



Geographic information—Transfer Nodes



AS ISO 19147:2018

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Preface

This Standard was prepared by the Australian members of the Joint Standards Australia/Standards New Zealand Committee IT-004, Geographical Information/Geomatics.

After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this Standard as an Australian Standard rather than an Australian/New Zealand Standard.

The objective of this Standard is to specify the data types and code lists associated with those types for the implementation of transfer nodes and their services in transport modelling and location based services.

This Standard is identical with, and has been reproduced from, ISO 19147:2015, *Geographic information — Transfer Nodes*.

As this document has been reproduced from an International Standard, the following applies:

- (a) In the source text 'this International Standard' should read 'this Australian Standard'.
- (b) A full point substitutes for a comma when referring to a decimal marker.

Australian or Australian/New Zealand Standards that are identical adoptions of international normative references may be used interchangeably. Refer to the online catalogue for information on specific Standards.

The terms 'normative' and 'informative' are used in Standards to define the application of the appendices or annexes to which they apply. A 'normative' appendix or annex is an integral part of a Standard, whereas an 'informative' appendix or annex is only for information and guidance.

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#)

The committee responsible for this document is ISO/TC 211, *Geographic information/Geomatics*.

Introduction

All over the world, the authorities are facing serious problems due to the steady rise in the traffic volume. This rise will sooner or later call for very dramatic measures; one first step might be to persuade or force car users to change modes partly or entirely. In order to help this process, the authorities will need a complete overview of where it is possible to change modes of transport.

Over the last few years, substantial work in this field has been carried out by CEN/TC 278 *Intelligent Transport Systems*. EN 28701 was published in 2012. This work is motivated by the fact that the public transport sector needs data on a number of objects and events in their transport networks in order to have them work efficiently. The work done by CEN/TC 278 has been one of the sources for the motivation and background material for the ISO 19147 work done by ISO/TC 211.

NOTES

Australian Standard®

Geographic information—Transfer Nodes

1 Scope

This International Standard specifies the data types and code lists associated with those types for the implementation of transfer nodes and their services in transport modelling and location based services.

This International Standard includes the following:

- defines transfer nodes in a multimodal way so that the definition is general and valid for all types of transport means and modes;
- links transfer nodes to a location;
- focuses on the attributes defining the transfer node in relation to nodes in mode-specific networks;
- defines the attributes of transfer nodes that are relevant for travel planning and modelling of interoperable transport systems by transport planners;
- defines a set of services and facilities that may be related to transfer nodes and a way to provide information on accessibility, deviations and restrictions related to these services and facilities.

This International Standard is applicable for transport infrastructure owners and operators when defining and/or describing their transport infrastructure and for transport-related Service Providers when providing information to travellers and others.

This International Standard is limited to the transport of persons and is also limited to the static getting-on and getting-off points. The main focus is on transfer nodes being part of public transport networks, that are located in road networks, but this International Standard is also applicable for transfer nodes in rail networks and in air and sea transport networks.

2 Normative references

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

ISO 639, *Code for the representation of names of languages*

ISO 3166, *Codes for the representation of names of countries and their subdivisions*

ISO 19103:—¹⁾, *Geographic information — Conceptual schema language*

ISO 19107, *Geographic information — Spatial schema*

ISO 19108, *Geographic information — Temporal schema*

ISO 19133, *Geographic information — Location-based services — Tracking and navigation*

ISO 19134, *Geographic information — Location-based services — Multimodal routing and navigation*

ISO 19136, *Geographic information — Geography Markup Language (GML)*

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

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

- 1) To be published. (Revision of ISO/TS 19103:2015)

3.1

access point

location (3.8) where travellers can enter or exit a *transfer node* (3.18)

Note 1 to entry: An access point may not be a *stop point* (3.15). An access point may for example be the entrance to a railway station or the connection between a parking area and a railway station.

3.2

accessibility

ability to access and benefit from the functionality provided by a *service* (3.14) or a *facility* (3.5)

Note 1 to entry: Accessibility is often associated with disabilities. According to the concept of universal design, accessibility is, however, a matter that permanently or temporarily is relevant to all of us, e.g. people with heavy luggage, people with broken legs, people with small children, elderly people, etc.

3.3

accessibility information

information about *accessibility* (3.2) issues

Note 1 to entry: According to the concept of universal design, accessibility information should be addressed in a neutral way, i.e. not directed towards people with specific disabilities.

