, 8859part8, 8859part9, 8859part10,
8859part11, 8859part13, 8859part14, 8859part15, 8859part16, jis, shiftJIS, eucJP, usAscii,
ebcdic, eucKR, big5, GB2312} -->
    <gmd:MD_CharacterSetCode
      codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_95"
      codeListValue="RI_458">utf8</gmd:MD_CharacterSetCode>
  </gmd:characterSet>
  <!-- (M-M) Resource type - Define if this record is a: dataset (default), service, feature,
software, etc. -->
```


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```
  <gmd:hierarchyLevel>
    <!-- napMD_ScopeCode code names: {attribute, attributeType, collectionHardware,
collectionSession, dataset, series, nonGeographicDataset, dimensionGroup, feature, featureType,
propertyType, fieldSession, software, service, model, tile} -->
    <gmd:MD_ScopeCode
      codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_108"
      codeListValue="RI_622">dataset</gmd:MD_ScopeCode>
  </gmd:hierarchyLevel>
  <!-- (O-M) Resource hierarchy level name - ISO 19115 assumes that the metadata hierarchy level
name defaults to “dataset” if it is not documented. NAP does not use it, recognizing that it is
redundant. USGIN makes this property mandatory to identify the USGIN resource type (see USGIN
Profile, "Resources of Interest"). Default USGIN hierarchyLevelName.CharacterString is “Dataset.”
Encode hierarchy by including hierarchyLevelName elements for all broader resource categories.
E.g. default should also include a hierarchyLevelName=”Collection” element. For services USGIN
hierarchyLevelName.CharacterString is “Service”. As use cases develop that provide rationale for
definition of sub-categories of service, the resource category list will be expanded. -->
  <gmd:hierarchyLevelName>
    <gco:CharacterString>Dataset</gco:CharacterString>
  </gmd:hierarchyLevelName>
  <!-- (M-M) Metadata point of contact - Point of contact for the metadata record, e.g. for users
to report errors, updates to metadata, etc. -->
  <gmd:contact>
    <gmd:CI_ResponsibleParty>
      <!-- (M-M) (individualName + organisationName + positionName) > 0 -->
      <gmd:individualName>
        <gco:CharacterString>Stephen Richard</gco:CharacterString>
      </gmd:individualName>
      <gmd:organisationName>
        <gco:CharacterString>Arizona Geological Survey</gco:CharacterString>
      </gmd:organisationName>
      <gmd:positionName>
        <gco:CharacterString>Metadata Czar</gco:CharacterString>
      </gmd:positionName>
      <gmd:contactInfo>
        <gmd:CI_Contact>
          <!-- Phone -->
          <gmd:phone>
            <gmd:CI_Telephone>
              <gmd:voice>
                <gco:CharacterString>520.770.3500</gco:CharacterString>
              </gmd:voice>
              <gmd:facsimile>
                <gco:CharacterString>520.770.3505</gco:CharacterString>
              </gmd:facsimile>
            </gmd:CI_Telephone>
          </gmd:phone>
          <!-- Address -->
          <gmd:address>
            <gmd:CI_Address>
              <gmd:deliveryPoint>
                <gco:CharacterString>416 W. Congress St., Suite 100</gco:CharacterString>
              </gmd:deliveryPoint>
              <gmd:city>
                <gco:CharacterString>Tucson</gco:CharacterString>
              </gmd:city>
              <gmd:administrativeArea>
                <gco:CharacterString>Arizona</gco:CharacterString>
              </gmd:administrativeArea>
              <gmd:postalCode>
                <gco:CharacterString>85701-1381</gco:CharacterString>
              </gmd:postalCode>
              <gmd:country>
                <gco:CharacterString>USA</gco:CharacterString>
              </gmd:country>
              <!-- (O-M) contact e-mail address -->
              <gmd:electronicMailAddress>
                <gco:CharacterString>metadata@azgs.az.gov</gco:CharacterString>
              </gmd:electronicMailAddress>
            </gmd:CI_Address>
          </gmd:address>
          <!-- (O-O) online resources - this is the online resource to contact the metadata
person-->
```


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```
          <gmd:onlineResource>
            <gmd:CI_OnlineResource>
              <gmd:linkage>
                <gmd:URL>http://www.azgs.az.gov</gmd:URL>
              </gmd:linkage>
              <gmd:protocol>
                <gco:CharacterString>HTTP</gco:CharacterString>
              </gmd:protocol>
              <gmd:description>
                <gco:CharacterString>Arizona Geological Survey Web Site</gco:CharacterString>
              </gmd:description>
            </gmd:CI_OnlineResource>
          </gmd:onlineResource>
          <!-- (O-O) hours of service -->
          <gmd:hoursOfService>
            <gco:CharacterString>8 AM to 5 PM Mountain Standard time (no day light
savings)</gco:CharacterString>
          </gmd:hoursOfService>
          <!-- (O-O) contact instructions -->
          <gmd:contactInstructions>
            <gco:CharacterString>Contact Steve Rauzi [Steve.Rauzi@azgs.az.gov] or call Oil and Gas
Commission Staff at Arizona Geological Survey, 520-770-3500.</gco:CharacterString>
          </gmd:contactInstructions>
        </gmd:CI_Contact>
      </gmd:contactInfo>
      <!-- (M-M) ISO 19139 Mandatory: contact role -->
      <gmd:role>
        <!-- napCI_RoleCode names: {resourceProvider, custodian, owner, user, distributor,
originator, pointOfContact, principalInvestigator, processor, publisher, author} -->
        <gmd:CI_RoleCode
          codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_90"
          codeListValue="RI_414">pointOfContact</gmd:CI_RoleCode>
      </gmd:role>
    </gmd:CI_ResponsibleParty>
  </gmd:contact>
  <!-- (X-O) Metadata should include a URL that locates a thumbnail logo for organizations
related to the metadata origination, the organization hosting the catalog that returned the
metadata, the organization that originated the data, and the organization hosting online services
that provide access to the data. -->
  <gmd:contact>
    <gmd:CI_ResponsibleParty>
      <gmd:organisationName>
        <gco:CharacterString>Arizona Geological Survey</gco:CharacterString>
      </gmd:organisationName>
      <gmd:contactInfo>
        <gmd:CI_Contact>
          <gmd:onlineResource>
            <gmd:CI_OnlineResource>
              <!-- Icon image file (e.g. tif, png, jpg) for the metadata originator. This Icon
will be displayed in search results to credit the metadata originator. -->
              <gmd:linkage>
                <gmd:URL>http://www.azgs.az.gov/logo/metadata/azgs.png</gmd:URL>
              </gmd:linkage>
              <!-- (X-C) For URL's that indicate icon thumbnails, the CI_OnlineResource/name
should be 'icon'. -->
              <gmd:name>
                <gco:CharacterString>icon</gco:CharacterString>
              </gmd:name>
            </gmd:CI_OnlineResource>
          </gmd:onlineResource>
        </gmd:CI_Contact>
      </gmd:contactInfo>
      <gmd:role>
        <gmd:CI_RoleCode
          codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_90"
          codeListValue="RI_413">originator</gmd:CI_RoleCode>
      </gmd:role>
    </gmd:CI_ResponsibleParty>
  </gmd:contact>
  <!-- (M-M) Metadata date stamp - USGIN profile requires use of dateStamp/gco:DateTime (Note
this contrasts with INSPIRE mandate to use dateStamp/gco:Date). This is the date and time when
the metadata record was created or updated (following NAP). -->
```


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```
  <gmd:dateStamp>
    <!-- Requires an extended ISO 8601 formatted combined UTC date and time string (2009-11-
17T10:00:00) -->
    <gco:DateTime>2009-11-17T10:00:00</gco:DateTime>
  </gmd:dateStamp>
  <!-- (M-M) metadata standard - NAP specifies "NAP - Metadata". USGIN profile conformant
metadata is indicated by using “ISO-NAP-USGIN" -->
  <gmd:metadataStandardName>
    <gco:CharacterString>ISO-NAP-USGIN</gco:CharacterString>
  </gmd:metadataStandardName>
  <!-- (O-M) USGIN profile version -->
  <gmd:metadataStandardVersion>
    <gco:CharacterString>1.0</gco:CharacterString>
  </gmd:metadataStandardVersion>
  <!-- (O-C) Dataset Identifier - For USGIN, this is a string that uniquely identifies the
described resource. If the resource has an identifier, it should be included here; if the
resource will be referenced from other metadata, it must have an identifier here. If the dataset
is coupled to a service, the value of the MD_Metadata/dataSetURI attribute is the unique resource
identifier used by srv:coupledResource to link the service with the dataset. For the USGIN
profile, the MD_Distribution/transferOptions/MD_DigitalTransferOptions/ online/CI_OnlineResource
is used to specify URLs for access to the resource. -->
  <gmd:dataSetURI>
    <!-- Uniform Resource Identifier (URI) -->
    <gco:CharacterString>http://azgs.az.gov/resource/00C02E67-F1ED-473D-A240-
068CCB041A73</gco:CharacterString>
  </gmd:dataSetURI>
  <!-- (C-C) Other Languages - If description in more than one language is provided, this
property should indicate what those languages are. The primary language used for metadata
description is identified with MD_Metadata/language and characterSet and any additional languages
are identified by MD_Metadata/locale/PT_locale elements, in which the language is provided
according to ISO 639-2/T three-letter terminology codes in lowercase, and an optional country is
provided according to ISO 3166-1 three-letter codes in uppercase, and mandatory
characterEncoding. -->
  <!-- This locale element example implies that all character string elements are available in
English (from the MD_Metadata/language element), and in French. -->
  <!--
  <gmd:locale>
    <gmd:PT_Locale id="FR">
      <gmd:languageCode>
        <gmd:LanguageCode

  codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/
Codelist/ML_gmxCodelists.xml#LanguageCode"
          codeListValue="fra">Français</gmd:LanguageCode>
      </gmd:languageCode>
      <gmd:characterEncoding>
        <gmd:MD_CharacterSetCode
          codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_95"
          codeListValue="RI_458">utf8</gmd:MD_CharacterSetCode>
      </gmd:characterEncoding>
    </gmd:PT_Locale>
  </gmd:locale>
  -->
  <!-- (O-O) Resource spatial representation - Spatial representation information for the dataset
(resource). Best practice is to include metadata for spatial representation if the described
resource is a georeferenced dataset. -->
  <gmd:spatialRepresentationInfo>
    <gmd:MD_VectorSpatialRepresentation>
      <gmd:topologyLevel>
        <!-- napMD_TopologyLevelCode names: {geometryOnly, topology1D, planarGraph,
fullPlanarGraph, surfaceGraph, fullSurfaceGraph, topology3D, fullTopology3D, abstract} -->
        <gmd:MD_TopologyLevelCode
          codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_111"
          codeListValue="RI_510">geometryOnly</gmd:MD_TopologyLevelCode>
      </gmd:topologyLevel>
      <!-- (C-C) Identification of the objects used to represent features in the dataset -  -->
      <gmd:geometricObjects>
        <gmd:MD_GeometricObjects>
          <gmd:geometricObjectType>
            <!-- napMD_GeometricObjectTypeCode names: {complex, composite, curve, point, solid,
surface} -->
            <gmd:MD_GeometricObjectTypeCode
```


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```
            codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_99"
            codeListValue="surface">surface</gmd:MD_GeometricObjectTypeCode>
        </gmd:geometricObjectType>
      </gmd:MD_GeometricObjects>
    </gmd:geometricObjects>
  </gmd:MD_VectorSpatialRepresentation>
 </gmd:spatialRepresentationInfo>
 <!-- (O-O) Resource's spatial reference system - Description of the spatial and/or temporal
reference systems used in the dataset. NAP specifies
{identificationInfo/spatialRepresentationType/MD_SpatialRepresentationTypeCode = "vector") or
(../MD_SpatialRepresentationTypeCode = "grid") or (../MD_SpatialRepresentationTypeCode = "tin")
implies count referenceSystemInfo >= 1) } -->
 <gmd:referenceSystemInfo>
   <gmd:MD_ReferenceSystem>
     <!-- ISO 19115:2003 Corrigendum 1:2006 removes CRS and projection parameter information,
and uses ISO 19111 instead  -->
     <gmd:referenceSystemIdentifier>
       <gmd:RS_Identifier>
         <!-- (C-C) Reference System identifier code - For USGIN the code should be a value from
the EPSG Geodetic Parameter Dataset register (http://www.epsg-registry.org/) in the form
"EPSG:nnnn" where nnnn is the EPSG code number for the CRS. -->
         <gmd:code>
           <gco:CharacterString>EPSG:5701</gco:CharacterString>
         </gmd:code>
         <gmd:codeSpace>
           <gco:CharacterString>urn:ogc:def:crs</gco:CharacterString>
         </gmd:codeSpace>
       </gmd:RS_Identifier>
     </gmd:referenceSystemIdentifier>
   </gmd:MD_ReferenceSystem>
 </gmd:referenceSystemInfo>
 <!-- (X-X) Metadata extension information - not used in USGIN -->
 <!--
 <gmd:metadataExtensionInfo/>
 -->
 <!-- ********************* -->
 <!-- (M-M) Resource identification information - At least one of MD_DataIdentification
(dataset, dataset series) or SV_ServiceIdentification (service) is required.  -->
 <gmd:identificationInfo>
   <!-- Resource Dataset or Dataset Series Identification -->
   <gmd:MD_DataIdentification>
     <gmd:citation>
       <!-- (M-M) Resource citation - For USGIN purposes, this should be viewed as information
to identify the intellectual origin of the content in the described resource, along the lines of
a citation in a scientific journal. Required content for a CI_Citation element are title, date,
and responsibleParty -->
       <gmd:CI_Citation>
         <!-- (M-M) Resource title - USGIN recommends using titles that inform the human reader
about the dataset's content as well as its context. -->
         <gmd:title>
           <gco:CharacterString>Scanned Borehole Compensated Sonic Log for 0391, Kerr-McGee08
Navajo</gco:CharacterString>
         </gmd:title>
         <!-- (O-O) Alternate title -->
         <!--
         <gmd:alternateTitle>
           <gco:CharacterString>some alternate title</gco:CharacterString>
         </gmd:alternateTitle>
         -->
         <!-- (M-M) Resource reference date - Best practice is to include at least the date of
publication or creation of the resource. The date of the resource reported in the citation
corresponds to the resource's last update version according to its update frequency. CI_Date
content includes a date and dateType. Date for USGIN profile uses xs:date data type, defined thus
"date uses the date/timeSevenPropertyModel, with hour, minute, and second  required to be absent.
timezoneOffset• remains optional" (http://www.w3.org/TR/xmlschema11-2). -->
         <gmd:date>
           <gmd:CI_Date>
             <gmd:date>
               <!-- Requires an extended ISO 8601 formatted combined UTC date and time string
(2001-12-17T09:30:47) -->
               <gco:DateTime>2001-12-17T09:30:47</gco:DateTime>
             </gmd:date>
```


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```
              <gmd:dateType>
                <!-- napCI_DateTypeCode names: {creation, publication, revision} -->
                <gmd:CI_DateTypeCode
                  codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_87"
                  codeListValue="RI_367">publication</gmd:CI_DateTypeCode>
              </gmd:dateType>
            </gmd:CI_Date>
          </gmd:date>
          <!-- (C-C) Unique resource identifier  - NAP makes MD_Identifier mandatory for dataset
and dataset series.
               For USGIN purposes, this element content value should be only considered an identifier
for the citation, without any assumption that it will use http protocol. The identifier may be
resolvable to a URL, if a protocol prefix specifies an identifier scheme that is resolvable (e.g.
http, urn…), but this is not necessary for a valid document, and should not be assumed when
processing metadata documents.
               For USGIN, IF the Citation has an identifier that is different from the identifier for
the described resource (MD_Metadata/dataSetURI), it must be included here. RS_Identifier may
substitute for MD_Identifier in the ISO19139 schema, but the USGIN profile requires use of
MD_Identifer. If additional codespace and version content is associated with the identifier, it
should be encoded as MD_Identifier/authority/ CI_Citation/ alternateTitle and MD_Identifier/
authority/ CI_Citation/ edition  -->
          <!--
          <gmd:identifier>
            <gmd:MD_Identifier>
              <gmd:code>
                --><!-- ISBN 13 example --><!--
                <gco:CharacterString>urn:isbn:000-0-000-00000-0</gco:CharacterString>
              </gmd:code>
            </gmd:MD_Identifier>
          </gmd:identifier>
          -->
          <!-- (M-M) Resource responsible party - USGIN requires at least one CI_ResponsibleParty
following the NAP rule. Best practice is to include point of contact information for the resource
in MD_DataIdentification/pointOfContact/CI_ResponsibleParty.  -->
          <gmd:citedResponsibleParty>
            <gmd:CI_ResponsibleParty>
              <!-- (C-C) (individualName + organisationName + positionName) > 0 -->
              <gmd:individualName>
                <gco:CharacterString>Steve Rauzi</gco:CharacterString>
              </gmd:individualName>
              <gmd:organisationName>
                <gco:CharacterString>Arizona Geological Survey</gco:CharacterString>
              </gmd:organisationName>
              <gmd:positionName>
                <gco:CharacterString>Oil and Gas Administrator</gco:CharacterString>
              </gmd:positionName>
              <!-- (O-O) Contact Information - -->
              <gmd:contactInfo>
                <gmd:CI_Contact>
                  <gmd:phone>
                    <gmd:CI_Telephone>
                      <gmd:voice>
                        <gco:CharacterString>520-770-3500</gco:CharacterString>
                      </gmd:voice>
                      <gmd:facsimile>
                        <gco:CharacterString>520-770-3505</gco:CharacterString>
                      </gmd:facsimile>
                    </gmd:CI_Telephone>
                  </gmd:phone>
                  <gmd:address>
                    <gmd:CI_Address>
                      <gmd:deliveryPoint>
                        <gco:CharacterString>416 W. Congress St., Suite 100</gco:CharacterString>
                      </gmd:deliveryPoint>
                      <gmd:city>
                        <gco:CharacterString>Tucson</gco:CharacterString>
                      </gmd:city>
                      <gmd:administrativeArea>
                        <gco:CharacterString>Arizona</gco:CharacterString>
                      </gmd:administrativeArea>
                      <gmd:postalCode>
                        <gco:CharacterString>85701</gco:CharacterString>
```


