ISO Workshop on address standards: Considering the issues related to an international address standard
25 May 2008, Copenhagen, Denmark, ISBN 978-1-86854-689-3

A conceptual framework for the description of Place Identifiers

Reese Plews[1] and Shigekazu Kawano[1]

[1]Japan Information Processing Development Corporation (JIPDEC) /
Database Promotion Center, Tokyo JAPAN
reese-plews@jipdec.or.jp , kawano-shigekazu@jipdec.or.jp

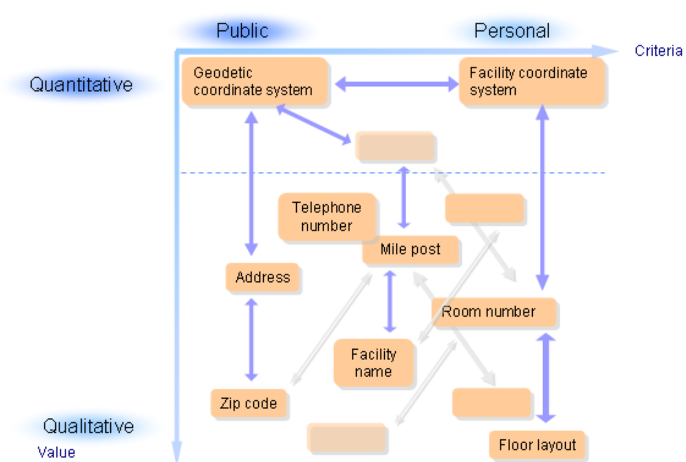
Abstract

A clear understanding of the concept of "place" is important in virtually every aspect of daily activity, with uses and requirements ranging from the simple to the complex. Yet the meaning or designation of a place to one group (community) could be the same or more commonly very different to another community. To handle these representations a conceptual framework has been designed for the description of Place Identifiers (PIs). Although similar framework concepts exist, they require each community to follow a specific, rigid identifier scheme which in turn guarantees uniqueness across all communities. However the Place Identifier (PI) framework defines a simple and more free-form structure which allows each community to easily make use of their own identifiers, thus retaining uniqueness within their respective community, yet facilitating representations of common places between communities. The Place Identifier framework consists of a series of models which define services for the registration, management, conversion, discovery and exchange of Place Identifiers. These framework models and services have been submitted to ISO/ TC 211 for consideration as a new work item for standardization.

1. Background

Vast amounts of digital information existing in the world today include some kind of location (spatial) component or identifier. These characteristics enable a user or application to find desired information by searching the identifiers and also act as a way to facilitate the distribution of information and data. In reality, multiple identifiers may often refer to a single location, as there are many kinds of location identifiers, such as coordinates, addresses, or facility names, etc. Humans can more easily see the relationship where some identifiers refer to the same location, however this relationship is much more difficult for machines to understand. This difficulty impedes information searches with location identifiers, as shown in Figure 1.

Figure 1. Multiple Location Identifiers



What if a standard structure and defined set of methods existed that would enable the description of the location of a place using a simple, yet concise form that would not require any modification of the descriptions and constructs currently in use, and yet would be extensible, interoperable and standardized? The merits of such a standardized structure can be easily envisioned. To address these needs, we have created a conceptual model and framework which supports the concept of Place Identifiers. The task of creating the PIs lies with each user community. Research and discussions have shown that seeking to enforce a single, standardized encoding rule on every user community to insure the creation of "globally unique" place identifier would not be successful. Therefore the hierarchical design structure of the PI model and service interface architecture mandates unique PI definitions within each user community, while allowing for similar or alike PI definitions between different user communities.

The services outlined in this paper define a platform to facilitate the registration, management, discovery and exchange of the PIs between those user communities. To more easily facilitate the distribution of information, the architecture to exchange different location identifiers that describe a single location should to be created. This paper will examine the research and introduce the conceptual design of a standard and platform for the description of place information.

2. Introduction to the PI Reference Model

During the design of the PI reference model, careful consideration was given to making the structure be concise, yet understandable to both experts and non-experts alike. In the simplest of terms, the structure of a PI consists of a *name space*, also referred to as a spatial reference system definition, and a *value*. These two classes alone comprise a PI. The actual content of *value* may be straight forward, having an easily recognizable spatial makeup, such as a street address or a latitude longitude pair. The content could also be a specialized identification number, whose meaning is known only to the immediate members of the specific community that have created those PIs. The important design point to consider here is that the syntactical structure of the actual content of the *value* is not mandated or specified and is therefore decided by the community. This facilitates more easy creation of the data by each community. In order to make use or share this data, a set of management interfaces are needed. These interfaces are collectively referred to as the PI reference model. A presentation of the services and mechanisms that comprise the PI reference model is provided in Section 3.0.