3.4

deviation

divergence from a plan or the normal situation

Note 1 to entry: These may be deviations with respect to the time schedule or the accomplishment of the transport or deviations with respect to the *services* (3.14) or facilities that are provided.

3.5

facility

physical installation or physical area that may be accessed and used

EXAMPLE Elevators, restaurant areas, waiting areas, seats, toilets, shops.

Note 1 to entry: Such facilities may be available on-board *transport means* (3.19) during the transport, at arrivals to and at departures from a *transfer node* (3.18), and at transfer nodes.

3.6

journey

movement of a person who is travelling between two *locations* (3.8)

Note 1 to entry: May consist of one or more *journey segments* (3.7).

3.7

journey segment

part of a *journey* (3.6) defined by a start and a stop *location* (3.8)

Note 1 to entry: A journey segment may be carried out by means of a *trip* (3.20) or a subset of a trip between locations that may be *transfer nodes* (3.18). A journey segment may also be road use (driving, walking and cycling).

3.8

location

identifiable geographic place

Note 1 to entry: A location may be represented by one or more data types that describe a point position, a curve or an area in the real world. A location may be referenced by coordinates from a coordinate reference system or an address from an address system.

[SOURCE: ISO 19112:2003, 4.4, modified – Note 1 to entry has been added.]

3.9 location-based service

LBS

service (3.14) whose return or other property is dependent on the *location* (3.8) of the client requesting the service or of some other thing, object or person

[SOURCE: ISO 19133:2005, 4.11]

3.10 restriction

formal or informal obligation to refrain from doing something

Note 1 to entry: In this International Standard, a restriction refers to a *transfer node* (3.15) or *transport service* (3.19) criterion that limits permissible courses of action.

[SOURCE: ISO 19152:2012, 4.1.19, modified – Note 1 to entry has been added.]

3.11 service

distinct part of the functionality that is provided by an entity through interfaces

[SOURCE: ISO 19119:2005, 4.1]

3.12 stop point

location (3.8), e.g. a platform, at a *transfer node* (3.15) where the *transport means* (3.16) stop to enable the traveller to board or alight from the transport means

3.13 transfer

person's activity to switch between *transport modes* (3.17), *transport networks* (3.18) or *transport means* (3.16)

3.14 transfer link

link that connects *transfer nodes* (3.15) or *stop points* (3.12) within a transfer node

Note 1 to entry: A transfer link enables travellers to move between the different transfer nodes and stop points within a transfer node.

3.15 transfer node

location (3.8) that facilitates *transfers* (3.13) between *transport modes* (3.17), *transport networks* (3.18) and/or *transport means* (3.16)

Note 1 to entry: A transfer node may contain other transfer nodes and may be related to one or more transport modes and transport networks. It may also contain *stop points* (3.12) and facilities for the users of the transfer node. A transfer node may host *services* (3.11) that are provided to the users of the transfer node, e.g. information services, ticket sales, etc.

Note 2 to entry: A transfer node may be a part of a hierarchy of transfer nodes. Thus, a transfer node may be related to many transport modes and transport networks. However, only transfer nodes that are related to just one transport network will have stop points.

Note 3 to entry: The stop points related to different transfer nodes, which may serve different transport modes and networks, may, in real life, have the same physical locations. A tram and a bus may for example share the same platform, but conceptually they may belong to different transfer nodes.

3.16 transport means

any type of vehicle, associated with any *transport mode* (3.17), that is used for the transport of persons or goods

3.17

transport mode

means that travellers can choose for transport

Note 1 to entry: In this International Standard, the term "transport mode" is frequently shortened to "mode" for convenience. Transport mode is usually covering groups of vehicles, e.g. *transport means* (3.16) used for road transport, rail transport, sea transport, air transport and cable transport. A mode for inland water-borne transport is also added.

[SOURCE: ISO 19134:2007, 4.14, modified – Note 1 to entry has been added.]

3.18

transport network

physical network infrastructure for mobility of *transport means* (3.16), containing infrastructure and equipment that facilitate traffic management

Note 1 to entry: A transport network is associated to a specific transport mode and specific types of transport means. The road network, consisting of streets in a city may for example support several transport networks such as transport networks for pedestrians, bicycles and use private cars. The network served by a *bus service* (3.11) is also a transport network.

3.19

transport service

service (3.14) that is offered to a person with a transport demand

Note 1 to entry: This may be services supporting mobility (e.g. public transport services) or services such as luggage handling, assistance, etc.