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```
                    </gmd:postalCode>
                    <gmd:country>
                      <gco:CharacterString>USA</gco:CharacterString>
                    </gmd:country>
                    <gmd:electronicMailAddress>
                      <gco:CharacterString>Steve.rauzi@azgs.az.go</gco:CharacterString>
                    </gmd:electronicMailAddress>
                  </gmd:CI_Address>
                </gmd:address>
              </gmd:CI_Contact>
            </gmd:contactInfo>
            <!-- (M-M) ISO 19139 Mandatory: contact role - Guidance on use of role codes would
be helpful for consistency, but has not been developed as yet.. -->
            <gmd:role>
              <!-- The CI_ResponsibleParty/role/CI_RoleCode@codeListValue is from napCI_RoleCode
names: {resourceProvider, custodian, owner, user, distributor, originator, pointOfContact,
principalInvestigator, processor, publisher, author, collaborator, editor, mediator,
rightsHolder} -->
              <gmd:CI_RoleCode
                codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_90"
                codeListValue="RI_414">pointOfContact</gmd:CI_RoleCode>
            </gmd:role>
          </gmd:CI_ResponsibleParty>
        </gmd:citedResponsibleParty>
        <!-- (O-C) Dataset Presentation Form - USGIN mandates required if there is a significant
difference between the resource's presentation format and distribution format. -->
        <!--
        <gmd:presentationForm>
        --><!-- napCI_PresentationFormCode names: {documentDigital, documentHardcopy,
imageDigital, imageHardcopy, mapDigital, mapHardcopy, modelDigital, modelHardcopy,
profileDigital, profileHardcopy, tableDigital, tableHardcopy, videoDigital, videoHardcopy,
audioDigital, audioHardcopy, multimediaDigital, multimediaHardcopy, diagramDigital,
diagramHardcopy} --><!--
          <gmd:CI_PresentationFormCode
            codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_89"
            codeListValue="RI_391">mapDigital</gmd:CI_PresentationFormCode>
        </gmd:presentationForm>
         -->
        <!-- (O-O) Resource series - Information about the series or collection of which the
cited resource is a part. Follow NAP rule (name + issueIdentification) > 0. -->
        <!--
        <gmd:series>
          <gmd:CI_Series>
            <gmd:name>
              --><!-- Name of the publication series or aggregate dataset of which the
referenced dataset is a part. --><!--
              <gco:CharacterString>Borehole Collection</gco:CharacterString>
            </gmd:name>
            <gmd:issueIdentification>
              --><!-- Identification of the series' issue information. --><!--
              <gco:CharacterString>Volume 10</gco:CharacterString>
            </gmd:issueIdentification>
            <gmd:page>
              --><!-- Identification of the articles' page number(s). --><!--
              <gco:CharacterString>100-110</gco:CharacterString>
            </gmd:page>
          </gmd:CI_Series>
        </gmd:series>
        -->
        <!-- (O-O) Resource other citation details -->
        <!--
        <gmd:otherCitationDetails/>
        -->
        <!-- (O-C) Resource collective title - Title of the combined resource that the cited
resource is part of, for example the cited resource may be a paper in an anthology, in which case
the anthology title would be the collective title. Required if the cited resource is part of such
a collective work. -->
        <!--
        <gmd:collectiveTitle/>
        -->
      </gmd:CI_Citation>
    </gmd:citation>
```


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```
      <!-- (M-M) Resource Abstract - A free text summary of the content, significance, purpose,
scope, etc. of the resource. Exactly one value. -->
      <gmd:abstract>
        <gco:CharacterString>Digital files containing Tiff images of scanned logs. Scanned using
Neutra scanner hardware.</gco:CharacterString>
      </gmd:abstract>
      <!-- (O-O) Resource purpose - Summary of the intentions for which the dataset was
developed. Purpose includes objectives for creating the dataset and what the dataset is to
support. -->
      <!--
      <gmd:purpose/>
      -->
      <!-- (M-M) Resource Status -  -->
      <gmd:status>
        <!-- Value is from napMD_ProgressCode names: {completed, historicalArchive, obsolete,
onGoing, planned, required, underDevelopment, proposed} Obsolete is synonymous with deprecated. -
->
        <gmd:MD_ProgressCode
          codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_106"
          codeListValue="RI_593">completed</gmd:MD_ProgressCode>
      </gmd:status>
      <!-- (O-C) Resource point of contact - CI_ResponsibleParty element here would contain
information for point of contact to access the resource. This information is mandatory for
physical resources such as core, cuttings, samples, manuscripts. -->
      <gmd:pointOfContact>
        <gmd:CI_ResponsibleParty>
          <!-- (M-M) (individualName + organisationName + positionName) > 0 -->
          <gmd:individualName>
            <gco:CharacterString>Steve Rauzi</gco:CharacterString>
          </gmd:individualName>
          <gmd:organisationName>
            <gco:CharacterString>Arizona Geological Survey</gco:CharacterString>
          </gmd:organisationName>
          <gmd:positionName>
            <gco:CharacterString>Oil and Gas Administrator</gco:CharacterString>
          </gmd:positionName>
          <!-- (O-O) Contact Information - -->
          <gmd:contactInfo>
            <gmd:CI_Contact>
              <gmd:phone>
                <gmd:CI_Telephone>
                  <gmd:voice>
                    <gco:CharacterString>520-770-3500</gco:CharacterString>
                  </gmd:voice>
                  <gmd:facsimile>
                    <gco:CharacterString>520-770-3505</gco:CharacterString>
                  </gmd:facsimile>
                </gmd:CI_Telephone>
              </gmd:phone>
              <gmd:address>
                <gmd:CI_Address>
                  <gmd:deliveryPoint>
                    <gco:CharacterString>416 W. Congress St., Suite 100</gco:CharacterString>
                  </gmd:deliveryPoint>
                  <gmd:city>
                    <gco:CharacterString>Tucson</gco:CharacterString>
                  </gmd:city>
                  <gmd:administrativeArea>
                    <gco:CharacterString>Arizona</gco:CharacterString>
                  </gmd:administrativeArea>
                  <gmd:postalCode>
                    <gco:CharacterString>85701</gco:CharacterString>
                  </gmd:postalCode>
                  <gmd:country>
                    <gco:CharacterString>USA</gco:CharacterString>
                  </gmd:country>
                  <gmd:electronicMailAddress>
                    <gco:CharacterString>Steve.rauzi@azgs.az.go</gco:CharacterString>
                  </gmd:electronicMailAddress>
                </gmd:CI_Address>
              </gmd:address>
            </gmd:CI_Contact>
```


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```
         </gmd:contactInfo>
         <!-- (M-M) ISO 19139 Mandatory: contact role - Guidance on use of role codes would be
helpful for consistency, but has not been developed as yet. -->
         <gmd:role>
           <!-- The CI_ResponsibleParty/role/CI_RoleCode is from napCI_RoleCode names:
{resourceProvider, custodian, owner, user, distributor, originator, pointOfContact,
principalInvestigator, processor, publisher, author, collaborator, editor, mediator,
rightsHolder} -->
           <gmd:CI_RoleCode
             codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_90"
             codeListValue="RI_414">pointOfContact</gmd:CI_RoleCode>
         </gmd:role>
       </gmd:CI_ResponsibleParty>
     </gmd:pointOfContact>
     <!-- (O-O) Resource Maintenance - This element provides information about the maintenance
schedule or history of the resource (or some subset/part of the resource specified by the scope
and scope description) described by the metadata record. 0 to many MD_MaintenanceInformation
elements may be included.   -->
     <gmd:resourceMaintenance>
       <gmd:MD_MaintenanceInformation>
         <gmd:maintenanceAndUpdateFrequency>
           <!-- napMD_MaintenanceFrequencyCode names: {continual, daily, weekly, fortnightly,
monthly, quarterly, biannually, annually, asNeeded, irregular, notPlanned, unknown, semimonthly}
-->
           <gmd:MD_MaintenanceFrequencyCode
             codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_102"
             codeListValue="RI_540">asNeeded</gmd:MD_MaintenanceFrequencyCode>
         </gmd:maintenanceAndUpdateFrequency>
       </gmd:MD_MaintenanceInformation>
     </gmd:resourceMaintenance>
     <!-- (O-O) Graphic overview of resource - USGIN best practice is to provide xlink:href URL
to file if it is available online, as an attribute of the MD_BrowseGraphic element. If
MD_BrowseGraphic is included, MD_BrowseGraphic/filename character string is mandatory.
Recommended practice is to use the Anchor extension of CharacterString xml element from ISO19139,
which provides a url as an attribute and a text string as a label for the link.  -->
     <gmd:graphicOverview>
       <gmd:MD_BrowseGraphic>
         <gmd:fileName>
           <gco:CharacterString>http://azgs.az.gov/resource/00C02E67-F1ED-473D-A240-
068CCB041A73/preview.jpg</gco:CharacterString>
         </gmd:fileName>
         <gmd:fileDescription>
           <gco:CharacterString>preview map</gco:CharacterString>
         </gmd:fileDescription>
         <!-- Use napMD_FileFormatCode code list
(http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_115). List names are {bil, bmp, bsq,
bzip2, cdr, cgm, cover, csv, dbf, dgn, doc, dwg, dxf, e00, ecw, eps, ers, gdb, geotiff, gif, gml,
grid, gzip, html, jpg, mdb, mif, pbm, pdf, png, ps, rtf, sdc, shp, sid, svg, tab, tar, tiff, txt,
xhtml, xls, xml, xwd, zip, wpd} See section 4.16.3 Codelists for discussion of encoding of
codelist values. Note that to use this napm namespace extension in a valid xml document, the
namespace declaration
xmlns:napm=http://www.cits.rncan.gc.ca/html/brodeurj/.protege/.napMetadata/napMetadataWebsite/nap
MetadataTools/napXsd/napm  must be included in the root element of th document. -->
         <!-- The current napm.xsd schema conflicts with gmd because it refernces a local copy of
the OGC gmd schema at
http://www.cits.rncan.gc.ca/html/brodeurj/.protege/.napMetadata/tools/napXsd/gmd/ Until this is
resolved, the gmd:fileType attributes can be obmited. However, USGIN requires the use of
napMD_FileFormatCode names. -->
         <!--
         <gmd:fileType
           xsi:type="napm:napMD_FileFormatCode_PropertyType"
           codeList="http://www.fgdc.gov/nap/metadata/register/registerItemClasses.html#IC_115"
           codeListValue="RI_711">
           <gco:CharacterString>jpg</gco:CharacterString>
         </gmd:fileType>
         -->
         <gmd:fileType>
           <gco:CharacterString>jpg</gco:CharacterString>
         </gmd:fileType>
       </gmd:MD_BrowseGraphic>
     </gmd:graphicOverview>
```


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```
      <!-- (X-X) Resource Format - This element is not used by NAP or USGIN; this information is
encoded in MD_Metadata/distributionInfo/MD_Distribution/ in USGIN metadata. -->
      <!--
      <gmd:resourceForma/>
      -->
      <!-- (O-O) Resource keywords - Best Practice for USGIN profile metadata is to supply
keywords to facilitate the discovery of metadata records relevant to the user. USGIN requires
that MD_Keyword/keyword contain a CharacterString. USGIN best practice is to include keywords in
English -->
      <!-- Theme keywords -->
      <gmd:descriptiveKeywords>
        <gmd:MD_Keywords>
          <gmd:keyword>
            <gco:CharacterString>Scanned Gamma Ray Neutron</gco:CharacterString>
          </gmd:keyword>
          <gmd:keyword>
            <gco:CharacterString>NMAL</gco:CharacterString>
          </gmd:keyword>
          <gmd:keyword>
            <gco:CharacterString>borehole</gco:CharacterString>
          </gmd:keyword>
          <!-- Keyword Type - allowed values from napMD_KeywordTypeCode names: {discipline, place,
stratum, temporal, theme, product, subTopicCategory} -->
          <gmd:type>
            <gmd:MD_KeywordTypeCode
              codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_101"
              codeListValue="RI_528">theme</gmd:MD_KeywordTypeCode>
          </gmd:type>
        </gmd:MD_Keywords>
      </gmd:descriptiveKeywords>
      <!-- Temporal keywords -->
      <gmd:descriptiveKeywords>
        <gmd:MD_Keywords>
          <gmd:keyword>
            <gco:CharacterString>Frasian</gco:CharacterString>
          </gmd:keyword>
          <gmd:keyword>
            <gco:CharacterString>Upper Devonian</gco:CharacterString>
          </gmd:keyword>
          <gmd:keyword>
            <gco:CharacterString>Devonian</gco:CharacterString>
          </gmd:keyword>
          <gmd:keyword>
            <gco:CharacterString>Paleozoic</gco:CharacterString>
          </gmd:keyword>
          <!-- Keyword Type - allowed values from napMD_KeywordTypeCode names: {discipline, place,
stratum, temporal, theme, product, subTopicCategory} -->
          <gmd:type>
            <gmd:MD_KeywordTypeCode
              codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_101"
              codeListValue="RI_527">temporal</gmd:MD_KeywordTypeCode>
          </gmd:type>
        </gmd:MD_Keywords>
      </gmd:descriptiveKeywords>
      <!-- Place keywords -->
      <gmd:descriptiveKeywords>
        <gmd:MD_Keywords>
          <gmd:keyword>
            <gco:CharacterString>Arizona</gco:CharacterString>
          </gmd:keyword>
          <gmd:keyword>
            <gco:CharacterString>T41N R27E S22 NE NE</gco:CharacterString>
          </gmd:keyword>
          <!-- Keyword Type - allowed values from napMD_KeywordTypeCode names: {discipline, place,
stratum, temporal, theme, product, subTopicCategory} -->
          <gmd:type>
            <gmd:MD_KeywordTypeCode
              codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_101"
              codeListValue="RI_525">place</gmd:MD_KeywordTypeCode>
          </gmd:type>
        </gmd:MD_Keywords>
      </gmd:descriptiveKeywords>
```


