

AN ISO 19115/19119 PROFILE FOR OGC CATALOGUE SERVICES CSW 2.0

Kristian Senkler, Dr. Uwe Voges, Dr. Albert Remke
con terra GmbH
Martin-Luther-King Weg 24
D-48155 Münster
{senkler|voges|remke}@conterra.de

ABSTRACT

In the context of spatial data infrastructures, the international of OGC and ISO standards form the basis of most existing catalogue interface implementations. However, practical interoperability has not yet been achieved: the available specifications still possess varying degrees of freedom, which lead to a diversity of implementations and lack of interoperability. A solution of this problem is currently under development within the context of the Catalogue Service Implementation Specification 2.0 (CSW 2.0) that introduces a conceptual framework for the definition of Catalogue Application Profiles (CAPs). The document at hand demonstrates how to set up an application profile that handles metadata description based on ISO 19115/19119.

KEYWORDS: CSW 2.0, OpenGIS OWS-2, ISO 19115/19119, SDI Germany, GDI NRW

1 INTRODUCTION

In the field of spatial data infrastructures, the international standards of OGC and ISO form the basis of most existing catalogue interface implementations. Nevertheless, the practical interoperability of these implementations has not yet been achieved. The specifications available still possess varying degrees of freedom, which lead to a diversity of implementations and lack of interoperability.

Currently, the OGC Catalogue Services Revision Working Group is editing final changes to the Catalogue Services 2.0 (CSW 2.0) implementation specification (OGC 2004a). This document introduces a conceptual framework for the definition of Catalogue Application Profiles (CAPs), on the basis of the CSW 2.0 specification. From the point of view of the demands of a certain information community, CAPs are used to select between alternatives left open by CSW 2.0, to make certain options mandatory, to add new features to the interface specification and to combine the interface specification with a specific information model. CSW 2.0 outlines a core set of rules defining minimal requirements which must be considered by all implementations as being compliant to this specification. As a result, the interoperability of catalogues is possible either on the level of the core set of rules (between all information communities) or on the level of a specific CAP (within a certain information community).

In Germany a number of SDI initiatives and institutions (GDI NRW, BKG, AdV, Nordrhein-Westfalen, Hamburg, Niedersachsen, Hessen, Brandenburg, UDK/GEIN, InGeoForum, GFZ, CeGI GmbH, con terra GmbH, lat/lon GbR) decided to develop a common Catalogue Application Profile for ISO 19115 and ISO 19119 which will form the basis for their catalogue interface implementations. At the same time this CAP is being discussed and adjusted within OGC's Web Services Initiative (OWS-2) by con terra. The specification process was finished by end of May 2004.

Within GDI NRW, the ISO 19115/19119 CAP will be the new standard for catalogue interface implementations. Beginning on 30 April the new joint project, 'GDI NRW 2004', will implement the operational kernel of GDI NRW. Part of this project is the development of an operational meta-information network, which will be based on the aforementioned CAP. The results of this project will be presented in October 2004 at the fair INTERGEO in Stuttgart (Germany).

2 THE PRINCIPLE OF PROFILES

The Catalogue Service Implementation Specification 2.0 (CSW 2.0) that is currently under development by the OpenGIS Consortium constitutes a general model for catalogue services. Along with that, the specification provides a general framework for the specification profiles which is based on ISO/IEC TR 10000-1:1998.

ISO/IEC TR 10000-1:1998 defines a general framework and taxonomy for the development of international standardized profiles. In the sense of this document, a profile makes explicit the relationships within a set of base standards used together (relationships which can be implicit in the definitions of the base standards themselves), and may also specify particular details of each base standard being used (ISO 1998). A profile identifies the use of particular options available in one or more base standards and it provides a basis for developing conformance tests. Furthermore, a compliant profile must not contradict the base specifications or otherwise give rise to non-conforming conditions. CSW 2.0 uses this concept of profiles as a basis for the development of application profiles for Catalogue Services.

An application profile specifies the use of an application-layer protocol (e.g., Z39.50, HTTP/1.1, CORBA/IIOP) in order to provide for the structured transfer of information between systems (ISO/IEC TR 10000-2:1998). An application profile is based on one of the protocol bindings in the base specification. A graphic model of the relationships is shown in Figure 1.