3.20

trip

instance of a *transport service* (3.19) supporting mobility, for example, a specific flight, a specific ferry departure or a specific taxi tour

Note 1 to entry: May follow a pre-defined *trip pattern* (3.21) or the trip may be *ad hoc* according to specific mobility demands. Depending on the nature of the trip, it may start and stop at several *transfer nodes* (3.15).

Note 2 to entry: A trip may serve many travellers, and the travellers may make use different part of a trip (e.g. different legs between different bus stops), and these parts may be whole *journeys* (3.6) or *journey segments* (3.7).

3.21

trip pattern

pre-defined path defined by means of two or more *transfer nodes* (3.15) and the links and waypoints in between

Note 1 to entry: Defines a path to be followed by a *transport service* (3.19); also called route.

4 Symbols and abbreviated terms

4.1 Acronyms

GML	Geographic Markup Language
LBS	Location-Based Service
UML	Unified Modelling language

4.2 UML Notation

The diagrams that appear in this International Standard are presented using the Unified Modelling Language (UML). UML notation is used as described in ISO 19103 and in the UML standard OMG Unified Modelling Language (OMG UML), Superstructure, Version 2.2.

4.3 Package abbreviations

Two letter abbreviations are used to denote the package that contains a class. Those abbreviations precede class names, connected by a “_”. The International Standard in which those classes are located is indicated in parentheses. A list of those abbreviations follows.

GM	geometry (ISO 19107)
AD	address (ISO 19133)
NT	network (ISO 19133)
TM	temporal (ISO 19108)
TN	transfer node
SF	services and facilities
AT	accessibility types
DT	deviation types
FT	facility types
RT	restriction types
ST	service types

5 Transfer node requirements

5.1 Transfer node context

Systems being compliant with this International Standard shall be built on the following context.

The transfer node context is based on the fact that within a geographically limited area there may be several transport networks. Each network can be described by a set of nodes and links (see layer A, B and N in [Figure 1](#)). Examples of such networks are rail networks, metro networks, bus network, public roads (private cars network) and pedestrian and cyclist networks.

Nodes that enable a transfer of persons between transport networks, as well as nodes that enable persons to transfer between two different transport means within the same transport networks, are in this International Standard called transfer nodes. Such a transfer node may include several nodes from different networks.

