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Geographic information — Place Identifier (PI) architecture —

Part 2: Place Identifier (PI) linking

Information géographique — Architecture d'identifiants de lieu (IL) — Partie 2: Liaison d'identifiants de lieu (IL)

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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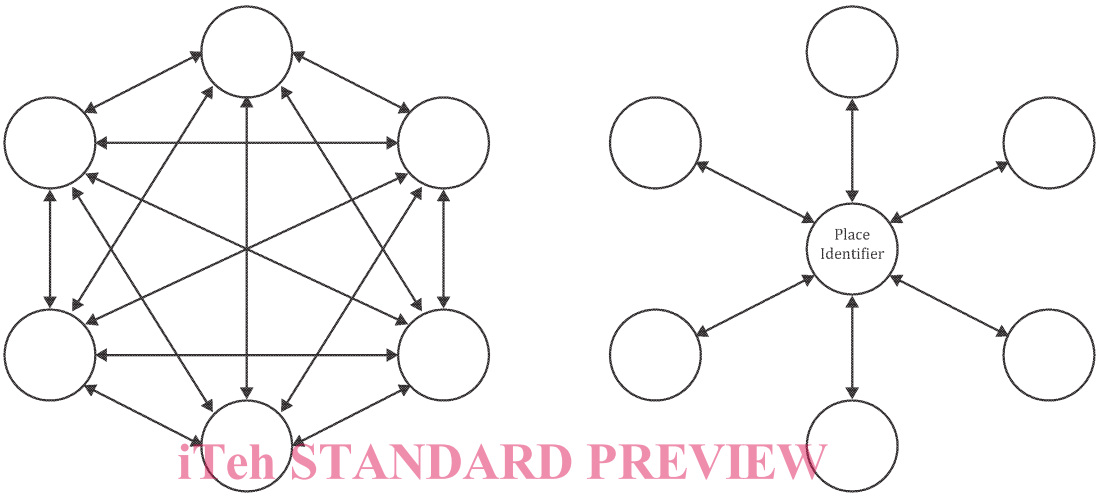
This document was prepared by Technical Committee ISO/TC 211, *Geographic information/Geomatics*.

A list of all parts in the ISO 19155 series can be found on the ISO website.

Introduction

The Place Identifier (PI) architecture (ISO 19155) defined the conceptual model of a place and specified normative encodings, for Place Identifiers, not specific to any type of geographic feature. In this document, three mechanisms are presented that define how Place Identifiers can be linked with features or objects in other encodings. Even though the identifiers of those features or objects may not specifically be a place, they may be referred to conceptually as "other identifiers."

Figure 1 depicts the abstractions of linking mechanisms among feature/object encoding rules.



a) Without the use of a Place Identifier **b) With the use of a Place Identifier**

Key

encoding rules

linkages

Figure 1 — Linkages with other encoding rules

The linking mechanisms presented in this document are based on accepted information technology for object identification and reference using gml:id, UUID, or URL. By using these linking mechanisms with the rules defined here, and according to the type of encoding rule being linked to, Place Identifiers can more uniformly be related to features and objects — other identifiers — in other encodings. This extends the functionality of those other identifiers, in different encodings, by linking with Place Identifiers encoded in GML.

Existing PI data can complement a range of other encodings through the use of the linking mechanisms defined in this document.

For example, a group of Place Identifiers representing stores in a shopping mall can be associated with the specific locations inside the shopping mall represented by a GML data set.

Geographic information — Place Identifier (PI) architecture —

Part 2: Place Identifier (PI) linking

1 Scope

This document defines the following three mechanisms for linking Place Identifiers (PIs) (see ISO 19155) to features or objects existing in other encodings:

— Id attribute of a GML object (gml:id) as defined in ISO 19136;

— Universally Unique Identifier (UUID) as defined in IETF RFC 4122;

— Uniform Resource Locator (URL) as defined in IETF RFC 1738.

These PI linking mechanisms are enabled using xlink:href as defined in W3C XML Linking Language (XLink).

While the identifiers of these features or objects can sometimes identify a place, within the scope of this document, the identifiers of features or objects existing in other encoding domains are referred to conceptually as other identifiers.

This document further defines that when PIs are encoded, as specified in ISO 19155, using the Geography Markup Language (GML) (ISO 19136), they are linked using gml:id to other GML encoded features. The details of encoding GML instances using gml:id are specified in a normative annex.

Additional normative annexes define encodings for linking Place Identifiers to other identifiers using UUID and URL and present examples for their use.

This document is applicable to location-based services, linked open data, robotic assisted services and other application domains that require a relationship between PIs and objects in either the real or virtual world.