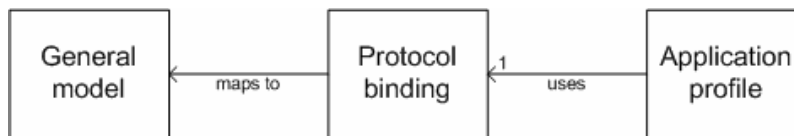


Figure 1 - Relationship of general model, protocol binding, and application profile

The developed Catalogue Application Profile defines an information model based on ISO 19115/ISO19119 and specifies a HTTP/1.1 protocol binding with support for SOAP messaging. By applying the concept of profiles it is possible to achieve interoperability between different Catalogue Service implementations: each implementation must comply with the base specification given by CSW 2.0 and can hence interoperate on that level.

3 APPLICATION PROFILE BASED ON ISO 19115/19119

In the following sections, the base structure and contents of the ISO application profile for CSW 2.0 is explained. The profile defines, in relation to the CSW 2.0 base specification, what external interfaces the catalogue service exposes, how core queryables and response properties of a catalogue query are mapped to the intrinsic information model, where the core attributes are

extended (and how these extensions are mapped). In the following sections we will mainly focus on the application domain, the information model and data bindings that are supported by this profile.

3.1 Application domain

A metadata repository managed by a catalogue implementing this application profile deals with metadata about geospatial data, geospatial services and applications. It is intentional that the specified profile does not attempt to specify a general-purpose catalogue. Rather, it allows the retrieval and management of the metadata objects referred to above.

This application profile has no specific disciplinary focus. All communities working with these sorts of geospatial information are addressed. Typical communities are surveying, environment, geology, landscaping, water management, power industry, telecommunications etc. The intention is to implement a generally understood information model based on standard metadata with only a few relationships among the catalogue items. Usage should be as simple as possible, implementing a set of use cases typical in the geospatial community.

The requirements of the information model, search properties, details of the results sets and interfaces were defined in close cooperation with users in various communities as well as software vendors. This profile allows for a catalogue to accept a request from a client and distribute the request to one or more other catalogues within a federation. In this case, the metadata entries managed by the other catalogues become available to their own clients. It is possible to start a search from only one known location and to search as many catalogues as possible with the same set of attributes.

3.2 Essential use cases

This section describes essential use cases for the purpose of demonstrating typical interactions between users, as well as a catalogue service that supports the specified application profile. Figure 2 shows the overall system that contains major interactions.

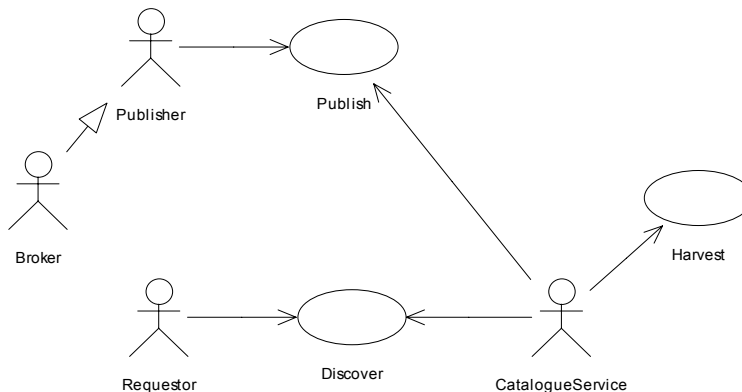


Figure 2: Overall system use cases

An actor is a person, organisation, or external system that plays a role in one or more interactions with the system. Four actors are identified:

- Publisher: A publisher publishes metadata descriptions to a catalogue. By doing so, he enables the discovery of that description record by a requestor entity. This actor is also the owner of the geo-resource that he describes.
- Broker: This actor is a specialised publisher that publishes and maintains metadata records on behalf of the owner of georesources.
- Requestor: This actor searches for metadata records in a catalogue service, either by browsing or through more complicated queries.
- Catalogue Service: This is a system that handles the discovery and publishing of metadata entries. Furthermore, this actor has the ability to harvest metadata records from affiliated metadata resources.

3.3 Information resources

Information resources are (logical) entities that can be managed by a catalogue service that complies with the given profile. The following resources are supported:

- Dataset: An identifiable collection of data.
- Dataset series: A collection of datasets sharing the same product specification.
- Service (general): A service instance hosted on a specific set of hardware and accessible over a network. A service is tightly coupled, loosely coupled or mixed coupled (ISO 2003b).
- Service (loosely coupled): A service instance that is not associated to a specific dataset or dataset series. 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 (ISO 2003b).
- Service (tightly coupled): A service that is associated with a specific dataset or dataset series. Service metadata shall describe both the service and the geographic dataset, the latter being defined in accordance with ISO19115:2003 (ISO 2003b).
- Service (mixed coupled): A service that is associated with a specific dataset or dataset series. Service metadata shall describe both the service and the geographic dataset, the latter being defined in accordance with ISO19115:2003. In contrast to a tightly coupled service, a service instance might be used with external data.
- Application: An information resource that is hosted on a specific set of hardware and accessible over a network.