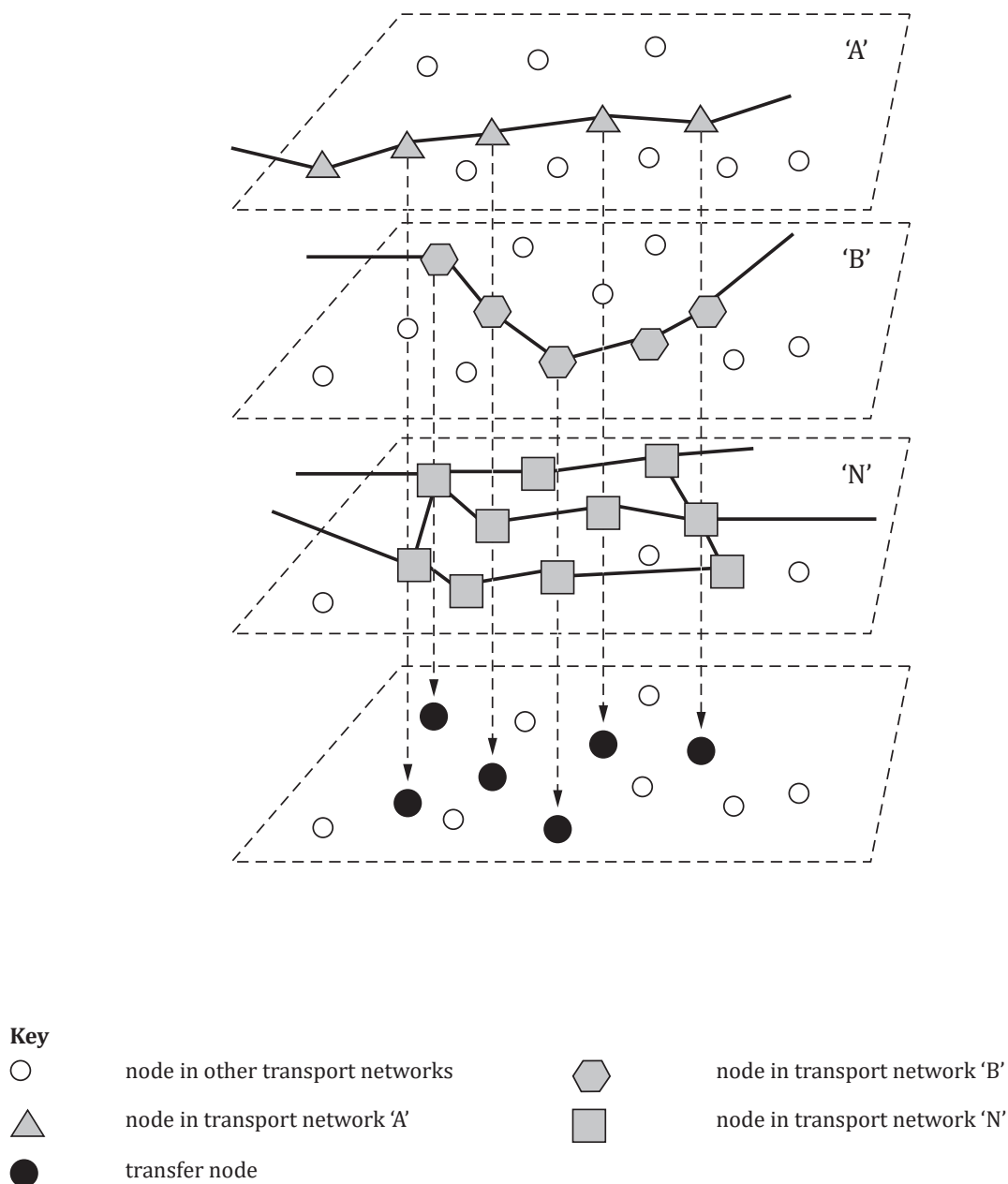


Figure 1 — Transfer node context

Indicated with vertical lines in [Figure 1](#) and illustrated in [Figure 2](#) there will be transfer nodes in the different networks that from a topological (location) point of view coincide with other transfer nodes in other networks. Such aggregations of transfer nodes (the lowest level in [Figure 1](#)) are in this International Standard also called transfer nodes. This implies that there may be a hierarchy of transfer nodes, and a transfer node may serve one network or be an aggregated transfer node that serves several networks. The principle is illustrated in [Figure 2](#). The geographical limitation of the transfer nodes in the 'cylinder' is an aggregated transfer node. It will include the transfer nodes for the different networks and may in addition also include common facilities.

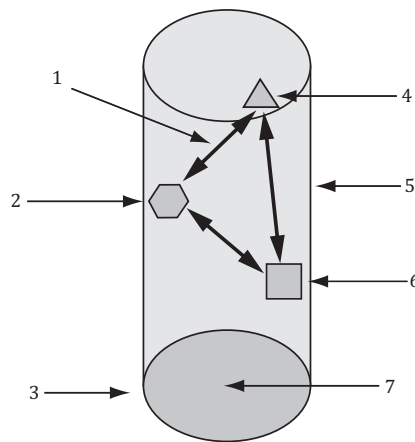
The decision on when different transfer nodes are to be aggregated into another transfer node is a practical concern. If they are co-located, if they have a common name, or if it is desirable to define

common services and facilities and transfer links between the transfer nodes or their stop points, they should be aggregated.

Transfer nodes may also include multiple nodes from the same type of network.

EXAMPLE 1 Both a bus stop and a bus terminal are transfer nodes. In both cases, a transfer from a pedestrian network or private car network to a bus network is supported, or they may also support a transfer from one bus to another bus.

EXAMPLE 2 Large airports are likely to be aggregated transfer nodes. They consist of transfer nodes connected to different networks such as one or more rail networks, the private car network, the bus network, and air network. The transfer node for the air network may also be an aggregated transfer node that may consist of a transfer node for all the different types of network, networks, a transfer node for domestic flights and a transfer node for international flights included.



Key

- | | |
|--|----------------------------|
| 1 transfer link(s) between nodes in 'A' and 'B' | 5 transfer node 'cylinder' |
| 2 node in network B | 6 node in network N |
| 3 location (geographical limits for the transfer node) | 7 transfer node |
| 4 node in network A | |

Figure 2 — Transfer nodes principle

5.2 Semantics

Systems being compliant with this International Standard shall be built on the following semantics as defined below and in [Annex A](#) and [Annex B](#):

The transfer node is described by means of two packages.

- Transfer node – a leaf package which specifies information directly related to the transfer nodes.
- Services and facilities – a package which specifies additional information that may be of interest to the users of transfer nodes such as available facilities and services; and deviations, restrictions and accessibility related to these services and facilities.