This document is not about creating a registry of Place Identifiers linked to specific features or objects, and support of linking mechanisms other than gml:id, UUID, and URL is out of the scope of this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 19103, *Geographic information — Conceptual schema language*

ISO 19136:2007, *Geographic information — Geography Markup Language*

ISO 19155:2012, *Geographic information — Place Identifier (PI) architecture*

IETF, *Universally Unique IDentifier (UUID) URN Namespace*, RFC 4122, July 2005

IETF, *Uniform Resource Locators (URL)*, RFC 1738, December 1994

W3C XML Linking Language (XLink) Version 1.1 — Recommendation, 06 May 2010

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 19155 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
Place Identifier (PI) link
relationship established between PIs and other identifiers in different encoding domains

Note 1 to entry: While the identifiers of these features or objects can sometimes identify a place, within the scope of this document, the identifiers of features or objects existing in other encoding domains are referred to conceptually as “other identifiers”.

Note 2 to entry: These “other identifiers” can exist outside of the PI architecture.

3.2
Place Identifier (PI) linking mechanism
means used to define a *place identifier (PI) link* (3.1)

4 Abbreviated terms

4.1 Abbreviated terms

BIM	Building Information Model
CSV	comma-separated values
IFC	Industry Foundation Class
GUID	Globally Unique IDentifier
OGC	Open Geospatial Consortium
PI	Place Identifier
RDF	Resource Description Framework
SVG	Scalable Vector Graphics
UML	Unified Modeling Language
URI	Uniform Resource Identifier
URL	Uniform Resource Locator
URN	Uniform Resource Name
UUID	Universally Unique IDentifier
XML	eXtensible Markup Language

4.2 UML Notation

In this document, conceptual schemas are presented in the Unified Modeling Language (UML). The user shall refer to ISO 19103 for the specific profile of UML used in this document.

4.3 Backward compatibility

This document uses the concepts defined in the Place Identifier (PI) Architecture (ISO 19155) without modification. Therefore, no backward compatibility issues exist in this document.

5 Conformance

5.1 General

This document defines three conformance classes, specified in 5.2 to 5.4, matching the requirements classes of the three linking mechanisms defined in Clause 8. Any PI linking mechanism for which conformance with this document is claimed shall pass all of the requirements of the abstract test suite specified in Annex A.

5.2 Linking mechanism: gml:id

PI linking for which gml:id conformance is claimed shall pass all of the requirements specified in the abstract test suite in A.2.

Table 1 — Conformance class: Linking mechanism: gml:id

Conformance class	/conf/19155-2/5/5.2
Dependency	A.1
Requirements	/req/linking_mechanism/GML_ID
Tests	A.2

5.3 Linking mechanism: UUID

PI linking for which UUID conformance is claimed shall pass all of the requirements specified in the abstract test suite in A.3.

Table 2 — Conformance class: Linking mechanism: UUID

Conformance class	/conf/19155-2/5/5.3
Dependency	A.1
Requirements	/req/linking_mechanism/UUID
Tests	A.3

5.4 Linking mechanism: URL

PI linking for which URL conformance is claimed shall pass all of the requirements specified in the abstract test suite in A.4.

Table 3 — Conformance class: Linking mechanism: URL

Conformance class	/conf/19155-2/5/5.4
Dependency	A.1
Requirements	/req/linking_mechanism/URL
Tests	A.4

6 Place Identifier (PI) concept

6.1 General

A “place” is defined as an identifiable part of any space (ISO 19155), either in the real world or virtual world.

ISO 19155:2012, 6.1 states that the same place can be identified with multiple Place Identifiers (PIs). If the place is identified with coordinates, it is called “position” and if the place is identified with geographic identifiers, it is called “location.” Additionally, the place may be identified with online resource identifiers such as URI.

In ISO 19109:2015, 7.4, “position” is a spatial attribute of a feature, “location” is a location attribute of a feature, and a virtual identifier, such as a URI, is a thematic attribute of a feature. Therefore, a PI can be considered as an attribute of a feature.

6.2 PI structure

Figure 2 shows the structure of the PI, as defined in ISO 19155:2012, 7.2.2. The PI_PlaceIdentifier type is the basic data type for the PI.

Figure 2 — PI_PlaceIdentifier

The PI_PlaceIdentifier class defines the following attributes.

a) The attribute *rs* specifies the reference system of the PI.

b) The attribute *value* is the identifier for a place and is unique within the context of the defined reference system.

c) The optional attribute *validPeriod* specifies the period in which the identifier is valid for the place.

The *validPeriod* can be used to set the expiration of the identifier which can be validated through implementation. The property of uniqueness of the identifier is determined by the reference system (*rs*).

7 PI linking

7.1 Overview

There are two main concepts that are standardized in this document.

The first concept is a mechanism for connecting PIs which identify the same place, where the connection is directly embedded into the PI.