3.4 Catalogue Information model

The information model of the proposed profile is based on the international standard for metadata description ISO 19115:2003. In addition, the catalogue uses a metadata description for service metadata based on the draft international ISO 19119:2003 standard to facilitate the management of service metadata. The main purpose of the information model is to provide a formal structure for the description of information resources that can be managed by a catalogue service that complies with the application profile. For a more comprehensive description of the model please refer to the original specification documents.

ISO19115:2003 specifies a general purpose model for metadata descriptions. The main class is called MD_Metadata and aggregates an abstract class of type MD_Identification. This abstract class must be implemented by any class that specifies an information resource. In case of datasets, dataset series and applications, this is realized by MD_DataIdentification; in case of services it is realized by SV_ServiceIdentification. The latter case is covered by ISO19119:2003, whereas some extensions had to be made to support multiple coupling types of services and data sets (see Figure 3).

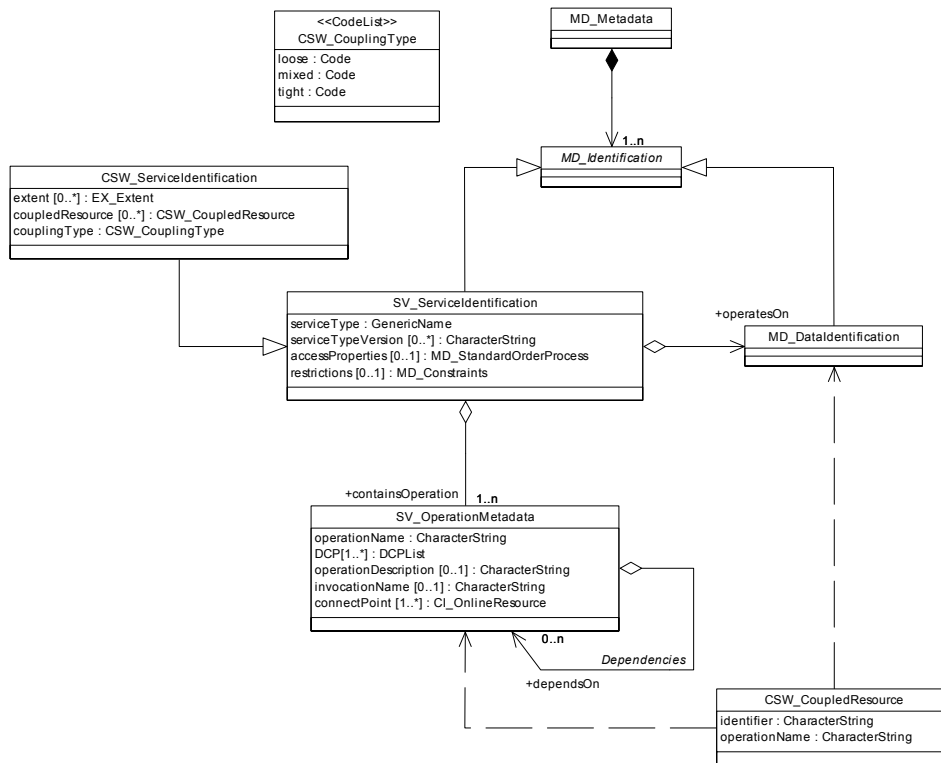


Figure 3: Profile information model (excerpt)

Some extensions have to be applied to ISO19119:2003: CSW_ServiceIdentification is a specialization of SV_ServiceIdentification and extends the ISO model with the following attributes.

Table 1 - Data dictionary for CSW_ServiceIdentification

	Attribute name/ Role name	Definition	Obligation /Condition	Maximum occurrence	Data type
1.	extent	extent information including the bounding box, bounding polygon, vertical, and temporal extent of the service	O	N	EX_Extent
2.	coupledResource	further description of the data coupling in case of tightly coupled services	O	N	CSW_CoupledResource
3.	couplingType	Type of coupling between service and associated data (if exists)	M	1	CSW_CouplingType

The class CSW_CoupledResource defines which service operations can operate on a specific dataset or dataset series. Therefore, this class is only useful in case of a tightly coupled service instance.