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```
      <!-- (O-O) Condition applying to access and use of resource - Follow NAP for specification
of resourceConstraints. This attribute provides information for access control to the described
resource itself. In some situations, the metadataConstraints may allow a user to learn of the
existence of a resource that they may not actually be able to access without further clearance.
Constraints may be represented by MD_Constraint, MD_LegalConstraint, or MD_SecurityConstraint. --
>
      <gmd:resourceConstraints>
        <gmd:MD_LegalConstraints>
          <gmd:useLimitation>
            <gco:CharacterString>none</gco:CharacterString>
          </gmd:useLimitation>
        </gmd:MD_LegalConstraints>
      </gmd:resourceConstraints>
      <!-- (O-O) Aggregation information - The citation for or name of an aggregate dataset, the
type of aggregate dataset, and optionally the activity which produced the dataset. -->
      <gmd:aggregationInfo>
        <!-- MD_AggregateInformation requires either aggregateDataSetName/CI_Citation or
aggregateDataSetIdentifier/MD_Identifier.   -->
        <gmd:MD_AggregateInformation>
          <!-- Related dataset name -->
          <gmd:aggregateDataSetName>
            <gmd:CI_Citation>
              <gmd:title>
                <gco:CharacterString>Related Resource's Title</gco:CharacterString>
              </gmd:title>
              <gmd:date>
                <gmd:CI_Date>
                  <gmd:date>
                    <gco:DateTime>2001-12-17T09:30:47</gco:DateTime>
                  </gmd:date>
                  <gmd:dateType>
                    <gmd:CI_DateTypeCode
                      codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_87"
                      codeListValue="RI_367">publication</gmd:CI_DateTypeCode>
                  </gmd:dateType>
                </gmd:CI_Date>
              </gmd:date>
            </gmd:CI_Citation>
          </gmd:aggregateDataSetName>
          <!-- Data Set Identifier -->
          <gmd:aggregateDataSetIdentifier>
            <gmd:MD_Identifier>
              <gmd:code>
                <gco:CharacterString>00000000-0000-0000-0000-000000000000</gco:CharacterString>
              </gmd:code>
            </gmd:MD_Identifier>
          </gmd:aggregateDataSetIdentifier>
          <!-- (M-M) Association Type is mandatory.. -->
          <gmd:associationType>
            <!-- Use napDS_AssociationTypeCode names: {crossReference, largerWorkCitation,
partOfSeamlessDatabase, source, stereoMate, isComposedOf} -->
            <gmd:DS_AssociationTypeCode
              codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_92"
              codeListValue="RI_428">crossReference</gmd:DS_AssociationTypeCode>
          </gmd:associationType>
        </gmd:MD_AggregateInformation>
      </gmd:aggregationInfo>
      <!-- (O-O) Spatial Representation Type - napMD_SpatialRepresentationTypeCode names {vector,
grid, textTable, tin, stereoModel, video} -->
      <!--
      <gmd:spatialRepresentationType/>
      -->
      <!-- (C-C) Resource spatial resolution - USGIN requires use of
equivalentScale/../denominator to express spatial resolution, in order to be more easily
interoperable.  -->
      <gmd:spatialResolution>
        <gmd:MD_Resolution>
          <gmd:equivalentScale>
            <gmd:MD_RepresentativeFraction>
              <gmd:denominator>
                <gco:Integer>100000</gco:Integer>
              </gmd:denominator>
```


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```
            </gmd:MD_RepresentativeFraction>
          </gmd:equivalentScale>
        </gmd:MD_Resolution>
      </gmd:spatialResolution>
      <!-- (M-M) Resource language - Multiple instances of this element indicate that the
linguistic content of the resource is available in multiple languages -->
      <gmd:language>
        <!-- Three-letter language code followed by an optional three-letter country code: <ISO
639-2/T three letter language code>{<;><blank space><ISO 3166-1 three letter country code>}
Language code is given in lowercase. Country code is given in uppercase.  -->
        <gco:CharacterString>eng; USA</gco:CharacterString>
      </gmd:language>
      <!-- (C-C) Topic category - NAP specifies that topicCategory code shall be provided when
hierarchyLevel is set to "dataset" or “dataset series”. Most USGIN resources will have
topicCategory=”geoscientificInformation”, which is the default value for this profile.  More
specific topic categorization should be done using keywords. NAP declares not applicable to
services. -->
      <gmd:topicCategory>
      <!-- napMD_TopicCategoryCode names: {farming, biota, boundaries,
climatologyMeterologyAtmosphere, economy, elevation, environment, geoscientificInformation,
health, imageryBaseMapsEarthCover, intelligenceMilitary, inlandWater, location, oceans,
planningCadastre, society, structure, transportation, utilitiesCommunication} -->
        <gmd:MD_TopicCategoryCode>geoscientificInformation</gmd:MD_TopicCategoryCode>
      </gmd:topicCategory>
      <!-- (C-C) Resource content extent - Defines the spatial (horizontal and vertical) and
temporal region to which the content of the resource applies. For USGIN, the spatial extent is a
rectangle that bounds the geographic extent to which resource content applies. NAP specifies
required when hierarchyLevel is set to ‘dataset’. USGIN specifies (description +
geographicElement + temporalElement) > 0. -->
      <gmd:extent>
        <gmd:EX_Extent>
          <!-- (C-C) Resource Content extent description - Free text that describes the spatial
and temporal extent of the dataset. USGIN specifies that description is mandatory if a
geographicElement or temporalElement is not provided. Note that if geographic place names are
used to express the geographic extent, USGIN profile specifies that these should be encoded using
keyword with keyword type code = ‘place.’ Geographic names may be duplicated in the
EX_Extent/description. -->
          <gmd:description>
            <gco:CharacterString>Some spatio-temporal description.</gco:CharacterString>
          </gmd:description>
          <!-- (O-C) Resource content extent bounding box -USGIN profile requires that if an
EX_Extent/geographicElement is supplied, it include a geographic bounding box with bounding
latitude and longitude expressed using WGS 84 decimal degrees. The corner coordinates for the
geographic bounding box must not coincide in one point, because this may result in fatal errors
with some CSW implementations. Point locations must thus be represented as tiny rectangles. USGIN
recommended practice is to place the actual point location in the lower left corner of the
rectangle. -->
          <gmd:geographicElement>
            <gmd:EX_GeographicBoundingBox>
              <gmd:extentTypeCode>
                <gco:Boolean>1</gco:Boolean>
              </gmd:extentTypeCode>
              <gmd:westBoundLongitude>
                <gco:Decimal>-109.911001</gco:Decimal>
              </gmd:westBoundLongitude>
              <gmd:eastBoundLongitude>
                <gco:Decimal>-109.910999</gco:Decimal>
              </gmd:eastBoundLongitude>
              <gmd:southBoundLatitude>
                <gco:Decimal>34.772899</gco:Decimal>
              </gmd:southBoundLatitude>
              <gmd:northBoundLatitude>
                <gco:Decimal>34.772901</gco:Decimal>
              </gmd:northBoundLatitude>
            </gmd:EX_GeographicBoundingBox>
          </gmd:geographicElement>
          <!-- (C-X) Resource content extent geographic description - Not used by USGIN profile,
use keyword with type code = ‘place’ (with thesaurus if necessary). -->
          <!--
          <gmd:geographicElement>
            <gmd:EX_GeographicDescription/>
          </gmd:geographicElement>
```


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```
          -->
          <!-- (C-X) Resource content extent bounding polygon - Not used by USGIN profile. To
improve interoperability, USGIN mandates the use of Geographic Bounding Box instead of bounding
polygon. “An element which describes inclusions or exclusions in a resource. The enclosed
boundary of the dataset expressed in x-y coordinates.” NAP mandates this element if no other
Geographic Bounding Box, Geographic Description, Temporal Element, or Vertical Element are
provided. -->
          <!--
          <gmd:geographicElement>
            <gmd:EX_BoundingPolygon/>
          </gmd:geographicElement>
          -->
        </gmd:EX_Extent>
      </gmd:extent>
      <!-- (O-O) Resource temporal extent -  -->
      <gmd:extent>
        <gmd:EX_Extent>
          <gmd:temporalElement>
            <gmd:EX_TemporalExtent>
              <gmd:extent>
                <gml:TimePeriod gml:id="IdJurassic">
                  <gml:name>Jurassic</gml:name>
                  <!-- USGIN requires the beginPosition and endPosition's frame property to be
defined. The default value is #ISO-8601. -->
                  <gml:beginPosition frame="#ISO-8601">2007-05-28T00:00:00</gml:beginPosition>
                  <gml:endPosition frame="#ISO-8601">2007-05-28T00:00:00</gml:endPosition>
                </gml:TimePeriod>
              </gmd:extent>
            </gmd:EX_TemporalExtent>
          </gmd:temporalElement>
        </gmd:EX_Extent>
      </gmd:extent>
      <!-- (O-X) Resource spatio-temporal extent - Not used. Although use of
EX_SpatialTemporalExtent is allowed by ISO19139 and NAP, USGIN mandates encoding space time
location with EX_TemporalExtent and EX_GeographicBoundingBox. -->
      <!--
      <gmd:extent>
        <gmd:EX_Extent>
          <gmd:temporalElement>
            <gmd:EX_SpatialTemporalExtent/>
          </gmd:temporalElement>
        </gmd:EX_Extent>
      </gmd:extent>
      -->
      <!-- (O-O) Resource vertical extent -  -->
      <gmd:extent>
        <gmd:EX_Extent>
          <gmd:verticalElement>
            <gmd:EX_VerticalExtent>
              <gmd:minimumValue>
                <gco:Real>-100</gco:Real>
              </gmd:minimumValue>
              <gmd:maximumValue>
                <gco:Real>200</gco:Real>
              </gmd:maximumValue>
              <!-- Use EPSG register of geodetic parameters such as at http://www.epsg-
registry.org/. The default VerticalCRS is World mean sea level (MSL): urn:ogc:def:crs:EPSG::5714
-->
              <gmd:verticalCRS xlink:href="urn:ogc:def:crs:EPSG::5714 "/>
            </gmd:EX_VerticalExtent>
          </gmd:verticalElement>
        </gmd:EX_Extent>
      </gmd:extent>
    </gmd:MD_DataIdentification>
  </gmd:identificationInfo>
  <!-- *************** -->
  <!-- (O-O) Content informnation - Characteristics describing the feature cataloguecatalog,
coverage, or image data. USGIN currently makes no recommendation for use of contentInfo; follow
NAP recommendations (see INCITS 453). -->
  <!--
  <gmd:contentInfo/>
  -->
```


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```
  <!-- (O-O) Resource distribution information - This element provides information to inform
users how to obtain or access the described resource.  NOTE: there are several ways elements can
be nested within MD_Distribution  -->
  <gmd:distributionInfo>
    <gmd:MD_Distribution>
      <!-- (O-O)  Resource distribution format - Information on the format or physical
manifestation of the resource. If the resource is a physical resource, like a book, rock sample,
paper document, the distributionFormat/MD_Format/name is mandatory, and must be from the USGIN
distribution format codelist. -->
      <!--
      <gmd:distributionFormat/>
      -->
      <!-- (O-C) Resource distributor information - USGIN differs from NAP in this case (but not
with ISO19115) by allowing multiple distributors, and binding between distributors, transfer
options, and formats.  -->
      <gmd:distributor>
        <!-- For USGIN profile, each distributor/MD_Distributor is a binding between one or more
transfer options and the distributor formats that are available through that/those transfer
options (MD_DigitalTransferOptions/onLine/CI_OnlineResource in particular). If different formats
are available from the same distributor, or have different transfer options, these should be
represented as different distributor/MD_Distributor instances. See the USGIN Profile section 'Use
of MD_Distribution and MD_Distributor' for instructions on use of these elements. -->
        <gmd:MD_Distributor>
          <gmd:distributorContact>
            <!-- (C-C) Distribution responsible party - For CI_ResponsibleParty, count of
(individualName + organisationName + positionName) > 0 -->
            <gmd:CI_ResponsibleParty>
              <gmd:organisationName>
                <gco:CharacterString>Arizona Geological Survey</gco:CharacterString>
              </gmd:organisationName>
              <!-- (C-C) If CI_ResponsibleParty exists, the role element is required -->
              <gmd:role>
                <!-- Use napCI_RoleCode names {resourceProvider, custodian, owner, distributor,
pointOfContact, publisher, author, editor, rights-Holder} -->
                <gmd:CI_RoleCode
                  codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_90"
                  codeListValue="RI_412">distributor</gmd:CI_RoleCode>
              </gmd:role>
            </gmd:CI_ResponsibleParty>
          </gmd:distributorContact>
          <!-- (O-O) Resource distributor order process - Information on the availability of the
service which includes at least one of fees, available date and time, ordering instructions, or
turnaround. -->
          <gmd:distributionOrderProcess>
            <gmd:MD_StandardOrderProcess>
              <gmd:fees>
                <gco:CharacterString>variable fees</gco:CharacterString>
              </gmd:fees>
              <gmd:orderingInstructions>
                <gco:CharacterString>ordering instructions</gco:CharacterString>
              </gmd:orderingInstructions>
              <gmd:turnaround>
                <gco:CharacterString>one to two weeks.</gco:CharacterString>
              </gmd:turnaround>
            </gmd:MD_StandardOrderProcess>
          </gmd:distributionOrderProcess>
          <!-- (O-C) Resource distributor format - USGIN profile specifies that the
distributionInfo/MD_Distribution/distributionFormat may be included in the document (its schema
valid...), but distribution format information must be duplicated in a
distributionInfo/distributor/MD_Distributor/distributorFormat element or the content can be lost
-->
          <gmd:distributorFormat>
            <gmd:MD_Format>
              <!-- Use USGIN distribution format code values. See the "Online resource format
names" section of the USGIN Profile -->
              <gmd:name>
                <gco:CharacterString>Adobe:Acrobat/pdf</gco:CharacterString>
              </gmd:name>
              <gmd:version>
                <gco:CharacterString>8.0</gco:CharacterString>
              </gmd:version>
            </gmd:MD_Format>
```