PI matching (ISO 19155:2012, 4.11) is the matching of multiple PIs that represent the same place. This matching is accomplished through the use of the PI matching service (ISO 19155:2012, 7.3.2) and when implemented, is performed within the PI architecture. The logical structure of “PI matching” is shown in ISO 19155:2012, Figure 8, where a “PI_MatchedPISet” connects more than two “PI_PlaceIdentifier”s which identify the same place. The one way association from “PI_MatchedPISet” to “PI_PlaceIdentifier” enables users to make links independently with the instances of PI_PlaceIdentifier, and the data

independence of the connection ensures the use of existing place identifiers because existing data need not change their schemas.

However, in many situations, relationships exist between PIs encoded using ISO 19155 and other identifiers in different encodings, existing independently or outside of the PI architecture. As these other identifiers are usually features or objects in different encodings, it is not possible for them to be included in or managed by the PI architecture. In these situations, users may want to simply embed the connection into their PI. Depending on the encodings of these other identifiers, a set of clearly defined mechanisms is required to expose and use those other identifiers for PI linking.

This is referred to as a Place Identifier (PI) link (3.1), similarly, a Place Identifier (PI) linking mechanism (3.2) is a means of defining a Place Identifier (PI) link.

While one specific linking mechanism is not suitable for all other identifiers in other encodings, similarities in linking mechanisms exist, such as the use of XLink for XML-based encodings.

The second concept standardized by this document is the structure of data instances for PI Linking. This document defines how to use existing constructs to enable linking to PIs without modification to those encoding rules for object identification and reference.

7.2 PI linking directionality

In this document, all links are directional. In cases where a bi-directional link is required, two distinct directional links shall be made, one in each direction.

/req/linking_directionality/direction-al_links	where a bi-directional link is required, two distinct directional links shall be made, one in each direction

A combination of directionality and encoding format limits the applicability of this document, as shown in the following cases:

a) if both identifiers are encoded in GML (ISO 19136:2007), the linking is normative;

b) if one identifier is in another encoding, the linking from a PI to that identifier is normative;

c) if one identifier is in another encoding, the linking from that identifier to a PI is informative.

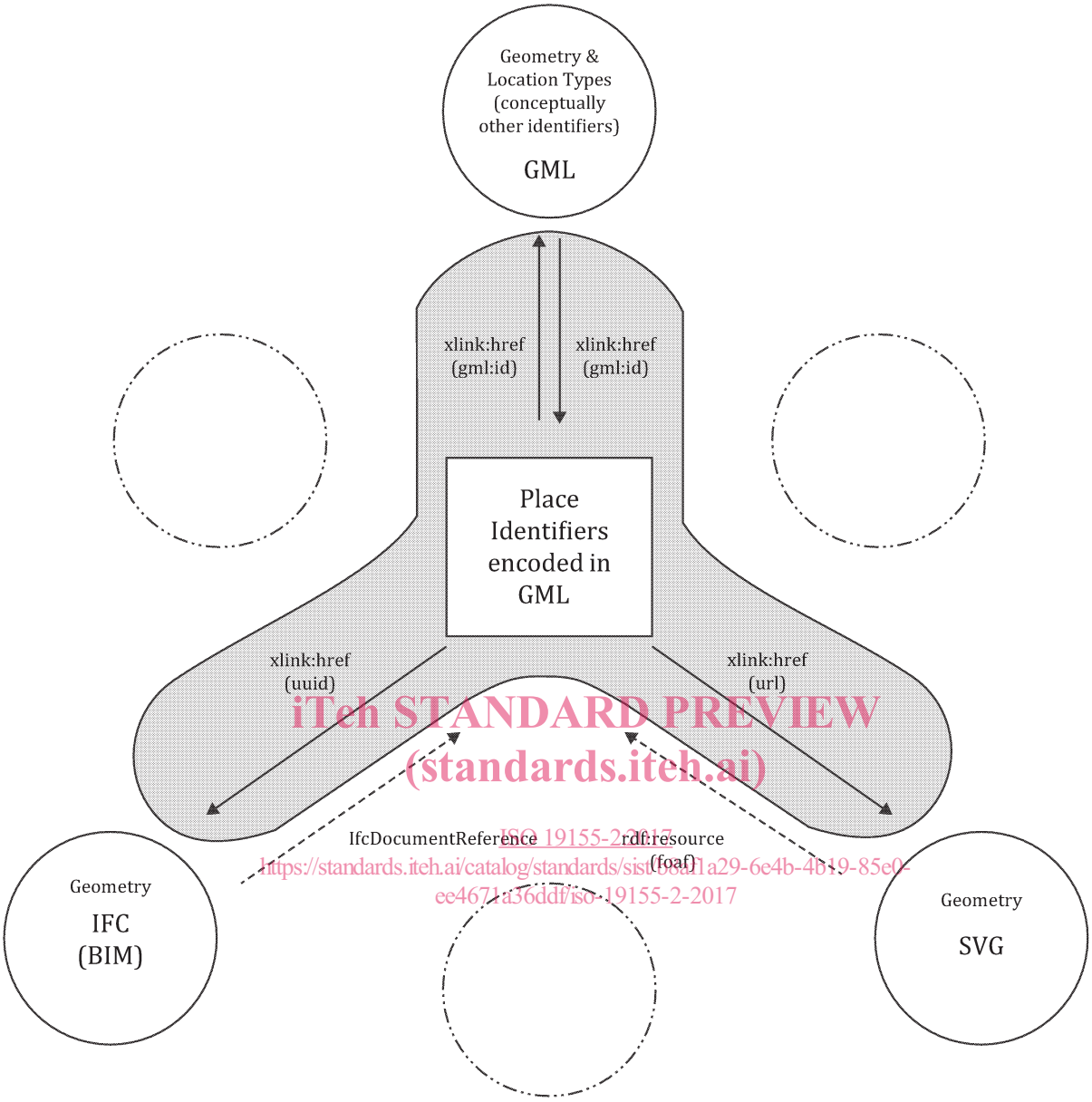
In Figure 3, the direction of the link between a PI encoded using ISO 19155 and an identifier in another encoding is shown using an arrow representing the directionality of the link. In addition, normative linking is shown using a solid line and informative linking is shown using a dashed line.