In addition, appropriate types and classes from other International Standards are used (see [Figure 3](#)):

- ISO 639 Language codes – which provides data types for language specification;

- ISO 3166 Country codes – which provides data types for country codes specification;
- ISO 19103 Conceptual schema language – which provides data types for date and clock time;
- ISO 19107 Spatial schema – which provides data types for coordinate geometry;
- ISO 19108 Temporal schema – which provides data types for time duration specifications;
- ISO 19133 Tracking and navigation – which provides data types for addresses and network;
- ISO 19134 Multimodal navigation – which provides some terms and definitions;
- ISO 19136 GML – which provide data types for information links (URIs);
- ISO 19155 Place Identifier (PI) architecture – which provides data types for places.

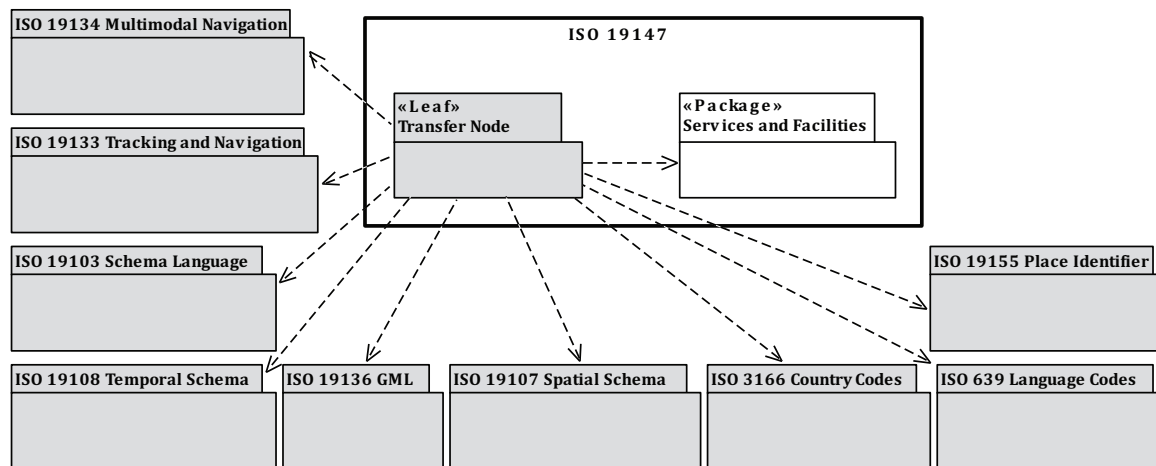


Figure 3 — Context diagram for ISO 19147

6 Conformance

This International Standard defines the requirements for transfer node specifications and has no specific conformance test defined herein.

Conformance to any other International Standard referenced in this International Standard shall be ascertained according to the requirements of the referenced standard or specification.

Conformance to this International Standard is therefore a matter of self-declaration of compliance or by submission to a test house to ascertain that the provisions of the clauses of this International Standard have been adhered to.

The specification of a transfer node is compliant with this International Standard if it includes the following:

- compliant with the normative references in [Clause 2](#);
- uses the terms and definitions in [Clause 3](#) and symbols and abbreviated terms in [Clause 4](#);
- fulfil the requirements in [Clause 5](#);
- uses the information model defined in [Annex A](#);
- uses the services and facilities defined in [Annex B](#).

Annex A (normative)

Transfer nodes information model

A.1 Semantics

The transfer nodes information model is defined in [Figure A.1](#).