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```
          </gmd:distributorFormat>
          <!-- Resource distributor transfer options - Provides information about the technical
means and media used by the distributor. -->
          <gmd:distributorTransferOptions>
            <gmd:MD_DigitalTransferOptions>
              <gmd:onLine>
                <gmd:CI_OnlineResource>
                  <!-- (M-M) Resource distributor on-line distribution linkage - Digital transfer
options are “technical means and media by which a dataset is obtained from the distributor.” NAP
requires CI_OnlineResource/linkage and CI_OnlineResource/protocol in CI_OnlineResource. -->
                  <gmd:linkage>
                    <!-- The linkage element should contain the complete URL to access the
resource directly. CI_Online-Resource requires a Linkage element that is a gmd:URL. -->
                    <gmd:URL>http://azgs.az.gov/resource/00C02E67-F1ED-473D-A240-
068CCB041A73/borehole_report.pdf</gmd:URL>
                  </gmd:linkage>
                  <gmd:protocol>
                    <!-- The protocol element defines a valid internet protocol used to access the
resource. NAP recommended best practice is that the protocol should be taken from an official
controlled list such as the Official Internet Protocol Standards published on the Web at
http://www.rfc-editor.org/rfcxx00.html or the Internet Assigned Numbers Authority (IANA) at
http://www.iana.org/numbers.html.  ‘ftp’ or ‘http’ are common values. -->
                    <gco:CharacterString>http</gco:CharacterString>
                  </gmd:protocol>
                  <!-- (C-C) Resource distributor online distribution application profile -
applicationProfile is required if the CI_OnlineResource/linkage does not connect to a web page,
and another software application is needed to use the indicated file resource. The
applicationProfile character string should specify the software using the following recommended
syntax: “vendor:application name/application version”, e.g. “Microsoft:Word/2007”, or
“ESRI:ArcGIS/9.3” -->
                  <gmd:applicationProfile>
                    <gco:CharacterString>Adobe:Acrobat/8.0</gco:CharacterString>
                  </gmd:applicationProfile>
                  <gmd:name>
                    <!-- The CI_OnlineResource/name element may duplicate the file name if the URL
is a link to a file, but it is recommended to provide a user-friendly label for the file that
could be presented in a user interface.  -->
                    <gco:CharacterString>borehole_report.pdf</gco:CharacterString>
                  </gmd:name>
                  <gmd:description>
                    <gco:CharacterString>Downloadable PDF document</gco:CharacterString>
                  </gmd:description>
                  <!-- (O-C) Resource distributor online distribution function -
CI_OnlineResource/function is required by USGIN to indicate how linkage is to be used. If the
resource is accessible as a web service, the metadata for the service should be separate metadata
record with the dataset(s) exposed through the service identified in the service metadata record
as coupledResources. -->
                  <gmd:function>
                    <!-- napCI_OnlineFunctionCode names: {download, information, offlineAccess,
order, search, upload, webService, emailService, browsing, fileAccess, webMapService >} -->
                    <gmd:CI_OnLineFunctionCode
                      codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_88"
                      codeListValue="RI_375">download</gmd:CI_OnLineFunctionCode>
                  </gmd:function>
                </gmd:CI_OnlineResource>
              </gmd:onLine>
            </gmd:MD_DigitalTransferOptions>
          </gmd:distributorTransferOptions>
        </gmd:MD_Distributor>
      </gmd:distributor>
      <!-- (C-C) Resource distribution transfer options - MD_DigitalTransferOptions provides
information on digital distribution of resource. See USGIN Profile ‘Use of MD_Distribution and
MD_Distributor’ for instructions on use of this element. Details on encoding for
MD_DigitalTransferOptions are above in the distributorTransferOptions elements description. -->
      <!--
      <gmd:transferOptions/>
      -->
    </gmd:MD_Distribution>
  </gmd:distributionInfo>
  <!-- (C-C) Data quality Information - NAP requires either dataQualityInfo/DQ_DataQuality/report
or dataQualityInfo/ DQ_Data-Quality/lineage   if
dataQualityInfo/DQ_DataQuality/scope/DQ_Scope/level = 'dataset'.   -->
```


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```
  <gmd:dataQualityInfo>
    <gmd:DQ_DataQuality>
      <!-- (C-C) Data quality scope - Mandatory if DQ_DataQuality is not null.  Specifies the
extent of characteristics for which data quality information is reported. -->
      <gmd:scope>
        <gmd:DQ_Scope>
          <gmd:level>
            <!-- napMD_ScopeCode names: {attribute, attributeType, collectionHardware,
collectionSession, dataset, series, nonGeographicDataset, dimensionGroup, feature, featureType,
propertyType, fieldSession, software, service, model, tile}. -->
            <gmd:MD_ScopeCode
              codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_108"
              codeListValue="RI_622">dataset</gmd:MD_ScopeCode>
          </gmd:level>
          <!-- (C-C) Data quality scope level description - NAP provision is that
DQ_DataQuality/scope/levelDescription is mandatory if scope/DQ_Scope/level is not equal to
'dataset' or 'series'. USGIN adds requirement that DataQuality/scope/levelDescription is
mandatory if DQ_DataQuality/scope/DQ_Scope/level/MD_ScopeCode.codeListValue is not equal to
MD_MetadataHierarchy/hierarchyLevel/MD_ScopeCode.codelistvalue level. -->
          <!--
          <gmd:levelDescription>
            <gmd:MD_ScopeDescription>
              --><!-- NAP BP: One and only one of the following must be entered: attributes,
features, featureInstances, attributeInstances, dataset, or other as appropriate. Encoding of the
values for the levelDescription element is unclear from the ISO or INCITs documentation. --><!--
              <gmd:attributes></gmd:attributes>
            </gmd:MD_ScopeDescription>
          </gmd:levelDescription>
          -->
        </gmd:DQ_Scope>
      </gmd:scope>
      <!-- (C-C) Data quality report - If a DQ_DataQuality/report element is included, at least
one of the 15 possible data quality elements must be present, and multiple report elements are
allowed within each DQ_DataQuality element.  -->
      <!--
      <gmd:report>
        <gmd:DQ_CompletenessCommission>
          <gmd:nameOfMeasure>
            <gco:CharacterString>Name of Measure</gco:CharacterString>
          </gmd:nameOfMeasure>
          <gmd:result>
            <gmd:DQ_QuantitativeResult>
            <gmd:valueUnit>a unit</gmd:valueUnit>
              <gmd:value>
                <gco:Record>a value</gco:Record>
              </gmd:value>
            </gmd:DQ_QuantitativeResult>
          </gmd:result>
        </gmd:DQ_CompletenessCommission>
      </gmd:report>
      -->
      <!-- (C-C) Data quality lineage - INSPIRE makes general lineage/LI_Lineage/statement
mandatory. USGIN follows NAP rule that count(lineage/LI_Lineage/source +
lineage/LI_Lineage/sourceStep + lineage/LI_Lineage/statement ) >0  for spatial dataset and
spatial dataset series. Not applicable to services. -->
      <gmd:lineage>
        <gmd:LI_Lineage>
          <!-- (C-C) Data quality lineage statement - General explanation of the data producer's
knowledge of the dataset lineage. -->
          <gmd:statement>
            <gco:CharacterString>This dataset is maintained by the Arizona Geological
Survey.</gco:CharacterString>
          </gmd:statement>
          <!-- (C-C) Data quality lineage source - Each source/LI_Source element describes a
source data resource that is input into a processStep. NAP provision is that
LI_Source/description is mandatory if LI_Source/sourceCitation and LI_Source/sourceExtent  are
not provided. The attribute description includes the source medium name code (CodeList
napMD_MediumNameCode) followed by <;><blank space> and a free text description, e.g. "dvd; source
satellite image."  -->
          <!--
          <gmd:source/>
          -->
```


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```
          <!-- (C-C) Data quality lineage process step - An event in the development of the
dataset. Best practice recommended for USGIN is that source association from a process step is to
inputs to a process, and processStep associations from a source element link an output resource
to a process step that produced it.  -->
          <!--
          <gmd:processStep>
            <gmd:LI_ProcessStep>
              <gmd:description>
                <gco:CharacterString></gco:CharacterString>
              </gmd:description>
            </gmd:LI_ProcessStep>
          </gmd:processStep>
          -->
        </gmd:LI_Lineage>
      </gmd:lineage>
    </gmd:DQ_DataQuality>
  </gmd:dataQualityInfo>
  <!-- (O-O) Portrayal catalog information - A portrayal cataloguecatalog is a collection of
defined symbols used to depict, to humans, features on a map. No documentation in ISO 19115 about
how this is supposed to work. ISO 19117 defines the structure of a Portrayal Catalogue. No USGIN
recommended practices here yet. -->
  <!--
  <gmd:portrayalCatalogueInfo/>
  -->
  <!-- (O-O) Metadata constraint information - This element specifies use constraints for access
to the metadata record.  -->
  <gmd:metadataConstraints>
    <!-- Constraints -->
    <gmd:MD_Constraints>
      <!-- NAP provision is that metadataConstraints/MD_Constraints/useLimitation is mandatory
when MD_Constraints is used to specify metadataConstraints.  -->
      <gmd:useLimitation>
        <gco:CharacterString>fair use</gco:CharacterString>
      </gmd:useLimitation>
    </gmd:MD_Constraints>
  </gmd:metadataConstraints>
  <gmd:metadataConstraints>
    <!-- Legal constraint -->
    <gmd:MD_LegalConstraints>
      <!-- When one of the subtypes MD_LegalConstraints or MD_SecurityConstraints is used,
useLimitation is optional. -->
      <gmd:useLimitation>
        <gco:CharacterString>one</gco:CharacterString>
      </gmd:useLimitation>
      <gmd:accessConstraints>
        <!-- napMD_RestrictionCode names: {copyright, patent, patentPending, trademark, license,
intellectualPropertyRights, restricted, otherRestrictions, licenseUnrestricted, licenseEndUser,
licenseDistributor, privacy, statutory, confidential, sensitivity}. -->
        <gmd:MD_RestrictionCode
          codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_107"
          codeListValue="RI_609">otherRestrictions</gmd:MD_RestrictionCode>
      </gmd:accessConstraints>
      <gmd:useConstraints>
        <!-- napMD_RestrictionCode names: {copyright, patent, patentPending, trademark, license,
intellectualPropertyRights, restricted, otherRestrictions, licenseUnrestricted, licenseEndUser,
licenseDistributor, privacy, statutory, confidential, sensitivity}. -->
        <gmd:MD_RestrictionCode
          codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_107"
          codeListValue="RI_609">otherRestrictions</gmd:MD_RestrictionCode>
      </gmd:useConstraints>
      <!-- (C-C) otherConstraints is a free text element required by NAP if accessConstraints or
useConstraints is set to "otherRestrictions." -->
      <gmd:otherConstraints>
        <gco:CharacterString>Data only to be used for the purposes for which they were
collected.</gco:CharacterString>
      </gmd:otherConstraints>
    </gmd:MD_LegalConstraints>
  </gmd:metadataConstraints>
  <gmd:metadataConstraints>
    <!-- Security constraints -->
    <gmd:MD_SecurityConstraints>
      <gmd:classification>
```


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```
        <!-- MD_SecurtyConstraints has various optional free text values, and a required
MD_SecurityConstraints/classification from napMD_ClassificationCode names: {unclassified,
restricted, confidential, secret, topSecret, sensitive, forOfficialUseOnly} -->
        <gmd:MD_ClassificationCode
          codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_96"
          codeListValue="RI_484">unclassified</gmd:MD_ClassificationCode>
      </gmd:classification>
    </gmd:MD_SecurityConstraints>
  </gmd:metadataConstraints>
  <!-- (O-O) Application schema information - Information about the conceptual schema of the
dataset. -->
  <!--
  <gmd:applicationSchemaInfo>
    --><!-- (M-M) The applicationSchemaInfo/MD_ApplicationSchemaInformation element has mandatory
name/CI_Citation, schemaLanguage free text, and constraintLanguage free text. --><!--
    <gmd:MD_ApplicationSchemaInformation>
      <gmd:name>
        <gmd:CI_Citation>
          <gmd:title>
            <gco:CharacterString>schema title string</gco:CharacterString>
          </gmd:title>
          <gmd:date>
            <gmd:CI_Date>
              <gmd:date>
                <gco:DateTime>2001-12-17T09:30:47</gco:DateTime>
              </gmd:date>
              <gmd:dateType>
                <gmd:CI_DateTypeCode
                  codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_87"
                  codeListValue="RI_367">publication</gmd:CI_DateTypeCode>
              </gmd:dateType>
            </gmd:CI_Date>
          </gmd:date>
        </gmd:CI_Citation>
      </gmd:name>
      <gmd:schemaLanguage>
        <gco:CharacterString>some schema language</gco:CharacterString>
      </gmd:schemaLanguage>
      <gmd:constraintLanguage>
        <gco:CharacterString>some constraint language</gco:CharacterString>
      </gmd:constraintLanguage>
    </gmd:MD_ApplicationSchemaInformation>
  </gmd:applicationSchemaInfo>
  -->
  <!-- (O-O) Metadata maintenance information - This element provides information about the
maintenance schedule or history of the metadata record.  -->
  <gmd:metadataMaintenance>
    <gmd:MD_MaintenanceInformation>
      <gmd:maintenanceAndUpdateFrequency>
        <!-- Only one MD_MaintenanceInformation element may be included, with a required
napMD_MaintenanceFrequencyCode names: {continual, daily, weekly, fortnightly, monthly, quarterly,
biannually, annually, asNeeded, irregular, notPlanned, unknown, semimonthly} -->
        <gmd:MD_MaintenanceFrequencyCode
          codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_102"
          codeListValue="RI_540">asNeeded</gmd:MD_MaintenanceFrequencyCode>
      </gmd:maintenanceAndUpdateFrequency>
    </gmd:MD_MaintenanceInformation>
  </gmd:metadataMaintenance>
  <!-- (X-X) Series information - Not used by USGIN. -->
  <!--
  <gmd:series/>
  -->
  <!-- (X-X) Described resource - Not used by USGIN. -->
  <!--
  <gmd:describes/>
  -->
  <!-- (X-X) Property type description - Not used by USGIN. -->
  <!--
  <gmd:propertyType/>
  -->
  <!-- (X-X) Feature type description - Not used by USGIN -->
  <!--
```