3. PI Reference Model

The PI reference model consists of PI data, PI data conversion services, users of converted PIs, and the relationships between them. The PI reference model is a conceptual model and does not specify the implementation of the components. This model represents a logical structure, not a physical one. Figure 2 refers to the relationships among each of the components in the PI Reference Model. For example, there can be multiple PI conversion services, and each can perform PI conversions across different PI data instances from different services. All users, services, and data must be independent of each other, meaning for example, that a PI conversion service should focus on PI conversion, while a PI data provider should focus on providing data. The packages which comprise the PI Reference Model are shown in Table 1.

Figure 2. PI reference model – A logical structure to register, manage, and convert PIs

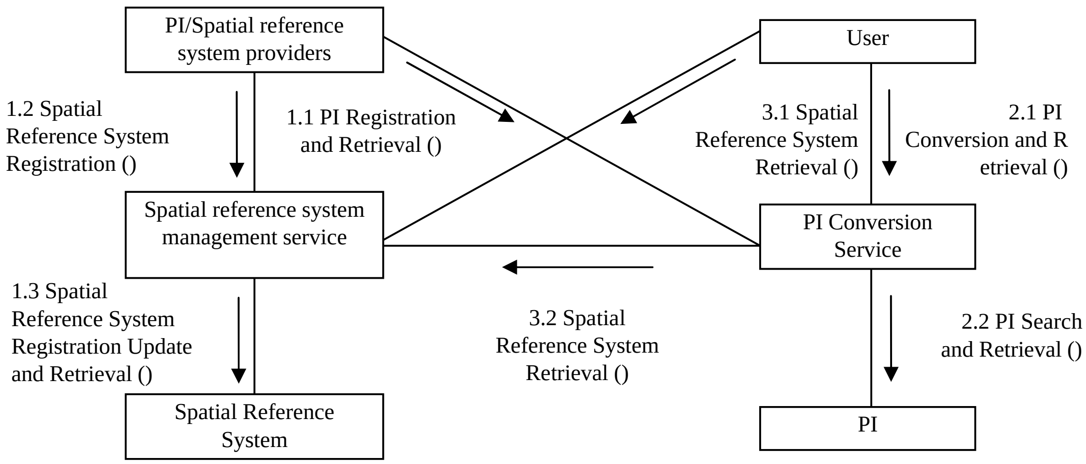
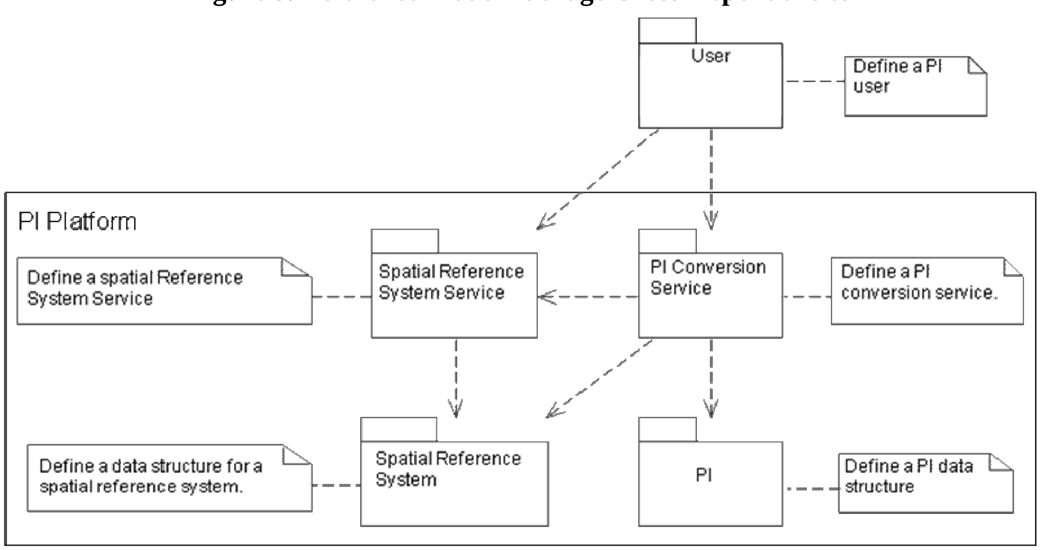


Table 1. Reference Model Packages

Package Name	Defined Components
PI Conversion Service	Definition of a PI conversion service.
Spatial Reference System Service	Definition of a service to provide spatial reference systems.
Spatial Reference System	Definition of an SRS data schema specifying PI contents and structures.
PI	Definition of a PI data schema.
User	Definition of a PI user or a user's application.