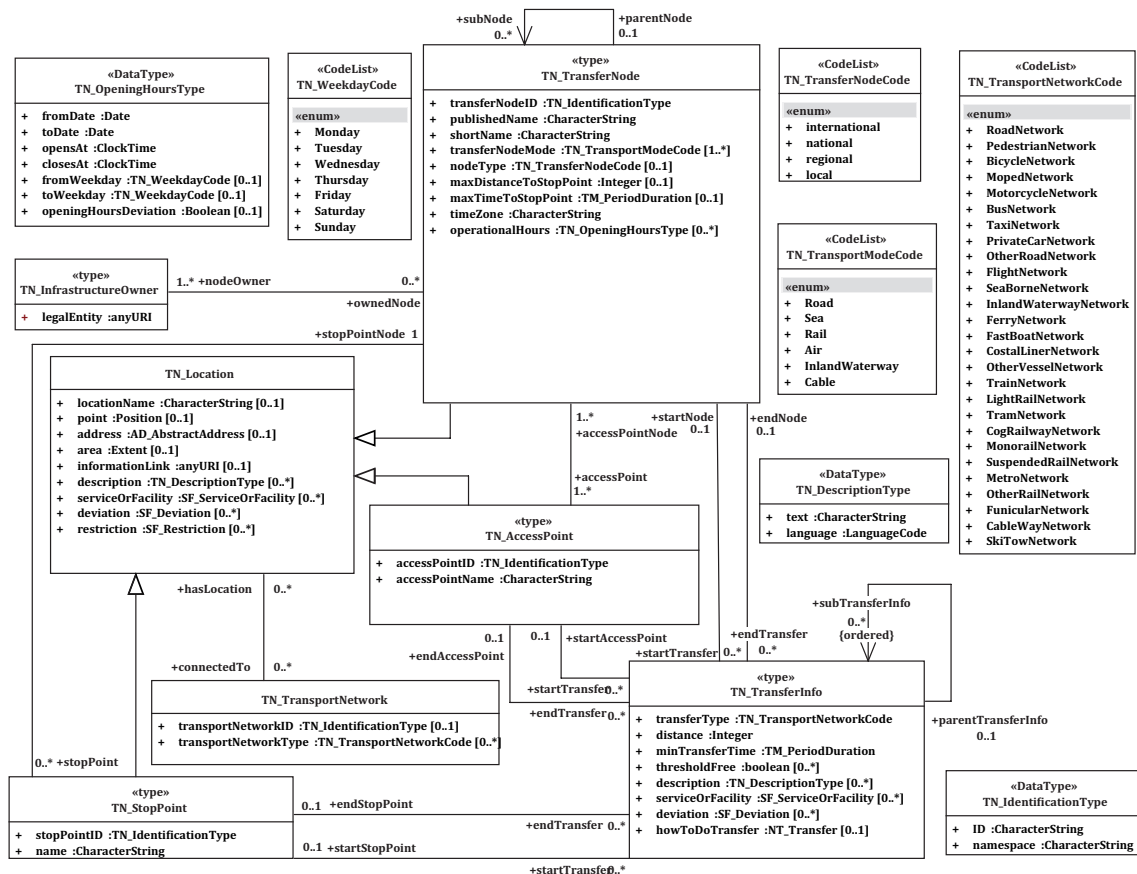


Figure A.1 — Context diagram for transfer node

The transfer node leaf package contains types, data types and code lists that specify overall aspects related to the transfer node infrastructure like the following:

- relations to other transfer nodes;
- stop points at the transfer node;
- transfer node access points;
- transfers to, from, between and within the transfer nodes and stop points.

NOTE 1 The transfer node infrastructure specification does not include the use of the transfer node and the stop point in transport services (bus routes, etc.). Such use is a matter for those planning the transport services (deciding trip patterns, time schedules, etc.). The transfer node model is by intention made independent of these issues.

NOTE 2 The transfer node infrastructure specification is independent of the traffic management related to entrance to, departure from and manoeuvring in the area of the transfer node.

NOTE 3 Services, facilities, deviation and restrictions related to the transfer node, stop points and transfers are defined in the Services and facilities package (see [Annex B](#)).

NOTE 4 TN_TransferNode will replace the MM_TransferNode in ISO 19134. The MM_TransferNode cannot be used since it only relates to one transport mode (the transferNodeType attribute). The networkPosition attribute relates to just the road network. The TN_TransferNode must be able to relate to several transport modes and it can be related to all types of network.

A.2 TN_Location

A.2.1 Semantics

The abstract class TN_Location defines location information that can be used to specify the location of transfer nodes, stop points at transfer nodes and transfer node access points. Different types of locations (i.e. point or area) may be relevant. Area is typically used for transfer nodes. Point may be used for stop points and access points. A location may also have facilities and host services (see the SF_ServiceOrFacility type), e.g. information services, ticket sales, etc. There may be deviations related to several aspects of the location (see the SF_Deviation type), some of the facilities may for example be out of order. There may be restrictions related to the location (see the SF_Restriction type), e.g. access restrictions.

The UML model for TN_Location is given in [Figure A.1](#).

A.2.2 Properties

The attributes of TN_Location are defined in [Table A.1](#).

The cardinalities of all attributes are 0..1 due to the freedom of choice in how to specify the location.