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```
  <gmd:featureType/>
  -->
  <!-- (X-X) Feature attributes - Not used by USGIN -->
  <!--
  <gmd:featureAttribute/>
  -->
</gmd:MD_Metadata>
```


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7.2 USGIN ISO 19139 Service Metadata

```
<?xml version="1.0" encoding="UTF-8"?>
<!--
*********************************************************************************************
*** Example ISO 19139 Geospatial Service Metadata  based on the USGIN v1 Profile
*** with explicitly linked references to coupled resources (map layers) for a WMS service
*** by USGIN Standards and Protocols Drafting Team
*** U.S. Geoscience Information System (USGIN) - http://lab.usgin.org
*** Contributors: Wolfgang Grunberg, Stephen M Richard
*** 01/11/2010
***
*** DISCLAIMER: this is not an authoritative metadata example but an aide to get started.
*** Scope notes are mostly from NAP or ISO documentation; refer to
*** the USGIN profile document for more specific and reliable guidelines.
***
*** Validated against http://www.isotc211.org/2005/gmd (ISO 19115, CSW 2.0.2)
*** and http://www.isotc211.org/2005/srv (ISO 19119, CSW 2.0.2)
*** Follows the USGIN ISO 19139 Dataset Metadata Profile v1.
*** a derivative of the North American Profile (NAP)
***
*** Key: (NAP-USGIN) - M/C/O/X (Mandatory, Conditional, Optional, Not Used)
*********************************************************************************************-->

<!-- USGIN ISO 19139 geospatial service metadata record with explicitly linked references to
coupled resources (map layers) for a WMS service -->
<!-- Note:
http://www.cits.rncan.gc.ca/html/brodeurj/.protege/.napMetadata/napMetadataWebsite/napMetadataToo
ls/napXsd/napm is the namespace for NAP extensions in napm namespace. Its schema is located at
http://www.cits.rncan.gc.ca/html/brodeurj/.protege/.napMetadata/tools/napXsd/napm/napm.xsd
However, that schema does not resolve properly because it also refernces gmd. -->
<gmd:MD_Metadata
  xmlns:gmd="http://www.isotc211.org/2005/gmd"
  xmlns:gco="http://www.isotc211.org/2005/gco"
  xmlns:gml="http://www.opengis.net/gml"
  xmlns:srv="http://www.isotc211.org/2005/srv"
  xmlns:napm="http://www.cits.rncan.gc.ca/html/brodeurj/.protege/.napMetadata/napMetadataWebsite/
napMetadataTools/napXsd/napm"
  xmlns:xlink="http://www.w3.org/1999/xlink"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="
    http://www.isotc211.org/2005/gmd http://schemas.opengis.net/iso/19139/20060504/gmd/gmd.xsd
    http://www.isotc211.org/2005/srv http://schemas.opengis.net/iso/19139/20060504/srv/srv.xsd
    ">
  <!-- (M-M) Metadata file identifier - A unique File Identifier (GUID) - USGIN recommends using
a valid Universally Unique Identifier (UUID) -->
  <gmd:fileIdentifier>
    <gco:CharacterString>53e3ad439d6043e25d875f3959445c3d7d9a1</gco:CharacterString>
  </gmd:fileIdentifier>
  <!-- (M-M) Metadata language - <ISO639-2/T three letter language code - lower case><;><blank
space><ISO3166-1 three letter country code - upper case> -->
  <gmd:language>
    <gco:CharacterString>eng; USA</gco:CharacterString>
  </gmd:language>
  <!-- (M-M) Metadata character set  - NAP specifies default is "utf8", codelist =
napMD_CharacterSetCode. USGIN requires that a character set code is defined to facilitate CSW
servers (deegree, GeoNetwork, etc.). -->
  <gmd:characterSet>
    <!-- napMD_CharacterSetCode names: {ucs2, ucs4, utf7, utf8, utf16, 8859part1, 8859part2,
8859part3, 8859part4, 8859part5, 8859part6, 8859part7, 8859part8, 8859part9, 8859part10,
8859part11, 8859part13, 8859part14, 8859part15, 8859part16, jis, shiftJIS, eucJP, usAscii,
ebcdic, eucKR, big5, GB2312} -->
    <gmd:MD_CharacterSetCode
      codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_95"
      codeListValue="RI_458">utf8</gmd:MD_CharacterSetCode>
  </gmd:characterSet>
  <!-- (M-M) Resource type - Define if this record is a: dataset (default), service, feature,
software, etc. -->
  <gmd:hierarchyLevel>
```


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```
    <!-- napMD_ScopeCode codelist names: {attribute, attributeType, collectionHardware,
collectionSession, dataset, series, nonGeographicDataset, dimensionGroup, feature, featureType,
propertyType, fieldSession, software, service, model, tile} -->
    <gmd:MD_ScopeCode
      codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_108"
      codeListValue="RI_631">service</gmd:MD_ScopeCode>
  </gmd:hierarchyLevel>
  <!-- (O-M) Resource hierarchy level name - ISO 19115 assumes that the metadata hierarchy level
name defaults to “dataset” if it is not documented. NAP does not use it, recognizing that it is
redundant. USGIN makes this property mandatory to identify the USGIN resource type (see USGIN
Profile, "Resources of Interest"). Default USGIN hierarchyLevelName.CharacterString is “Dataset.”
Encode hierarchy by including hierarchyLevelName elements for all broader resource categories.
E.g. default should also include a hierarchyLevelName=”Collection” element. For services USGIN
hierarchyLevelName.CharacterString is “Service”. As use cases develop that provide rationale for
definition of sub-categories of service, the resource category list will be expanded. -->
  <gmd:hierarchyLevelName>
    <gco:CharacterString>Service</gco:CharacterString>
  </gmd:hierarchyLevelName>
  <!-- (M-M) Metadata point of contact - Point of contact for the metadata record, e.g. for users
to report errors, updates to metadata, etc. -->
  <gmd:contact>
    <gmd:CI_ResponsibleParty>
      <!-- (M-M) (individualName + organisationName + positionName) > 0 -->
      <gmd:individualName>
        <gco:CharacterString>Ryan Clark</gco:CharacterString>
      </gmd:individualName>
      <gmd:organisationName>
        <gco:CharacterString>Arizona Geological Survey</gco:CharacterString>
      </gmd:organisationName>
      <gmd:positionName>
        <gco:CharacterString>GIS Manager</gco:CharacterString>
      </gmd:positionName>
      <gmd:contactInfo>
        <gmd:CI_Contact>
          <!-- Phone -->
          <gmd:phone>
            <gmd:CI_Telephone>
              <gmd:voice>
                <gco:CharacterString>520.770.3500</gco:CharacterString>
              </gmd:voice>
              <gmd:facsimile>
                <gco:CharacterString>520.770.3505</gco:CharacterString>
              </gmd:facsimile>
            </gmd:CI_Telephone>
          </gmd:phone>
          <!-- Address -->
          <gmd:address>
            <gmd:CI_Address>
              <gmd:deliveryPoint>
                <gco:CharacterString>416 W. Congress St., Suite 100</gco:CharacterString>
              </gmd:deliveryPoint>
              <gmd:city>
                <gco:CharacterString>Tucson</gco:CharacterString>
              </gmd:city>
              <gmd:administrativeArea>
                <gco:CharacterString>Arizona</gco:CharacterString>
              </gmd:administrativeArea>
              <gmd:postalCode>
                <gco:CharacterString>85701-1381</gco:CharacterString>
              </gmd:postalCode>
              <gmd:country>
                <gco:CharacterString>USA</gco:CharacterString>
              </gmd:country>
              <!-- (O-M) contact e-mail address -->
              <gmd:electronicMailAddress>
                <gco:CharacterString>metadata@azgs.az.gov</gco:CharacterString>
              </gmd:electronicMailAddress>
            </gmd:CI_Address>
          </gmd:address>
          <!-- (O-O) online resources - this is the online resource to contact the metadata
person-->
          <gmd:onlineResource>
```


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```
            <gmd:CI_OnlineResource>
              <gmd:linkage>
                <gmd:URL>http://www.azgs.az.gov</gmd:URL>
              </gmd:linkage>
              <gmd:protocol>
                <gco:CharacterString>HTTP</gco:CharacterString>
              </gmd:protocol>
              <gmd:description>
                <gco:CharacterString>Arizona Geological Survey Web Site</gco:CharacterString>
              </gmd:description>
            </gmd:CI_OnlineResource>
          </gmd:onlineResource>
          <!-- (O-O) hours of service -->
          <gmd:hoursOfService>
            <gco:CharacterString>8 AM to 5 PM Mountain Standard time (no day light
savings)</gco:CharacterString>
          </gmd:hoursOfService>
          <!-- (O-O) contact instructions -->
          <gmd:contactInstructions>
            <gco:CharacterString>Fill out contact form at http://www.azgs.az.gov
</gco:CharacterString>
          </gmd:contactInstructions>
        </gmd:CI_Contact>
      </gmd:contactInfo>
      <!-- (M-M) ISO 19139 Mandatory: contact role -->
      <gmd:role>
        <!-- napCI_RoleCode names: {resourceProvider, custodian, owner, user, distributor,
originator, pointOfContact, principalInvestigator, processor, publisher, author} -->
        <gmd:CI_RoleCode
          codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_90"
          codeListValue="RI_414">pointOfContact</gmd:CI_RoleCode>
      </gmd:role>
    </gmd:CI_ResponsibleParty>
  </gmd:contact>
  <!-- (X-O) Metadata should include a URL that locates a thumbnail logo for organizations
related to the metadata origination, the organization hosting the catalog that returned the
metadata, the organization that originated the data, and the organization hosting online services
that provide access to the data. -->
  <gmd:contact>
    <gmd:CI_ResponsibleParty>
      <gmd:organisationName>
        <gco:CharacterString>Arizona Geological Survey</gco:CharacterString>
      </gmd:organisationName>
      <gmd:contactInfo>
        <gmd:CI_Contact>
          <gmd:onlineResource>
            <gmd:CI_OnlineResource>
              <!-- Icon image file (e.g. tif, png, jpg) for the metadata originator. This Icon
will be displayed in search results to credit the metadata originator. -->
              <gmd:linkage>
                <gmd:URL>http://www.azgs.az.gov/logo/metadata/azgs.png</gmd:URL>
              </gmd:linkage>
              <!-- (X-C) For URL's that indicate icon thumbnails, the CI_OnlineResource/name
should be 'icon'. -->
              <gmd:name>
                <gco:CharacterString>icon</gco:CharacterString>
              </gmd:name>
            </gmd:CI_OnlineResource>
          </gmd:onlineResource>
        </gmd:CI_Contact>
      </gmd:contactInfo>
      <gmd:role>
        <gmd:CI_RoleCode
          codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_90"
          codeListValue="RI_413">originator</gmd:CI_RoleCode>
      </gmd:role>
    </gmd:CI_ResponsibleParty>
  </gmd:contact>
  <!-- (M-M) Metadata date stamp - USGIN profile requires use of dateStamp/gco:DateTime (Note
this contrasts with INSPIRE mandate to use dateStamp/gco:Date). This is the date and time when
the metadata record was created or updated (following NAP). -->
  <gmd:dateStamp>
```


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```
    <!-- Requires an extended ISO 8601 formatted combined UTC date and time string (2009-11-
17T10:00:00) -->
    <gco:DateTime>2009-11-17T10:00:00</gco:DateTime>
  </gmd:dateStamp>
  <!-- (M-M) metadata standard - NAP specifies "NAP - Metadata". USGIN profile conformant
metadata is indicated by using “ISO-NAP-USGIN" -->
  <gmd:metadataStandardName>
    <gco:CharacterString>ISO-NAP-USGIN</gco:CharacterString>
  </gmd:metadataStandardName>
  <!-- (O-M) USGIN profile version -->
  <gmd:metadataStandardVersion>
    <gco:CharacterString>1.0</gco:CharacterString>
  </gmd:metadataStandardVersion>
  <!-- (O-C) Dataset Identifier - For USGIN, this is a string that uniquely identifies the
described resource. If the resource has an identifier, it should be included here; if the
resource will be referenced from other metadata, it must have an identifier here. If the dataset
is coupled to a service, the value of the MD_Metadata/dataSetURI attribute is the unique resource
identifier used by srv:coupledResource to link the service with the dataset. For the USGIN
profile, the MD_Distribution/transferOptions/MD_DigitalTransferOptions/ online/CI_OnlineResource
is used to specify URLs for access to the resource. -->
  <!--
  <gmd:dataSetURI/>
  -->
  <!-- (C-C) Other Languages - If description in more than one language is provided, this
property should indicate what those languages are. The primary language used for metadata
description is identified with MD_Metadata/language and characterSet and any additional languages
are identified by MD_Metadata/locale/PT_locale elements, in which the language is provided
according to ISO 639-2/T three-letter terminology codes in lowercase, and an optional country is
provided according to ISO 3166-1 three-letter codes in uppercase, and mandatory
characterEncoding. -->
    <!--
    <gmd:locale/>
    -->
  <!-- (O-O) Resource spatial representation - Spatial representation Information for the dataset
(resource). Best practice is to include metadata for spatial representation if the described
resource is a georeferenced dataset. -->
  <!--
  <gmd:spatialRepresentationInfo/>
  -->
  <!-- (O-O) Resource’s spatial reference system - Description of the spatial and/or temporal
reference systems used in the dataset.
    NAP specifies {
(identificationInfo/spatialRepresentationType/MD_SpatialRepresentationTypeCode= "vector") or
(../MD_SpatialRepresentationTypeCode = "grid") or (../MD_SpatialRepresentationTypeCode = "tin")
implies count referenceSystemInfo >= 1) } -->
  <gmd:referenceSystemInfo>
    <gmd:MD_ReferenceSystem>
      <!-- ISO 19115:2003 Corrigendum 1:2006 removes CRS and projection parameter information. It
uses the new ISO 19111 instead  -->
      <gmd:referenceSystemIdentifier>
        <gmd:RS_Identifier>
          <!-- (C-C) Reference System identifier code - For USGIN the code should be a value from
the EPSG Geodetic Parameter Dataset register (http://www.epsg-registry.org/) in the form
"EPSG:nnnn" where nnnn is the EPSG code number for the CRS. -->
          <gmd:code>
            <gco:CharacterString>EPSG:5701</gco:CharacterString>
          </gmd:code>
          <gmd:codeSpace>
            <gco:CharacterString>urn:ogc:def:crs</gco:CharacterString>
          </gmd:codeSpace>
        </gmd:RS_Identifier>
      </gmd:referenceSystemIdentifier>
    </gmd:MD_ReferenceSystem>
  </gmd:referenceSystemInfo>
  <!-- (X-X) Metadata extension information - not used in USGIN -->
  <!--
  <gmd:metadataExtensionInfo/>
  -->
  <!--******************-->
  <!-- (M-M) Resource identification information - At least one of MD_DataIdentification
(dataset, dataset series) or SV_ServiceIdentification (service) is required.  -->
  <gmd:identificationInfo>
```