Components in the packages are "cross-dependant" with each other. In a package diagram, these dependencies are indicated using a dotted arrow between the source package and the target package, including those components as shown in Figure 3.

Figure 3. Reference Model Package Cross-Dependencies



To create a PI application, the user needs to perform a PI conversion using a PI conversion service, or must retrieve a spatial reference system from a spatial reference system service. These operations show that a user package is dependent on both the PI conversion service and the SRS service packages.

The PI conversion service is dependent on the SRS service package as it must obtain SRSs for PI conversion. In addition, the PI conversion service also requires information for coordinate operations from the SRS service.

The PI conversion service package, SRS service package, SRS package, and PI package make up the foundation for PI conversion. This foundation is referred to as the "PI platform" in this specification.

As shown above in Figure 3, all UML class names in the PI reference model shall begin with "PI_" in order to distinguish them from other geographic information standard class names. Section 4 contains a more detailed examination of the services and interfaces which comprise the PI Platform as defined by the reference model.

4. PI Platform

Briefly defined, the PI platform consists of PI services, PI data, and interfaces connecting them to each other. Interfaces will be required for using PI services or retrieving PI data. Sub-section 4.2 PI interface provides a discussion of those interfaces.

More specifically, however, the PI platform consists of PI data, a service to register, manage, and convert that PI data, a spatial reference system that specifies the PI contents and structure, and a service to register, manage, and provide the SRS data. The PI data structure and PI service functions are discussed in detail in Sub-section 4.3.

4.1 PI Conversion Service

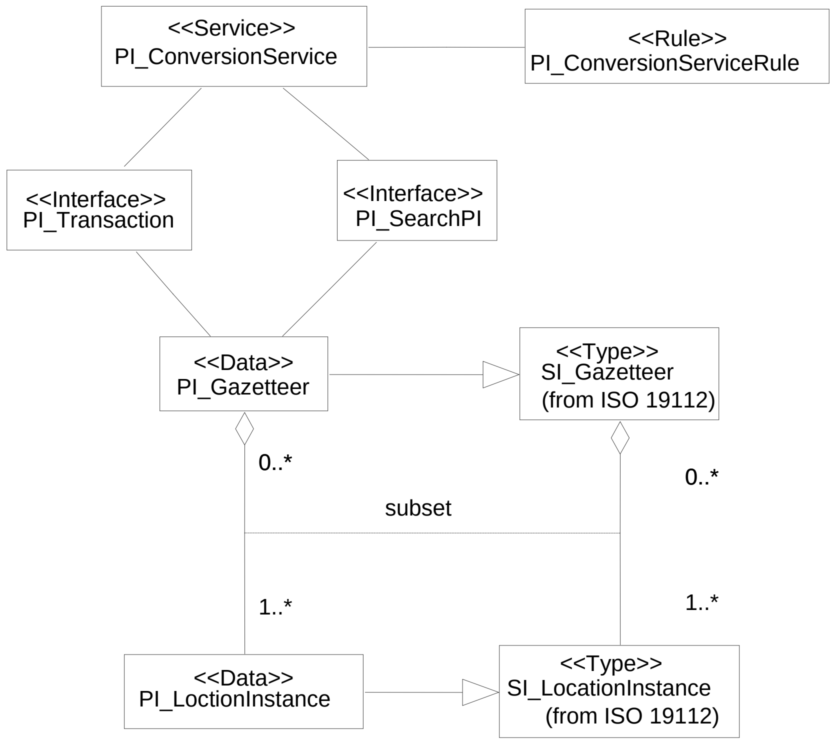
The PI conversion service manages information for PI conversion, and retrieves and transfers the desired PIs as requested by a user. In addition to searching PIs which are managed by the same PI conversion service, the service can also retrieve PIs that are owned (managed) by other PI conversion services. A PI conversion service can also request an SRS for a PI, or the conversion parameters of a coordinate reference system for coordinate operations from an SRS management service.