Table A.1 — TN_Location properties

Attribute	Definition	Mandatory/ Optional	Data type	Max. occurrence	Defined in
locationName	Name of a location	0	CharacterString	1	ISO 19103
point	Used if the location is a position (i.e. a point with coordinates)	0	Position	1	ISO 19155
address	Location address	0	AD_AbstractAddress	1	ISO 19133
area	Used if the location is an area	0	Extent	1	ISO 19155
transportNetwork	Transport network associated with the location	0	TN_IdentificationType	N	This IS
informationLink	Link to more information	0	anyURI	1	ISO 19136
description	Text description	0	TN_DescriptionType	N	This IS
serviceOrFacility	Service or facility related to the location	0	SF_ServiceOrFacility	N	This IS
deviation	Deviation related to the location	0	SF_Deviation	N	This IS

Table A.1 (continued)

Attribute	Definition	Mandatory/Optional	Data type	Max. occurrence	Defined in
restriction	Restriction related to the location	0	SF_Restriction	N	This IS
Role name: hasConnection	A location may be connected to transport networks	0	Association to TN_TransportNetwork	N	This IS

A.2.3 Constraints

Related to	Constraint
Data type TN_Location	At least one of the attributes must be used.

A.3 TN_TransportNetwork

A.3.1 Semantics

The abstract class TN_TransportNetwork identifies a physical transport network by means of an identifier and/or the network type(s) served by the physical network. This information can be related to a location (see TN_Location type).

Note One physical transport network (e.g. the road network) may serve several transport network types. The networks for pedestrians, bicycles, buses, private cars, etc. may partly overlap and partly have dedicated sections (bicycle paths, pedestrian roads, bus lanes, etc.) in the physical transport network. Thus, at one location, the physical network may be a part of one or more transport network types.

The UML model for TN_TransportNetwork is given in [Figure A.1](#).

A.3.2 Properties

The attributes of TN_TransportNetwork are defined in [Table A.2](#).

The cardinalities of all attributes are 0..1 due to the freedom of choice in how to specify the location.

Table A.2 — TN_TransportNetwork properties

Attribute	Definition	Mandatory/Optional	Data type	Max. occurrence	Defined in
transportNetworkID	Unique identifier of a physical transport network	0	TN_IdentificationType	1	This IS
transportNetworkType	Transport network type(s) served by the physical transport network at a specific location. This may for example be road users in general or just pedestrians and bicycles	0	TN_TransportNetworkCode	N	This IS
Role name: connected To	A transport network may be linked to locations	0	Association to TN_Location	N	This IS

A.3.3 Constraints

Related to	Constraint
Data type TN_TransportNetwork	Should be used if it is relevant to identify transport networks associated to a location and/or if it is relevant to indicate the transport network type(s) associated to a location.
Data type TN_TransportNetwork	At least one of the attributes must be used.
Attribute transportNetworkID	Should be provided if it is relevant to identify the transport network associated to a location.
Attribute transportNetworkType	Should be provided to indicate that certain transport network types provide access to a location. The need for such information must be considered and can be omitted if the access to the location is obvious. For bus stops, it may for example not be necessary to indicate that the road network provides access to the transfer node unless the access is limited to a subset of the road network types (e.g. the pedestrian network). The use varies depending on the type of the associated location (i.e. specializations of TN_Location). — If the location is a transfer node: — At the lowest level in a transfer node hierarchy, transport network type(s) served by the stop points should be provided. — For transfer nodes at higher levels and for transfer nodes without a hierarchy, the provision of information on all transport network types providing access to the transfer node should be considered. In addition to those served by the stop points in the hierarchy, this may also be the road network in general, networks for pedestrians, passenger cars, etc. For bus stops, this may however not be necessary as mentioned above. — If the location is a stop point: The transport network type(s) served by the stop point should be provided. — If the location is an access point: The transport network types providing access to the transfer access point should be provided.

A.4 TN_TransferNode

A.4.1 Semantics

The type TN_TransferNode supports the provision of descriptions of transfer nodes. A transfer node is a location that facilitates transfers between transport modes or transport means operating in the same or different transport networks.

A transfer node is a specialization of the TN_Location type and inherits location attributes. It may have one or more access points (see the TN_AccessPoint type), and it may have stop points (see the TN_StopPoint type). It may facilitate transfers to other transfer nodes, to access points and between stop points (see the TN_TransferInfo type). A transfer node will have an owner (see the TN_InfrastructureOwner type).

A transfer node may contain other transfer nodes. Hence, there may be a hierarchy of transfer nodes, and one node may support one or more transport modes. Transfer nodes at the lowest level of such a hierarchy have one or more stop points (see the TN_StopPoint type), which are the locations where transport means may stop. The physical location of a transfer node and its stop points may, however, coincide with other transfer nodes and other stop points.