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```
    <!-- Resource Service Identification -->
    <srv:SV_ServiceIdentification>
      <gmd:citation>
        <!-- (M-M) Resource citation - For USGIN purposes, this should be viewed as information
to identify the intellectual origin of the content in the described resource, along the lines of
a citation in a scientific journal. Required content for a CI_Citation element are title, date,
and responsibleParty -->
        <gmd:CI_Citation>
          <!-- (M-M) Resource title - USGIN recommends using titles that inform the human reader
about the dataset's content as well as its context.  -->
          <gmd:title>
            <gco:CharacterString>Arizona Geological Survey Web Map Service</gco:CharacterString>
          </gmd:title>
          <!-- (O-O) Alternate title -->
          <!--
          <gmd:alternateTitle/>
          -->
          <!-- (M-M) Resource reference date - Best practice is to include at least the date of
publication or creation of the resource. The date of the resource reported in the citation
corresponds to the resource's last update version according to its update frequency. CI_Date
content includes a date and dateType. Date for USGIN profile uses xs:date data type, defined thus
"date uses the date/timeSevenPropertyModel, with hour, minute, and second  required to be absent.
timezoneOffset• remains optional" (http://www.w3.org/TR/xmlschema11-2). -->
          <gmd:date>
            <gmd:CI_Date>
              <gmd:date>
                <!-- Requires an extended ISO 8601 formatted combined UTC date and time string
(2001-12-17T09:30:47) -->
                <gco:DateTime>2009-11-22T23:35:22</gco:DateTime>
              </gmd:date>
              <gmd:dateType>
                <!-- CI_DateTypeCode names: {creation, publication, revision} -->
                <gmd:CI_DateTypeCode
                  codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_87"
                  codeListValue="RI_368">revision</gmd:CI_DateTypeCode>
              </gmd:dateType>
            </gmd:CI_Date>
          </gmd:date>
          <!-- (C-O) Unique resource identifier  - For USGIN,  because the Citation is for the
service, this identifier should be identical to MD_Metadta/dataSetURI, and is therefore optional.
For USGIN purposes, this element content value is only an identifier for the citation; it is not
a URL for accessing the service. The USGIN profile requires the use of MD_Identifier element to
identify resources. RS_Identifier may substitute for MD_Identifier in the ISO19139 schema, but
the USGIN profile requires use of MD_Identifer. If additional codespace and version content is
associated with the identifier, it should be encoded as
MD_Identifier/authority/CI_Citation/alternateTitle and
MD_Identifier/authority/CI_Citation/edition  -->
          <!--
          <gmd:identifier/>
          -->
          <!-- (M-M) Resource responsible party - USGIN requires at least one CI_ResponsibleParty
following the NAP rule. Best practice is to include point of contact information for the resource
in MD_DataIdentification/pointOfContact/CI_ResponsibleParty.  -->
          <gmd:citedResponsibleParty>
            <gmd:CI_ResponsibleParty id="R264537">
              <!-- (M-M) (individualName + organisationName + positionName) > 0 -->
              <!--
              <gmd:individualName/>
              -->
              <gmd:organisationName>
                <gco:CharacterString>Arizona Geological Survey</gco:CharacterString>
              </gmd:organisationName>
              <gmd:positionName>
                <gco:CharacterString>GIS Manager</gco:CharacterString>
              </gmd:positionName>
              <!-- (O-O) Contact Information - Best practice is to include at least an e-mail
address -->
              <gmd:contactInfo>
                <gmd:CI_Contact>
                  <gmd:address>
                    <gmd:CI_Address>
                      <gmd:electronicMailAddress>
```


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```
                        <gco:CharacterString>webServices@azgs.az.gov</gco:CharacterString>
                      </gmd:electronicMailAddress>
                    </gmd:CI_Address>
                  </gmd:address>
                </gmd:CI_Contact>
              </gmd:contactInfo>
              <!-- (M-M) ISO 19139 Mandatory: contact role - Guidance on use of role codes would
be helpful for consistency, but has not been developed as yet. -->
              <gmd:role>
                <!-- The CI_ResponsibleParty/role/CI_RoleCode@codeListValue is from
napCI_RoleCode: {resourceProvider, custodian, owner, user, distributor, originator,
pointOfContact, principalInvestigator, processor, publisher, author, collaborator, editor,
mediator, rightsHolder} -->
                <gmd:CI_RoleCode
                  codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_90"
                  codeListValue="RI_408">resourceProvider</gmd:CI_RoleCode>
              </gmd:role>
            </gmd:CI_ResponsibleParty>
          </gmd:citedResponsibleParty>
          <!-- (O-O) Resource Presentation Form - The form in which the service is available,
which in the case of a service is only through the service implementation described by the
metadata record, so the information here is not generally very useful. Note that the citation is
to the original source of intellectual content in the described resource should be in
MD_DataIdentification/citation/CI_Citation that describes the datasets operated on by the
service. -->
          <gmd:presentationForm gco:nilReason="not applicable"/>
          <!-- (O-O) Resource series - Information about the series or collection of which the
cited service is a part. NAP rule: (name + issueIdentification) > 0. At this point there is not
much precedent for aggregating services into a formal series, so in general this element is
probably not applicable to services. -->
          <!--
          <gmd:series/>
          -->
          <!-- (O-O) Resource other citation details -->
          <!--
          <gmd:otherCitationDetails/>
          -->
          <!-- (O-C) Resource collective title - At this point there is not much precedent for
aggregating services into a collections, so in general this element is probably not applicable to
services. -->
          <!--
          <gmd:collectiveTitle/>
          -->
        </gmd:CI_Citation>
      </gmd:citation>
      <!-- (M-M) Resource Abstract - A free text summary of the content, significance, purpose,
scope, etc. of the resource. Exactly one value. -->
      <gmd:abstract>
        <gco:CharacterString>A collection of Web Map Service (WMS) layers created and maintained
by the Arizona Geological Survey.</gco:CharacterString>
      </gmd:abstract>
      <!-- (O-O) Resource purpose - Summary of the intentions for which the service was
developed, including objectives for creating the service and use cases it is designed to support.
-->
      <gmd:purpose>
        <gco:CharacterString>To provide geologic data for the state of Arizona at 1:1,000,000
scale online and free-of-charge.</gco:CharacterString>
      </gmd:purpose>
      <!-- (M-M) Resource Status -  -->
      <gmd:status>
        <!-- Value is from napMD_ProgressCode names: {completed, historicalArchive, obsolete,
onGoing, planned, required, underDevelopment, proposed} Obsolete is synonymous with deprecated. -
->
        <gmd:MD_ProgressCode
          codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_106"
          codeListValue="RI_593">completed</gmd:MD_ProgressCode>
      </gmd:status>
      <!-- (O-C) Resource Service point of contact - CI_ResponsibleParty element here would
contain information for point of contact to access the resource. This information is mandatory
for physical resources such as core, cuttings, samples, manuscripts. -->
      <gmd:pointOfContact>
```


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```
        <!-- CI_Responsible party has an id in order to allow reuse of this element later in the
document by an internal href; see distributionInfo/../distributor near end of document -->
        <gmd:CI_ResponsibleParty>
          <!-- (M-M) (individualName + organisationName + positionName) > 0 -->
          <gmd:individualName>
            <gco:CharacterString>Ryan Clark</gco:CharacterString>
          </gmd:individualName>
          <gmd:organisationName>
            <gco:CharacterString>Arizona Geological Survey</gco:CharacterString>
          </gmd:organisationName>
          <gmd:positionName>
            <gco:CharacterString>GIS Manager</gco:CharacterString>
          </gmd:positionName>
          <!-- (O-O) Contact Information - -->
          <gmd:contactInfo>
            <gmd:CI_Contact>
              <gmd:phone>
                <gmd:CI_Telephone>
                  <gmd:voice>
                    <gco:CharacterString>520-770-3500</gco:CharacterString>
                  </gmd:voice>
                  <gmd:facsimile>
                    <gco:CharacterString>520-770-3505</gco:CharacterString>
                  </gmd:facsimile>
                </gmd:CI_Telephone>
              </gmd:phone>
              <gmd:address>
                <gmd:CI_Address>
                  <gmd:deliveryPoint>
                    <gco:CharacterString>416 W. Congress St. Suite 100</gco:CharacterString>
                  </gmd:deliveryPoint>
                  <gmd:city>
                    <gco:CharacterString>Tucson</gco:CharacterString>
                  </gmd:city>
                  <gmd:administrativeArea>
                    <gco:CharacterString>Arizona</gco:CharacterString>
                  </gmd:administrativeArea>
                  <gmd:postalCode>
                    <gco:CharacterString>85701</gco:CharacterString>
                  </gmd:postalCode>
                  <gmd:country>
                    <gco:CharacterString>USA</gco:CharacterString>
                  </gmd:country>
                  <gmd:electronicMailAddress>
                    <gco:CharacterString>ryan.clark@azgs.az.gov</gco:CharacterString>
                  </gmd:electronicMailAddress>
                </gmd:CI_Address>
              </gmd:address>
              <!--(O-O)  "Information about Internet hosted resources: availability; URL; protocol
used; resource name; resource description, and resource function." NAP -->
              <gmd:onlineResource>
                <gmd:CI_OnlineResource>
                  <gmd:linkage>
                    <gmd:URL>http://75.101.143.247:8080/gsvr/wms</gmd:URL>
                  </gmd:linkage>
                  <gmd:protocol>
                    <gco:CharacterString>http</gco:CharacterString>
                  </gmd:protocol>
                </gmd:CI_OnlineResource>
              </gmd:onlineResource>
            </gmd:CI_Contact>
          </gmd:contactInfo>
          <!-- (M-M) ISO 19139 Mandatory: contact role - Guidance on use of role codes would be
helpful for consistency, but has not been developed as yet. -->
          <gmd:role>
            <!-- The CI_ResponsibleParty/role/CI_RoleCode is from napCI_RoleCode names:
{resourceProvider, custodian, owner, user, distributor, originator, pointOfContact,
principalInvestigator, processor, publisher, author, collaborator, editor, mediator,
rightsHolder} -->
            <gmd:CI_RoleCode
              codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_90"
              codeListValue="RI_414" >pointOfContact</gmd:CI_RoleCode>
```


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```
          </gmd:role>
        </gmd:CI_ResponsibleParty>
      </gmd:pointOfContact>
      <!-- (O-O) Resource Maintenance - This element provides information about the maintenance
schedule or history of the service described by the metadata record. For a service, only one
MD_MaintenanceInformation elements may be included; for which the MD_ScopeDescription
napMD_ScopeCode will be 'service'. If MD_MaintenanceInformation is present, then
maintenanceAndUpdateFrequency is mandatory.  -->
      <gmd:resourceMaintenance>
        <gmd:MD_MaintenanceInformation>
          <gmd:maintenanceAndUpdateFrequency>
            <!-- napMD_MaintenanceFrequencyCode names: {continual, daily, weekly, fortnightly,
monthly, quarterly, biannually, annually, asNeeded, irregular, notPlanned, unknown, semimonthly}
-->
            <gmd:MD_MaintenanceFrequencyCode
              codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_102"
              codeListValue="RI_540">asNeeded</gmd:MD_MaintenanceFrequencyCode>
          </gmd:maintenanceAndUpdateFrequency>
        </gmd:MD_MaintenanceInformation>
      </gmd:resourceMaintenance>
      <!-- (O-O) Graphic overview of resource - Highly recommended to include a small image
visual representation of the resource provided by a map or image service. For geographic feature
or data services, a graphic overview might show the geographic distribution of available data.
If MD_BrowseGraphic is included, MD_BrowseGraphic/filename character string is mandatory. USGIN
Recommended practice is to provide a complete URL as a gco:characterString value for the filename
property.  -->
      <!--
      <gmd:graphicOverview/>
      -->
      <!-- (O-X) Resource Format - This element is not used by USGIN; this information is encoded
in MD_Metadata/distributionInfo/MD_Distribution/ in USGIN metadata. -->
      <!--
      <gmd:resourceFormat>
      -->
      <!-- (O-O) Resource keywords - Best Practice for USGIN profile metadata is to supply
keywords to facilitate the discovery of metadata records relevant to the user. USGIN requires
that MD_Keyword/keyword contain a CharacterString. USGIN best practice is to include keywords in
English -->
      <!-- Theme keywords -->
      <gmd:descriptiveKeywords>
        <gmd:MD_Keywords>
          <gmd:keyword>
            <gco:CharacterString>WMS</gco:CharacterString>
          </gmd:keyword>
          <gmd:keyword>
            <gco:CharacterString>GEOSERVER</gco:CharacterString>
          </gmd:keyword>
          <gmd:keyword>
            <gco:CharacterString>AZGS</gco:CharacterString>
          </gmd:keyword>
          <gmd:keyword>
            <gco:CharacterString>GEOLOGY</gco:CharacterString>
          </gmd:keyword>
          <gmd:type>
            <!-- keyword identifies a particular subject or topic -->
            <gmd:MD_KeywordTypeCode
              codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_101"
              codeListValue="RI_528">theme</gmd:MD_KeywordTypeCode>
          </gmd:type>
        </gmd:MD_Keywords>
      </gmd:descriptiveKeywords>
      <!-- Temporal keywords -->
      <!--
      <gmd:descriptiveKeywords/>
      -->
      <!-- Place keywords -->
      <gmd:descriptiveKeywords>
        <gmd:MD_Keywords>
          <gmd:keyword>
            <gco:CharacterString>ARIZONA</gco:CharacterString>
          </gmd:keyword>
          <gmd:type>
```


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```
            <!-- keyword identifies a particular subject or topic -->
            <gmd:MD_KeywordTypeCode
              codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_101"
              codeListValue="RI_525">place</gmd:MD_KeywordTypeCode>
          </gmd:type>
        </gmd:MD_Keywords>
      </gmd:descriptiveKeywords>
      <!-- (O-X) Resource specific usage - NAP excludes this property in INCITS 453, figure 64
p.175, but it is schema valid under
http://schemas.opengis.net/iso/19139/20060504/serviceMetadata.xsd, which is the service metadata
schema imported by apiso.xsd for the OGC CSW profile for ISO19115/19 metadata. Property not USED
by USGIN. -->
      <!--
      <gmd:resourceSpecificUsage/>
      -->
      <!-- (O-O) Condition applying to access and use of resource - Restrictions on the access
and use of a service. Follow NAP for specification of resourceConstraints. This attribute
provides information for access control to the described service. In some situations, the
metadataConstraints may allow a user to learn of the existence of a resource that they may not
actually be able to access without further clearance. Follow NAP for specification of
resourceConstraints.  -->
      <gmd:resourceConstraints>
        <gmd:MD_LegalConstraints>
          <gmd:useLimitation>
            <gco:CharacterString>Read only</gco:CharacterString>
          </gmd:useLimitation>
          <gmd:accessConstraints>
            <!-- napMD_RestrictionCode names: {copyright, patent, patentPending, trademark,
license, intellectualPropertyRights, restricted, otherRestrictions, licenseUnrestricted,
licenseEndUser, licenseDistributor, privacy, statutory, confidential, sensitivity} -->
            <gmd:MD_RestrictionCode
              codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_107"
              codeListValue="RI_602">copyright</gmd:MD_RestrictionCode>
          </gmd:accessConstraints>
          <gmd:otherConstraints>
            <gco:CharacterString>NONE</gco:CharacterString>
          </gmd:otherConstraints>
        </gmd:MD_LegalConstraints>
      </gmd:resourceConstraints>
      <!-- (O-X) Aggregation information - The citation for the aggregate service or the name of
the aggregate service, the type of aggregate service, and optionally the activity which produced
the service. The citation for or name of an aggregate dataset, the type of aggregate dataset, and
optionally the activity which produced the dataset. For USGIN profile, this property, rather than
MD_Metadata/parentIdentifier, should be used to indicate relationships between described
resources. -->
      <!--
      <gmd:aggregationInfo/>
      -->
      <!-- (M-M) Service type - Choose a service type name from a registry of services. USGIN
mandates use of a LocalName value from the service type listing in section 8.2 of the USGIN
ISO19139 profile document, with the codespace http://resources.usgin.org/registry/
serviceType201001  -->
      <srv:serviceType>
        <!-- Valid values for OGC services would be then {<WMS, WFS, WVS, CSW, …}  -->
        <gco:LocalName
codeSpace="http://resources.usgin.org/registry/serviceType201001">WMS</gco:LocalName>