The PI_ConversionServiceRule class specifies the operations of a PI conversion service, the information that is managed by that service, and the rules that are required when exchanging PIs with another service. Every PI conversion service must adhere to the definitions in the PI_ConversionServiceRule class when providing services.

The PI_Gazetteer is a directory of PIs. The gazetteer definitions are inherited from SI_Gazetteer which is specified in ISO 19112 (ISO 19112:2003).

The PI_LocationInstance class describes not only the PIs themselves, but the relationships with other PIs that refer to the same location. PI_LocationInstance inherits the SI_LocationInstance class as specified in ISO 19112. Relationships with other PIs shall be described through an association of PI_LocationInstance. It is also possible to create a relationship with PI_LocationInstance in other PI_Gazetteers. Clarification of the relationships between these classes is shown below in Figure 4.

Figure 4. PI Conversion Service Model



The Spatial reference system management service registers and manages SRSs that are required to define PIs and exchanges the specific information about an SRS as requested by either a user or a PI conversion service. A PI conversion service requests a spatial reference system for PIs, or the conversion parameters of the coordinate reference system for coordinate operations from an SRS management service. The PI_SpatialReferenceSystemServiceRule class specifies the operations for an SRS management service, the information that is managed by the service, and rules between SRS management and PI conversion services.

The PI_ReferenceSystem abstract class is the foundation of the spatial reference system in the PI Specification. PI_ReferenceSystem inherits RS_ReferenceSystem as specified in ISO 19115 (ISO 19115:2003).

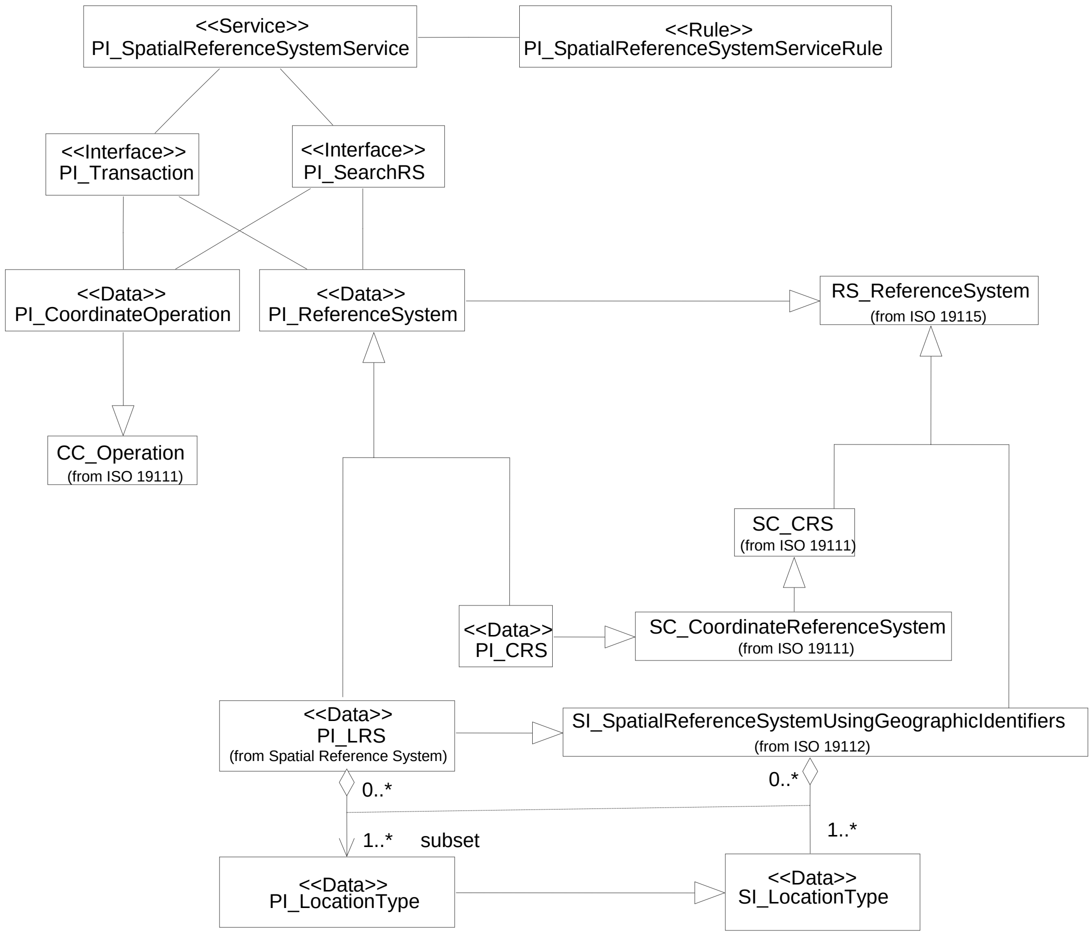
The PI_CRS is a class that describes a coordinate reference system when a PI is constructed using only coordinates. PI_CRS inherits SC_CoordinateReferenceSystem as specified in ISO 19111. PI_CRS can describe not only a coordinate reference system in a geographic space but also a local coordinate reference system as used in a floor-plan or various image formats.