Table 2 - Data dictionary for CSW_CoupledResource

	Attribute name/ Role name	Definition	Obligation/ Condition	Maximum occurrence	Data type
1.	operationName	Name of the service operation	M	1	CharacterString
2.	identifier	Name of the identifier of a given tightly coupled dataset	M	1	MD_Identifier

CSW_CoupledResource demands that a given operationName or identifier MUST refer to an existing operationName given by SV_OperationMetadata.operationName or an identifier given by MD_DataIdentification.citation.identifier, respectively. By applying ISO 19115:2003 and ISO 19119:2003 (plus extensions), any information resource that has been described in section 3.3 can be expressed from a logical point of view.

3.5 Encoding

The supported data binding, i.e., the encoding of each of the information resources explained above, is described in this section. Currently, the only data binding supported by this ISO profile is XML. The encoding of any information resource in this profile is based on ISO19139:2004 v0.9 (ISO 2004). To determine the type of the information resource that is described in XML, the property MD_Metadata.hierarchyLevel must have the appropriate value (i.e. 'dataset', 'dataset series', 'application' or 'service').

Any information resource can be described entirely by applying ISO 19139 v0.9. Unfortunately, this implementation specification does not provide any classes to encode service metadata (since this is not part of ISO19115 but ISO19119). The XML encoding for services was specified for ISO 19119 during this project. It bases on ISO 19139 in that its basic classes are deviated from ISO19139 classes and covers any of the extension that have been made towards service descriptions (see Figure 3). Hence, the XML encoding for services is completely integrated in ISO19139. Listing 1 shows an excerpt form an XML encoding of a tightly coupled service that complies with the developed schema.

Listing 1: XML encoding tightly coupled service (excerpt)

```
<MD_Metadata xmlns="http://metadata.dgiwg.org/smXML"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:noNamespaceSchemaLocation="./iso19115_full.xsd"
xmlns:iso19119="http://schemas.opengis.net/iso19119">
  <fileIdentifier>
    <CharacterString>5a389ad2-22dd-11d1-aa77-
    002035b29092</CharacterString>
  </fileIdentifier>
  <hierarchyLevel>
    <MD_ScopeCode codeList="http://www.altova.com"
    codeListValue="service"/>
  </hierarchyLevel>
  <contact>
    <CI_ResponsibleParty>
      <role>
        <CI_RoleCode codeList="http://www.example.com"
        codeListValue="author"/>
      </role>
    </CI_ResponsibleParty>
  </contact>
  <dateStamp>
    <Date>2004-12-30</Date>
  </dateStamp>
  <identificationInfo>
    <iso19119:CSW_ServiceIdentification>
      [...]
      <iso19119:serviceType>
        <CharacterString>WMS</CharacterString>
      </iso19119:serviceType>
      <iso19119:serviceTypeVersion>
        <CharacterString>1.1.0</CharacterString>
      </iso19119:serviceTypeVersion>
      <iso19119:operationMetadata>
        [...]
      </iso19119:operationMetadata>
      <iso19119:operatesOn>
        <MD_DataIdentification>
          [...]
        </MD_DataIdentification>
      </iso19119:operatesOn>
    </iso19119:CSW_ServiceIdentification>
  </identificationInfo>
  <iso19119:coupledResource>
    <iso19119:CSW_CoupledResource>
      <iso19119:operationName>
        <CharacterString>Insert</CharacterString>
      </iso19119:operationName>
      <iso19119:identifier>
        <CharacterString>5a389ad2-22dd-11d1-aa77-
        002035b29093</CharacterString>
      </iso19119:identifier>
    </iso19119:CSW_CoupledResource>
  </iso19119:coupledResource>
</MD_Metadata>
```

```
        </iso19119:identifier>
    </iso19119:CSW_CoupledResource>
        <iso19119:CSW_couplingType codeList="http://www.example.com"
            codeListValue="tight"/>
    </iso19119:coupledResource>
</iso19119:CSW_ServiceIdentification>
</identificationInfo>
</MD_Metadata>
```

5 CONCLUSION

It is planned that the developed application profile for CSW 2.0 will form the basis for any catalogue service implementations throughout SDI Germany. This creates the conditions for catalogue service instances that can interoperate on both profile level. Furthermore, interoperability on level of the base specification is guaranteed whereby on catalogue service instance that complies with the ISO profile can interoperate with any other catalogue service that complies with CSW 2.0 (provided that the same protocol bindings are supported).

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