      </srv:serviceType>
      <!-- (O-C) Resource service type version - MMultiple serviceTypeVersion tags may not be
implemented in applications - USGIN recommends a reverse chronological order for supported
versions. Constraint: if various versions are available, mandatory to list versions that are
supported. Default is oldest version of service. -->
      <srv:serviceTypeVersion>
        <gco:CharacterString>1.3.0</gco:CharacterString>
      </srv:serviceTypeVersion>
      <srv:serviceTypeVersion>
        <gco:CharacterString>1.1.3</gco:CharacterString>
      </srv:serviceTypeVersion>
      <srv:serviceTypeVersion>
        <gco:CharacterString>1.1.1</gco:CharacterString>
      </srv:serviceTypeVersion>
```


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```
      <!-- (O-O) Resource service access properties - Information on the availability of the
service which includes attributes from Standard Order Process. Applicable sub elements for
service are: fees, and available date and time. -->
      <!--
      <srv:accessProperties/>
      -->
      <!-- (O-X) Resource service restrictions - Not used by USGIN; use resourceConstraints as
per NAP. -->
      <!--
      <srv:restrictions/>
      -->
      <!-- (O-X) Keywords - Not used by USGIN; use descriptiveKeywords as per NAP -->
      <!--
      <srv:keywords/>
      -->

      <!-- (C-C) Service Extent - Defines the spatial (horizontal and vertical) and temporal
region to which the content of the resource applies. For USGIN, the spatial extent is a rectangle
that bounds the geographic extent to which resource content applies. Best Practice for USGIN is
to include an extent for any resource with content related to some geographic or temporal
location. For geoscience resources, the temporal extent may be expressed using time ordinal eras
from a geologic time scale if the resource is related to some particular geologic time. USGIN
specifies count(description + geographicElement + temporal¬Element) >0  -->
      <srv:extent>
        <gmd:EX_Extent>
          <!-- (C-C) Resource Content extent description - Free text that describes the spatial
and temporal extent of the dataset. USGIN specifies that description is mandatory if a
geographicElement or temporalElement is not provided. Note that if geographic place names are
used to express the geographic extent, USGIN profile specifies that these should be encoded using
keyword with keyword type code = ‘place.’ Geographic names may be duplicated in the
EX_Extent/description. -->
          <!--
          <gmd:description/>
          -->
          <!-- (O-C) Resource content extent bounding box -USGIN profile requires that if an
EX_Extent/geographicElement is supplied, it include a geographic bounding box with bounding
latitude and longitude expressed using WGS 84 decimal degrees.
The corner coordinates for the geographic bounding box must not coincide in one point, because
this may result in fatal errors with some CSW implementations. Point locations must thus be
represented as tiny rectangles. USGIN recommended practice is to place the actual point location
in the lower left corner of the rectangle. -->
          <gmd:geographicElement>
            <gmd:EX_GeographicBoundingBox>
              <gmd:westBoundLongitude>
                <gco:Decimal>-114.815</gco:Decimal>
              </gmd:westBoundLongitude>
              <gmd:eastBoundLongitude>
                <gco:Decimal>-108.984</gco:Decimal>
              </gmd:eastBoundLongitude>
              <gmd:southBoundLatitude>
                <gco:Decimal>31.25</gco:Decimal>
              </gmd:southBoundLatitude>
              <gmd:northBoundLatitude>
                <gco:Decimal>37.004</gco:Decimal>
              </gmd:northBoundLatitude>
            </gmd:EX_GeographicBoundingBox>
          </gmd:geographicElement>
          <!-- (C-X) Resource content extent geographic description - Not used by USGIN profile,
use keyword with type code = ‘place’ (with thesaurus if necessary). -->
          <!--
          <gmd:geographicElement>
            <gmd:EX_GeographicDescription/>
          </gmd:geographicElement>
          -->
          <!-- (C-X) Resource content extent bounding polygon - To improve interoperability, USGIN
mandates use of Geographic Bounding Box; bounding polygons may be present, but may be ignored by
harvesters. -->
          <!--
          <gmd:geographicElement>
            <gmd:EX_BoundingPolygon/>
          </gmd:geographicElement>
          -->
```


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```
          <!-- (O-O) Resource temporal extent - Property contains information about temporal
extent to which resource is applicable. For many geoscience resources, this would be the geologic
time period(s) to which the resource applies. Although TM_Primitive allows the description of an
instant, USGIN requires a TM_Period (TimePeriod) for temporal extent. USGIN requires the values
for beginPosition@frame and endPosition@frame to be populated. The default frame property value
is “#ISO-8601” – frame properties for geological time frames will be developed. -->
          <!--
          <gmd:temporalElement>
            <gmd:EX_TemporalExtent>
              <gmd:extent>
                <gml:TimePeriod gml:id="IdJurassic">
                  <gml:name>Jurassic</gml:name>
                  --><!-- USGIN requires the beginPosition and endPosition's frame property to be
defined. The default value is #ISO-8601. --><!--
                  <gml:beginPosition frame="#ISO-8601">2007-05-28T00:00:00</gml:beginPosition>
                  <gml:endPosition frame="#ISO-8601">2007-05-28T00:00:00</gml:endPosition>
                </gml:TimePeriod>
              </gmd:extent>
            </gmd:EX_TemporalExtent>
          </gmd:temporalElement>
          -->
          <!-- (O-X) Resource spatial-temporal extent - Although use of EX_SpatialTemporalExtent
is allowed by ISO19139 and NAP, USGIN best practice is to encode space time location with
EX_TemporalExtent and EX_GeographicBoundingBox. Other optional extent elements may be included,
but they may be ignored by client implementations processing the metadata document. -->
          <!--
          <gmd:temporalElement>
            <gmd:EX_SpatialTemporalExtent>
              <gmd:extent></gmd:extent>
              <gmd:spatialExtent></gmd:spatialExtent>
            </gmd:EX_SpatialTemporalExtent>
          </gmd:temporalElement>
          -->
          <!-- (O-O) Resource service vertical extent - Vertical extent is used to provide
elevation location for resources that have an explicit vertical location. EX_VerticalExtent has
minimumValue, maximumValue that are real numbers, and a verticalCRS verticalCRS has (minimally)
an xlink:href attribute which references an EPSG registry code (http://www.epsg-registry.org/).
The default VerticalCRS code is for the World mean sea level (MSL) in meters:
“urn:ogc:def:crs:EPSG::5714” -->
          <!--
          <gmd:verticalElement>
            <gmd:EX_VerticalExtent>
              <gmd:minimumValue>
                <gco:Real>-100</gco:Real>
              </gmd:minimumValue>
              <gmd:maximumValue>
                <gco:Real>200</gco:Real>
              </gmd:maximumValue>
              --><!-- Use EPSG register of geodetic parameters such as at http://www.epsg-
registry.org/. The default VerticalCRS is World mean sea level (MSL): urn:ogc:def:crs:EPSG::5714
--><!--
              <gmd:verticalCRS xlink:href="urn:ogc:def:crs:EPSG::5714 "/>
            </gmd:EX_VerticalExtent>
          </gmd:verticalElement>
          -->
        </gmd:EX_Extent>
      </srv:extent>
      <!-- (O-O) Coupled Resources - This element correlates operations (identified by
operationName) with datasets (identified by identifier). For logical consistency
SV_coupledResource/identifier values should be equal to
MD_DataIdentification/citation/CI_Citation/identifier/MD_Identifier/code for a dataset that is
the target of a SV_ServiceIdentification/operatesOn element (either in an inline
MD_DataIdentification/citation../code element, or a @uuidref attribute). This element is
necessary to implement the many-to-many relationship between data sources and operations in a
single service. -->
      <!-- NOTE: This is an example for TIGHTLY coupled resources with EXPLICIT links. This means
that the example resource service's WMS layers are described in existing and separate metadata
records. -->
      <srv:coupledResource>
        <srv:SV_CoupledResource>
          <!-- (M-M) Coupled resource operation name - Name of the service operation: GetMap,
GetFeature, etc. -->
```


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```
          <srv:operationName>
            <gco:CharacterString>GetMap</gco:CharacterString>
          </srv:operationName>
          <!-- (M-M) Coupled Resource identifier  - Identifier of a given tightly coupled dataset.
Equal to MD_DataIdentification/citation/CI_Citation/identifier/MD_Identifier/code for a dataset
that is the target of a SV_ServiceIdentification/operatesOn element (either in an inline
MD_DataIdentification/citation../code element, or a @uuidref attribute).  -->
          <srv:identifier>
            <gco:CharacterString>8215ed91-6c92-4ae9-b094-8b58ddd5e7e0</gco:CharacterString>
          </srv:identifier>
          <!-- (X-O) Coupled Resource scoped name - OGC 07-045 application profile for ISO
metadata using CSW 2.0.2 extends SV_CoupledResource with a ScopedName, defined as a scoped
identifier of the resource in the context of the given service instance (e.g. layer name or
featureTypeName). This is necessary for users to generate service requests (like GetMap or
GetFeature) based on ISO service metadata. Note that if multiple WMS layers are related to a
single dataset, separate coupledResource elements are required for each layer because the
cardinality of ScopedName here is 0 or 1.-->
          <gco:ScopedName>azgs:trace_nonmetals_earthchem</gco:ScopedName>
        </srv:SV_CoupledResource>
      </srv:coupledResource>
      <srv:coupledResource>
        <srv:SV_CoupledResource>
          <srv:operationName>
            <gco:CharacterString>GetMap</gco:CharacterString>
          </srv:operationName>
          <srv:identifier>
            <gco:CharacterString>55932c11-67d6-4414-8a5f-a45f7dc3ecf6</gco:CharacterString>
          </srv:identifier>
          <gco:ScopedName>azgs:trace_metals_earthchem</gco:ScopedName>
        </srv:SV_CoupledResource>
      </srv:coupledResource>
      <srv:coupledResource>
        <srv:SV_CoupledResource>
          <srv:operationName>
            <gco:CharacterString>GetMap</gco:CharacterString>
          </srv:operationName>
          <srv:identifier>
            <gco:CharacterString>8504f947-39d6-4c1f-a4fa-672534f94856</gco:CharacterString>
          </srv:identifier>
          <gco:ScopedName>azgs:trace_alk_alkearth_earthchem</gco:ScopedName>
        </srv:SV_CoupledResource>
      </srv:coupledResource>
      <srv:coupledResource>
        <srv:SV_CoupledResource>
          <srv:operationName>
            <gco:CharacterString>GetMap</gco:CharacterString>
          </srv:operationName>
          <srv:identifier>
            <gco:CharacterString>4dbd380c-7ba4-49d6-b34c-7f9415dde6f0</gco:CharacterString>
          </srv:identifier>
          <gco:ScopedName>azgs:ree_earthchem</gco:ScopedName>
        </srv:SV_CoupledResource>
      </srv:coupledResource>
      <srv:coupledResource>
        <srv:SV_CoupledResource>
          <srv:operationName>
            <gco:CharacterString>GetMap</gco:CharacterString>
          </srv:operationName>
          <srv:identifier>
            <gco:CharacterString>a3120268-1fb4-496a-84cc-c3a02dd0be16</gco:CharacterString>
          </srv:identifier>
          <gco:ScopedName>ncgmp:mapunitpolys</gco:ScopedName>
        </srv:SV_CoupledResource>
      </srv:coupledResource>
      <srv:coupledResource>
        <srv:SV_CoupledResource>
          <srv:operationName>
            <gco:CharacterString>GetMap</gco:CharacterString>
          </srv:operationName>
          <srv:identifier>
            <gco:CharacterString>39d94525-b1d6-494f-a739-357088e5a2e9</gco:CharacterString>
          </srv:identifier>
```