The PI_LRS is a class that describes a spatial reference system having PIs that are not defined as coordinates. PI_LRS inherits SI_SpatialReferenceSystemUsingGeographicIdentifiers as specified in ISO 19112.

The PI_LocationType is a class that describes the contents or structure of a PI. PI_LocationType inherits SI_SlocationType as specified in ISO 19112. PI_LocationInstance refers to PI_LocationType to obtain details of PI contents or structure.

The PI_CoordinateOperation is a class that describes information which is used for converting PIs between coordinate systems (PI_CRS). PI_CoordinateOperation inherits CC_Operation as specified in ISO 19111 (ISO 19111:2007). The PI conversion service can perform a PI conversion using coordinate operations based on conversion parameters as specified in PI_CoordinateOperation. Figure 5 shows the relationships between those classes.

Figure 5. Spatial Reference System Management Service Model



4.2 PI Interface

Within the PI reference model, the following six interfaces are defined:

a) Registration interface

b) PI conversion interface

c) PI retrieval interface

d) SRS retrieval interface

e) User management interface

f) Service metadata retrieval interface

These aforementioned interfaces shall be used in the following cases: between a PI platform and a user, between a PI conversion service and a spatial reference system management service, between an SRS management service and an SRS review service, between a PI service and PI data, and between different PI conversion services within a PI platform.

These interfaces are not limited to automatic processing via machines, as they also include a user interface or could require manual processing by humans.

The Registration interface is used by a PI provider to register PIs to a PI conversion service and for the PI conversion service to issue a response. A PI conversion service shall use a registration interface to register PI data into the PI_Gazetteer database. The registration interface is used by an SRS provider to register SRSs to an SRS management service and for the SRS management service to issue a response.

The SRS management service shall use a registration interface to register an SRS or a coordinate operation parameter to a database. “Registration” here refers not only to the addition of new data, but also updates such as editing or removing an entry.

The PI conversion interface is used by a PI_Application to request a PI conversion from a PI_ConversionService and for the PI_ConversionService to issue a response. The PI conversion interface can also be used for the PI_ConversionService to make a request to other PI_ConversionServices.

The PI search interface shall be used by a PI conversion service to search within a database for a desired PI to perform PI conversion. It can also be used for a user to request a desired PI list.

The Spatial reference system search interface is used by a PI_Application, a PI_RSProvider, or a PI_ConversionService to request an SRS or a location type from a PI_SpatialReferenceSystemService and for the PI_SpatialReferenceSystemService to issue a response.

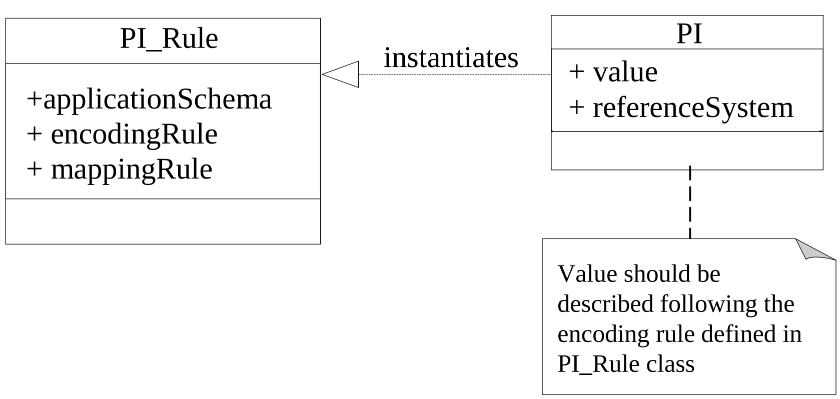
PI services can manage requests from users via a user management interface. There are no technical requirements to use this interface for PI conversion, but service credibility or usefulness shall be enhanced by managing users receiving or registering PI data.