The normative linking mechanisms are:

a) gml:id: for linking between a PI and another identifier encoded in GML, see 8.2.2 and 8.2.3;

b) UUID or URL: for linking from a PI to an identifier in another encoding, see 8.3 and 8.4, respectively.

Figure 3 depicts linking to PIs from IFC(BIM) and SVG using IfcDocumentReference and rdf:resource as linking mechanisms. These mechanisms are shown as informative because those encodings are not being modified by this document.



Key

encoding rules (examples in this document)

other encoding rules

linking methods (normative)

linking methods (informative)

ISO 19155-2 scope (normative content)

ISO 19155 (normative PI encoding)

Figure 3 — Overview of content in ISO 19155-2

7.3 PI linking model

The conceptual model in Figure 4 defines the structure of PI linking.

The PI_PlaceIdentifier class defined in this document is an extended data type for the Place Identifier which enables users to connect a PI directly to other PIs.

The PI_PlaceIdentifier class also has a mandatory association "Linking" in addition to the derived three attributes. The association "Linking" is a mechanism for connecting PIs which identify the same place, where the connection is directly embedded into the PI.

NOTE While "PI_MatchedPISet" defined in ISO 19155 has an association to connect more than two "PI_PlaceIdentifier"s which identify the same place, "PI_PlaceIdentifier" defined in ISO 19155 itself does not have a property to connect other "PI_PlaceIdentifier"s.

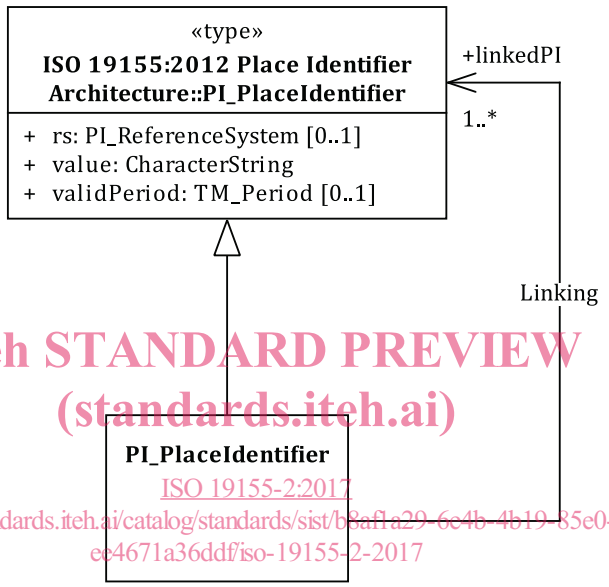


Figure 4 — PI linking model

8 PI linking mechanisms

8.1 Overview

This document defines three mechanisms for linking Place Identifiers to features or objects existing in other encodings. These PI linking mechanisms are enabled using the following information technologies for object identification and reference:

— using a gml:id linking both from and to a PI, see 8.2;

— using a Universally Unique Identifier (UUID) linking from a PI, see 8.3;

— using a Uniform Resource Locator (URL) linking from a PI, see 8.4.

When using the linking mechanisms defined in this document, the PIs shall be encoded using ISO 19136, which is the recommended normative encoding option, as specified in ISO 19155:2012, Annex B.

/req/linking_mechanisms/encoding	existing Place Identifiers shall be encoded using ISO 19136 as specified in ISO 19155:2012, Annex B