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```
          <gco:ScopedName>azgs:earthfissures</gco:ScopedName>
        </srv:SV_CoupledResource>
      </srv:coupledResource>
      <srv:coupledResource>
        <srv:SV_CoupledResource>
          <srv:operationName>
            <gco:CharacterString>GetMap</gco:CharacterString>
          </srv:operationName>
          <srv:identifier>
            <gco:CharacterString>13ce1e84-c887-4fd8-b888-8d021b1fa4c2</gco:CharacterString>
          </srv:identifier>
          <gco:ScopedName>azgs:azgeochron</gco:ScopedName>
        </srv:SV_CoupledResource>
      </srv:coupledResource>
      <!-- (M-M) Service coupling type - Type of coupling between service and associated data (if
exists) - "Qualitative information on the tightness with which the service and the associated
data are coupled." NAP.  -->
      <!-- According to ISO: -->
      <!--  1) loose - service instance is loosely coupled with a data instance, i.e. no
MD_DataIdentification class has to be described (ISO 19119). -->
      <!--  2) mixed - service instance is mixed coupled with a data instance, i.e.
MD_DataIdentification describes the associated data instance and additionally the service
instance might work with other external data instances (ISO 19119 / ISO 19115). -->
      <!--  3) tight - service instance is tightly coupled with a data instance, i.e.
MD_DataIdentification class MUST be described. (ISO 19119 / ISO 19115) -->
      <!-- According to OGC: -->
      <!--  1) loose - A service instance that is not associated with a specific dataset or
dataset collection. Loosely coupled services may have an association with data types through the
service type definition. Dataset metadata need not be provided in the service metadata. -->
      <!--  2) mixed - A service that is associated with a specific dataset or dataset collection.
Service metadata shall describe both the service and the geographic dataset, the latter being
defined in accordance with ISO 19115. But this service instance can also be used with external
data (i.e. data that is not described by the operatesOn association). -->
      <!--  3) tight - An information resource that is hosted on a specific set of hardware and
accessible over a network. -->
      <srv:couplingType>
        <!-- napSV_CouplingType names: {loose, mixed, tight} -->
        <srv:SV_CouplingType
          codeList="http://www.fgdc.gov/nap/metadata/register/codelists.html#IC_114"
          codeListValue="RI_685">tight</srv:SV_CouplingType>
      </srv:couplingType>
      <!--***-->
      <!-- (M-M) Service operation - "Operations performed by the service" NAP. Each
SV_OperationMetadata element describes the signature of one and only one method provided by the
service. -->
      <!-- See WMS GetCapabilities for operation metadata -->
      <srv:containsOperations gco:nilReason="missing"/>
      <!-- (O-C) Service operates on - "Provides information on the datasets that the service
operates on" ISO 19119. With tightly coupled references, operatesOn must  include a map or
feature layer's valid MD_DataIdentification element inline or a @uuidref attribute value that
explicitly links to an existing dataset metadata record that describes the same layer. Mandatory
if linkage to datasets on which the service operates are available. The value of
SV_ServiceIdentification/operatesOn@uuidref or
SV_ServiceIdentification/operatesOn/MD_DataIdentification/citation/CI_Citation/identifier/MD_Iden
tifier/code must correspond to one of the coupledResource/MD_CoupledResource/identifier values.
If the metadata record for the coupled dataset is a separate gmd:MD_Metadata record, the service
described in the service metadata record should be identified as a distribution for the dataset.
-->
      <!-- NOTE:  In this explicitly linked reference example, the uuidref property must point to
an existing (already loaded) CSW metadata record! -->
      <srv:operatesOn
        uuidref="13ce1e84-c887-4fd8-b888-8d021b1fa4c2"
        xlink:href="http://resources.azgs.org/geonetwork/srv/en/metadata.show?id=8717"
        xlink:title="azgs:azgeochron"/>
      <srv:operatesOn
        uuidref="39d94525-b1d6-494f-a739-357088e5a2e9"
        xlink:href="http://resources.azgs.org/geonetwork/srv/en/metadata.show?id=8718"
        xlink:title="azgs:earthfissures"/>
      <srv:operatesOn
        uuidref="a3120268-1fb4-496a-84cc-c3a02dd0be16"
        xlink:href="http://resources.azgs.org/geonetwork/srv/en/metadata.show?id=8719"
        xlink:title="ncgmp:mapunitpolys"/>
```


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```
      <srv:operatesOn
        uuidref="4dbd380c-7ba4-49d6-b34c-7f9415dde6f0"
        xlink:href="http://resources.azgs.org/geonetwork/srv/en/metadata.show?id=8720"
        xlink:title="azgs:ree_earthchem"/>
      <srv:operatesOn
        uuidref="8504f947-39d6-4c1f-a4fa-672534f94856"
        xlink:href="http://resources.azgs.org/geonetwork/srv/en/metadata.show?id=8721"
        xlink:title="azgs:trace_alk_alkearth_earthchem"/>
      <srv:operatesOn
        uuidref="55932c11-67d6-4414-8a5f-a45f7dc3ecf6"
        xlink:href="http://resources.azgs.org/geonetwork/srv/en/metadata.show?id=8722"
        xlink:title="azgs:trace_metals_earthchem"/>
      <srv:operatesOn
        uuidref="8215ed91-6c92-4ae9-b094-8b58ddd5e7e0"
        xlink:href="http://resources.azgs.org/geonetwork/srv/en/metadata.show?id=8723"
        xlink:title="azgs:trace_nonmetals_earthchem"/>
    </srv:SV_ServiceIdentification>
  </gmd:identificationInfo>
  <!--******************-->
  <!-- (O-O) Content information - Characteristics describing the feature cataloguecatalog,
coverage, or image data. USGIN currently makes no recommendation for use of contentInfo; follow
NAP recommendations (see INCITS 453). -->
    <!--
    <gmd:contentInfo gco:nilReason="missing"/>
    -->
  <!-- (O-O) Resource distribution information - This element provides information to inform
users how to obtain or access the described resource.  For service metadata, the only
distribution is the interface offered by the described service. The distributionFormat is nil
because the format depends on the operation and request. TransferOptions is used to provide the
URL's for accessing the service and a serviceDescription resource (WSDL, getCapabilities, web
page..). Distributor is used to identify the agent that is responsible for hosting the service. -
->
  <gmd:distributionInfo>
    <gmd:MD_Distribution>
      <!-- (O-O)  Resource distribution format - Information on the format or physical
manifestation of the resource. If the resource is a physical resource, like a book, rock sample,
paper document, the distributionFormat/MD_Format/name is mandatory, and must be from the USGIN
distribution format codelist. In the case of a service, the format information is operation and
request dependent.-->
      <!--
      <gmd:distributionFormat gco:nilReason="missing"/>
      -->
      <!-- (O-C) Resource distributor information - For a service, the distributor element
identifies the agent that is responsible for hosting the service, probably the same as the
CI_ResponsibleParty for the service identification citation. -->
      <!-- in this example, the distributo is the same as the metadata point of contact, so the
CI_Responsible party is included by reference to the element earlier in the document -->
      <gmd:distributor>
        <gmd:MD_Distributor>
          <gmd:distributorContact xlink:href="#R264537"/>
        </gmd:MD_Distributor>
      </gmd:distributor>
      <!-- (C-C) Resource distribution transfer options - MD_DigitalTransferOptions provides
information on digital distribution of resource. See USGIN Profile 'Use of MD_Distribution and
MD_Distributor' for instructions on use of this element. Details on encoding for
MD_DigitalTransferOptions are above in the distributorTransferOptions elements description.  -->
      <gmd:transferOptions>
        <gmd:MD_DigitalTransferOptions>
          <!-- Two online elements are included, one for the serviceDescription and one for the
baseURL, which in this case is the full URL for the OGC getCapabilities document -->
          <gmd:onLine>
            <gmd:CI_OnlineResource>
              <!-- (M-M) Resource distributor on-line distribution linkage - Digital transfer
options are "technical means and media by which a dataset is obtained from the distributor." NAP
requires CI_OnlineResource/linkage and CI_OnlineResource/protocol in CI_OnlineResource. -->
              <gmd:linkage>
                <!-- This linkage element contains the complete URL to access the getCapabilities
document directly. If the service is described by a WSDL document, this would be a URL for the
WSDL desription of service operation. CI_Online-Resource requires a Linkage element that is a
gmd:URL. -->
                <gmd:URL>http://75.101.143.247:8080/gsvr/wms?SERVICE=WMS&amp;
http://75.101.143.247:8080/gsvr/wms?SERVICE=WMS&amp;</gmd:URL>
```


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```
            </gmd:linkage>
            <!-- The protocol element defines a valid internet protocol used to access the
resource. NAP recommended best practice is that the protocol should be taken from an official
controlled list such as the Official Internet Protocol Standards published on the Web at
http://www.rfc-editor.org/rfcxx00.html or the Internet Assigned Numbers Authority (IANA) at
http://www.iana.org/numbers.html.  'ftp' or 'http' are common values. -->
            <gmd:protocol>
              <gco:CharacterString>http</gco:CharacterString>
            </gmd:protocol>
            <!-- Linkage names for service URL's are from "Linkage name conventions" section in
the USGIN ISO19139 profile document.  -->
            <gmd:name>
              <gco:CharacterString>serviceDescription</gco:CharacterString>
            </gmd:name>
            <!-- Service Description -->
            <gmd:description>
              <gco:CharacterString>Full URL to request the OGC getCapabilities document. This is
the mechanism used to acquire detailed operation description for USGIN
metadata.</gco:CharacterString>
            </gmd:description>
          </gmd:CI_OnlineResource>
        </gmd:onLine>
        <gmd:onLine>
          <gmd:CI_OnlineResource>
            <!-- (M-M) Resource distributor on-line distribution linkage - Digital transfer
options are "technical means and media by which a dataset is obtained from the distributor." NAP
requires CI_OnlineResource/linkage and CI_OnlineResource/protocol in CI_OnlineResource. -->
            <gmd:linkage>
              <!-- This linkage element contains the base URL to compose requests to the
service. CI_Online-Resource requires a Linkage element that is a gmd:URL. -->
              <gmd:URL>http://75.101.143.247:8080/gsvr/wms?</gmd:URL>
            </gmd:linkage>
            <!-- The protocol element defines a valid internet protocol used to access the
resource. NAP recommended best practice is that the protocol should be taken from an official
controlled list such as the Official Internet Protocol Standards published on the Web at
http://www.rfc-editor.org/rfcxx00.html or the Internet Assigned Numbers Authority (IANA) at
http://www.iana.org/numbers.html.  'ftp' or 'http' are common values. -->
            <gmd:protocol>
              <gco:CharacterString>http</gco:CharacterString>
            </gmd:protocol>
<!-- Linkage names for service URL's are from "Linkage name conventions" section in the USGIN
ISO19139 profile document  -->
            <gmd:name>
              <gco:CharacterString>baseURL</gco:CharacterString>
            </gmd:name>
            <gmd:description>
              <gco:CharacterString>Base URL for service access; append standard WMS request
parameters to compose query.</gco:CharacterString>
            </gmd:description>
          </gmd:CI_OnlineResource>
        </gmd:onLine>
      </gmd:MD_DigitalTransferOptions>
    </gmd:transferOptions>
  </gmd:MD_Distribution>
 </gmd:distributionInfo>
 <!-- (C-C) Data quality Information - NAP requires either dataQualityInfo/DQ_DataQuality/report
or dataQualityInfo/ DQ_Data-Quality/lineage  if
dataQualityInfo/DQ_DataQuality/scope/DQ_Scope/level = 'dataset'.   -->
 <!--
 <gmd:dataQualityInfo/>
 -->
 <!-- (O-O) Portrayal catalog information - A portrayal cataloguecatalog is a collection of
defined symbols used to depict, to humans, features on a map. No documentation in ISO 19115 about
how this is supposed to work. ISO 19117 defines the structure of a Portrayal Catalogue. No USGIN
recommended practices here yet. -->
 <!--
 <gmd:portrayalCatalogueInfo/>
 -->
 <!-- (O-O) Metadata constraint information - This element specifies use constraints for access
to the metadata record.  -->
 <!--
 <gmd:metadataConstraints/>
```


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```
  -->
  <!-- (O-O) Application schema information - Information about the conceptual schema of the
dataset. This would be populated with a citation to a schema, or may have an inline binary file
representing the schema. No USGIN provision for usage of this element. -->
  <!--
  <gmd:applicationSchemaInfo/>
  -->
  <!-- (O-O) Metadata maintenance information - This element provides information about the
maintenance schedule or history of the metadata record.  -->
  <!--
  <gmd:metadataMaintenance/>
  -->
  <!-- (X-X) Series information - Not used by USGIN. -->
  <!--
  <gmd:series/>
  -->
  <!-- (X-X) Described resource - Not used by USGIN. -->
  <!--
  <gmd:describes/>
  -->
  <!-- (X-X) Property type description - Not used by USGIN. -->
  <!--
  <gmd:propertyType/>
  -->
  <!-- (X-X) Feature type description - Not used by USGIN -->
  <!--
  <gmd:featureType/>
  -->
  <!-- (X-X) Feature attributes - Not used by USGIN -->
  <!--
  <gmd:featureAttribute/>
  -->
</gmd:MD_Metadata>
```


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8 Codelists

8.1 Online resource format names

Code list URI: http://resources.usgin.org/registry/distributionFormatNames201001. For data files, the vendor/application name syntax is the same as that recommended for specifying `MD_DigitalTransferOptions/online/CI_OnlineResource/applicationProfile` values, but the file type information is appended instead of version. These format names are used in `MD_Format/name elements`; version information in this situation goes in the `MD_Format/version` element.

1) Book
2) Rock sample
3) Core
4) Cuttings
5) Paper map
6) Service
    a) Layer in multilayer WMS
    b) Single layer WMS
    c) Feature type in WFS
    d) Other service
7) Datafile
    a) ESRI:ARCINFO/Coverage
    b) ESRI:shapefile/shp
    c) ESRI:ARCINFO/e00
    d) PitneyBowes:MapInfo/mid mif
    e) ESRI:ArcGIS/personal geodatabase mdb
    f) ESRI:ArcGIS/file geodatabase
    g) /txt
    h) /csv
    i) Adobe:Acrobat/pdf
    j) Microsoft:Word/doc
    k) Microsoft:Access/mdb

8.2 ServiceType

This is an interim listing of serviceTypes. The code list URI for this registry is http://resources.usgin.org/registry/serviceType201001.

INSPIRE SPATIAL DATA SERVICE TYPE

discovery	Discovery Service
view	View Service
download	Download Service
transformation	Transformation Service
invoke	Invoke Spatial Data Service
other	Other Services

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Identifier	Name	Description
WMS	OGC Web Map service	provides a simple HTTP interface for requesting geo-registered map images from one or more distributed geospatial databases. A WMS request defines the geographic layer(s) and area of interest to be processed. The response to the request is one or more geo-registered map images (returned as JPEG, PNG, etc) that can be displayed in a browser application. The interface also supports the ability to specify whether the returned images should be transparent so that layers from multiple servers can be combined or not. (http://www.opengeospatial.org/standards/wms)
WFS	OGC Web Feature service	http://www.opengeospatial.org/standards/wfs
WCS	OGC Web coverage service	defines a standard interface and operations that enables interoperable access to geospatial "coverages" [http://www.opengeospatial.org/ogc/glossary/c]. The term "grid coverages" typically refers to content such as satellite images, digital aerial photos, digital elevation data, and other phenomena represented by values at each measurement point.
CSW	OGC Web catalog service	supports the ability to publish and search collections of descriptive information (metadata) about geospatial data, services and related resources. Providers of resources use catalogues to register metadata that conform to the provider's choice of an information model; such models include descriptions of spatial references and thematic information. (http://www.opengeospatial.org/standards/cat)
SOS	OGC Sensor observation service	provides an API for managing deployed sensors and retrieving sensor data and specifically "observation" data. Whether from in-situ sensors (e.g., water monitoring) or dynamic sensors (e.g., satellite imaging), measurements made from sensor systems contribute most of the geospatial data by volume used in geospatial systems today. (http://www.opengeospatial.org/standards/sos)
WPS	OGC Web Processing service	provides rules for standardizing how inputs and outputs (requests and responses) for geospatial processing services, such as polygon overlay. The standard also defines how a client can request the execution of a process, and how the output from the process is handled. It defines an interface that facilitates the publishing of geospatial processes and clients' discovery of and binding to those processes. The data required by the WPS can be delivered across a network or they can be available at the server. (http://www.opengeospatial.org/standards/wps)
SPS	OGC Sensor planning service	defines interfaces for queries that provide information about the capabilities of a sensor and how to task the sensor. The standard is designed to support queries that have the following purposes: to determine the feasibility of a sensor planning request; to submit such a request; to inquire about the status of such a request; to update or cancel such a request; and to request information about other OGC Web services that provide access to the data collected by the requested task.
OAI-PMH	Open Archives Initiative Protocol for Metadata Harvesting	provides an application-independent interoperability framework based on metadata harvesting.

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8.3 Linkage name conventions

The cardinality of the `online` element in DigitalTransferOptions is 0..*. In order to distinguish the nature of various linkages that might be provided, above and beyond function, protocol, and applicationProfile, USGIN profile mandates use of the following names to associate with links to identify important linkages.

Name	Usage
icon	linkage url is link to a thumbnail icon. Icon pixel height and width range?
serviceDescription	linkage url is link to getCapabilities or WSDL that describes a service using a formal syntax such that computer programs can automate connection to the service.
baseURL	Base url for service. Assumes that ServiceType specifies a well know service type such that requests can be constructed without significant additional information.
serviceClient	URL is linkage to a web application that allows the user to access the service
webpage	URL locates a web page with instructions for accessing the service. This provides the user with information to implement a connection to the service, but does not enable automated service access.

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