The Service metadata retrieval interface enables a user to make an inquiry as to the functions that are offered by each service, and receives the response from the service. There are no technical requirements in the use of this interface for PI conversion; however this interface is required when using services from many parties, like a web service, instead of fixed and limited services.

4.3 PI Encoding

The following sub-section illustrates the encoding of PIs being exchanged between a PI platform and a PI application, as well as the encoding of PIs being exchanged within PI applications, and between different user communities. Figure 6 shows this encoding structure.

Figure 6. PI Encoding Structure



The PI_Rule type subclass specifies the PI contents and structure. For automatically processing a location identifier, the PI, its contents and its structure must be clarified. PI_Rule defines the PI contents and whose structure has the following three attributes, applicationSchema, encodingRule, and mappingRule.

A PI class is a type of attribute geographic value, which is inherited from SI_LocationInstance and is a superclass of PI_LocationInstance. A PI class which is encoded for distribution requires a value and a reference to a spatial reference system, while a PI_LocationInstance which is encoded for distribution uses a spatial reference system with a URI from the PI_LocationInstance to a PI_Rule class.

5. Conclusion

The previous sections of this paper have provided a brief introduction into the content and structure of the PI reference model and conceptual PI platform structure. The main goals in designing this model were to provide user communities with a simple structure for representing their identifiers without modification, and to provide developers with a defined set of services and interfaces which when followed, would enable the registration, management and most importantly the discovery and sharing of those PIs between different communities. To move these ideas forward the basic design and conceptual model has been developed into a draft specification and submitted as a new work item proposal to ISO/TC 211.(ISO/TC 211:N2413).

The concept of the PI is not to define a globally unique identifier to each object but to enable each user community to maintain the uniqueness and importance of their place identifiers while allowing access, on a global scale, to place identifiers in other communities.

The design concept of the PI is not to replace location identification schemes already in existence but to co-exist with those schemes, and to more importantly establish linkages between those schemes with those of other communities. We believe the PI concept will ultimately be more acceptable to each community.

More information about the PI reference model and overall PI concept is available in English on our web site (JIPDEC/DPC, 2008).

Within the context of this Addressing Standards Workshop (ISO/TC 211:N2436), the creation of a global standardized addressing scheme will require careful consideration and discussion. Detailed review articles such as (Coetzee et al, 2008) provide a starting point on which to base future discussions. During our research we have noticed that the same place is often described differently between user communities. On a global scale these communities are, many times, culturally different. We believe that careful consideration of the pre-existing and refined address practices which are currently in use by each culture must somehow be maintained. Concepts such as the PI reference model described in this paper could be one method in facilitating linkages between each type of addressing system while maintaining the unique structure of the addressing systems currently in use. While there are opportunities for addressing standards, more consideration will be needed and future workshops should be planned.

Acknowledgements

The authors would like to acknowledge and thank, Ms. S. Coetzee and Mr. A. Cooper for their invitation to make a presentation of the Place Identifier framework during the Addressing Standards Workshop held on May 25, 2008, and Mr. M. Lind and the National Survey and Cadastre of Denmark for providing the venue and handling the logistics involved with the workshop.

References

Cotezee, S., et al 2008, ‘Towards an International Address Standard’, *Proceedings of GSDI-10*, viewed May 2008, < http://www.gsdi.org/gsdi10/prog_details.html >.

International Organization for Standardization (ISO) 2007, Geographic information – Spatial referencing by coordinates, ISO 19111:2007, Geneva, Switzerland.

ISO 2003, Geographic information – Spatial referencing by geographic identifiers, ISO 19112:2003, Geneva, Switzerland.

ISO 2003, Geographic information – Metadata, ISO 19115:2003, Geneva, Switzerland.

ISO/TC 211:N2436 2008, *Notice of workshop and draft agenda for an ISO Workshop on address standards: Considering the issues related to an international address standard, Copenhagen, Denmark, 2008-05-25*, viewed May 2008, < http://www.isotc211.org/opendoc/211n2436 >.

ISO/TC 211:N2413 2008, Draft New Work Item Proposal: Geographic information – Place Identifier (PI), < http://www.isotc211.org/protdoc/211n2413/ >, [password required].

JIPDEC/DPC 2008, *Place Identifier*, JIPDEC/DPC, Tokyo Japan, viewed May 2008, < http://www.dpc.jipdec.or.jp/jiku/english/pi_e.html >.