The UML model for TN_TransferNode is given in [Figure A.1](#).

A.4.2 Properties

The attributes and roles of TN_TransferNode are defined in [Table A.3](#).

Table A.3 — TN_TransferNode properties

Attribute/Role name	Definition	Mandatory/Optional	Data type	Max. occurrence	Defined in
transferNodeID	The ID of the transfer node	M	TN_IdentificationType	1	This IS
publishedName	The name that is published to the travellers (e.g. in route tables)	M	CharacterString	1	ISO 19103
shortName	Short name (e.g. airport codes)	M	CharacterString	1	ISO 19103
transferNodeMode	Transport modes served by the transfer node. May be several modes for multimodal transfer nodes	M	TN_TransportMode Code	N	This IS
nodeType	International, national, regional, local	O	TN_TransferNode Code	1	This IS
informationLink	Link to more information	O	anyURI	1	ISO 19136
maxDistanceToStop Point	Maximum distance to stop points belonging to the transfer node in metres	O	Integer	1	ISO 19103
maxTimeToStop Point	Maximum time it takes to go to stop points belonging to the transfer node (average duration)	O	TM_PeriodDuration	1	ISO 19108
timeZone	Time zone to which the transfer node belongs	M	CharacterString	1	ISO 19103
operationalHours	The time when the transfer node is open	O	TN_OpeningHours Type	N	This IS
Role name: parentNode	The transfer node may be the parent of other transfer nodes (the airport may for example have several terminals)	O	Association to: TN_TransferNode	1	This IS
Role name: subNode	The transfer node may be a part of another transfer node (an airport terminal for domestic flights is for example a part of the airport)	O	Association to TN_TransferNode	N	This IS
Role name: accessPoint	A transfer node has one or more access points	M	Association to TN_AccessPoint	N	This IS
Role name: endTransfer	A transfer node may be the end of a transfer	O	Association to TN_TransferInfo	N	This IS
Role name: nodeOwner	A transfer node will have an owner	M	Association to TN_InfrastructureOwner	N	This IS
Role name: startTransfer	A transfer node may be the start of a transfer	O	Association to TN_TransferInfo	N	This IS
Role name: stopPoint	A transfer node may have stop points	O	Association to TN_StopPoint	N	This IS

A.4.3 Constraint

Related to	Constraint
Relation between TN_TransferNode and TN_StopPoint	In a hierarchy of transfer nodes, only the lowest level in a hierarchy of transfer nodes can have stop points.

A.5 TN_AccessPoint

A.5.1 Semantics

The type TN_AccessPoint supports the provision of descriptions of access points to transfer nodes (see the TN_TransferNode type). One access point may provide access to one or more transfer nodes, and access points may also be included in transfer descriptions (see the TN_TransferInfo type).

Location attributes are inherited from TN_Location.

The UML model for TN_AccessPoint is given in [Figure A.1](#).

A.5.2 Properties

The attributes and roles of TN_AccessPoint are defined in [Table A.4](#).

Table A.4 — TN_AccessPoint properties

Attribute/Role name	Definition	Mandatory/Optional	Data type	Max. occurrence	Defined in
accessPointID	The unique identifier of the access point	M	TN_IdentificationType	1	ISO 19103
accessPointName	Name of access point	M	CharacterString	1	ISO 19103
Role name: startTransfer	The TN_AccessPoint may be the start of one or more transfers	O	Association to TN_TransferInfo	N	This IS
Role name: endTransfer	The TN_AccessPoint may be the end of one or more transfers	O	Association to TN_TransferInfo	N	This IS
Role name: accessPointNode	The TN_AccessPoint to a transfer node	M	Association to TN_TransferNode	N	This IS

A.6 TN_StopPoint

A.6.1 Semantics

The type TN_StopPoint supports the provision descriptions of stop points. A stop point is a location at a transfer node (see the TN_TransferNode type) where transport means can stop.

A stop point is related to just one transfer node and serves one or more transport networks. The associated transfer node must be connected to the associated mode(s).

Transfers may be specified to and from stop points (see the TN_TransferInfo type).

Location attributes are inherited from TN_Location.

NOTE The physical location of a stop point may coincide with stop points belonging to other transfer nodes and other transport modes. This depends on how the logical definition of the transfer node hierarchy is defined.

The UML model for TN_StopPoint is given in [Figure A.1](#).