TECHNICAL SPECIFICATION

ISO/TS 18234-6

Traffic and Travel Information (TTI) — TTI via Transport Protocol Expert Group (TPEG) data-streams —

Part 6:
Location referencing applications

Informations sur le trafic et le tourisme (TTI) — Messages TTI via les flux de données du groupe d'experts du protocole de transport (TPEG) —

Partie 6: Applications de référence de localisation

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of normative document:

— an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;

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An ISO/PAS or ISO/TS is reviewed after three years in order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn. If the ISO/PAS or ISO/TS is confirmed, it is reviewed again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.

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.

ISO/TS 18234-6 was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*.

ISO/TS 18234 consists of the following parts, under the general title *Traffic and Travel Information (TTI) — TTI via Transport Protocol Expert Group (TPEG) data-streams*:

⎯ *Part 1: Introduction, numbering and versions*

⎯ *Part 2: Syntax, Semantics and Framing Structure (SSF)*

⎯ *Part 3: Service and Network Information (SNI) application*

⎯ *Part 4: Road Traffic Message (RTM) application*

⎯ *Part 5: Public Transport Information (PTI) application*

⎯ *Part 6: Location referencing applications*

Introduction

The TPEG technology uses a byte-oriented stream format, which may be carried on almost any digital bearer with an appropriate adaptation layer. TPEG-messages are delivered from service providers to end-users, and are used to transfer information from the database of a service provider to an end-user's equipment.

The TPEG-Loc methodology has been developed to provide a unified location referencing system for all TPEG applications that require such referencing systems. This CEN ISO Technical Specification describes the TPEG-Loc application in detail.

TPEG-Loc is designed to offer service providers and end-users several large and significant advantages over previous location based services. TPEG-Loc forms the basis of location referencing for any TPEG application that may be specified.

It is very important to remember the original TPEG objectives, which ensure that the TPEG-Loc is designed to meet all needs. It is flexible in use, from both a service provision and end-user viewpoint. TPEG-Loc offers choices for service providers to provide simple single-application services through to multi-application services using the *same* location referencing method. TPEG-Loc offers filtering choices for end-users to provide wide or narrowly focussed information, both urban and inter-urban and for single or multi-modal journeys. TPEG-Loc provides for both large networked service providers and small single area service providers and allows a full range of end-user products to be developed, from thick clients such as navigation systems to thin clients such as small hand held travel assistants.

The Broadcast Management Committee of the European Broadcast Union (EBU) established the B/TPEG project group in autumn 1997 with the mandate to develop, as soon as possible, a new protocol for broadcasting traffic and travel-related information in the multimedia environment. The TPEG technology, its applications and service features are designed to enable travel-related messages to be coded, decoded, filtered and understood by humans (visually and/or audibly in the user's language) and by agent systems.

One year later in December 1998, the B/TPEG group produced its first public specifications. Two documents were released. Part 2 (TPEG-SSF, CEN ISO/TS 18234-2) described the Syntax, Semantics and Framing structure, which will be used for all TPEG applications. Part 4 (TPEG-RTM, CEN ISO/TS 18234-4) described the *first* application, for Road Traffic Messages.

CEN /C 278/WG 4, in conjunction with ISO/TC 204/WG 10, established a project group comprising the members of B/TPEG and they have continued the work concurrently since March 1999. Since then two further parts have been developed to make the initial complete set of four parts, enabling the implementation of a consistent service. Part 3 (TPEG-SNI, CEN ISO/TS 18234-3) describes the Service and Network Information Application, which is likely to be used by all service implementations to ensure appropriate referencing from one service source to another. Part 1 (TPEG-INV, CEN ISO/TS 18234-1), completes the work, by describing the other parts and their relationship; it also contains the application IDs used within the other parts.

In April 2000, the B/TPEG group released revised Parts 1 to 4, all four parts having been reviewed and updated in the light of initial implementation results. Thus a consistent suite of specifications, ready for wide scale implementation, was submitted to the CEN/ISO commenting process.

In November 2001, after extensive response to the comments received and from many internally suggested improvements, all four parts were completed for the next stage: the Parallel Formal Vote in CEN and ISO. But a major step forward has been to develop the so-called TPEG-Loc location referencing method, which enables both map-based TPEG-decoders and non map-based ones to deliver either map-based location referencing or human readable information. Part 6 (TPEG-Loc, CEN ISO/TS 18234-6, this document) is now a separate specification and is used in association with the other parts of CEN ISO/TS 18234 to provide comprehensive location referencing. Additionally Part 5, the Public Transport Information Application (TPEG-PTI, CEN ISO/TS 18234-5), has been developed and been through the commenting process.

This Technical Specification, CEN ISO/TS 18234-6, describes the data structure, the encoding and decoding of "TPEG-Loc". This document has been prepared by CEN/TC 278 *Road Transport and Traffic Telematics* in co-operation with ISO/TC 204, *Intelligent Transport Systems*.

During the development of the TPEG technology a number of versions have been documented and various trials implemented using various versions of the specifications. At the time of the publication of this Technical Specification, all parts are fully inter-workable and no specific dependencies exist. This Technical Specification has the technical version number TPEG-Loc_3.0/001.

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Traffic and Travel Information (TTI) — TTI via Transport Protocol Expert Group (TPEG) data-streams —

Part 6:
Location referencing applications

1 Scope

This Technical Specification establishes the method of location referencing used by TPEG applications such as TPEG-RTM or TPEG-PTI.

TPEG applications are specified to contain all the information required by a client TPEG decoder (i.e. both location referencing and event information), to present all the information intended for the end-user when it was originated by the service provider.

The term "application" is used in TPEG specifications to describe specific applications, which are at the highest layer of the ISO/OSI protocol stack (ISO/IEC 7498-1). Each TPEG application (e.g. TPEG-RTM) is assigned a unique number that is called the Application IDentification (AID). In this respect TPEG-Loc is not an application, but it is an *essential* constituent part of an application.

Location referencing requires a service provider to give an impression or image to the human end-user of where an event has taken place. This cannot be done easily because the human end-user may or may not be familiar with the location. TPEG-Loc has the added challenge of attempting to be as language independent as possible. This is achieved by the use of TPEG-Loc tables (essentially word oriented data object dictionaries).

TPEG-Loc also provides location data in a machine-readable form that allows a "thick" client such as a navigation system to map-match, on-the-fly, to locate the event being described onto a digital map display.

NOTE   Explicit backwards compatibility with the RDS-TMC location referencing method (EN ISO 14819-3) has NOT been attempted, because RDS-TMC locations are finite in number and must be predetermined. TPEG technology does not suffer from this restriction.

2 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/TS 18234-1, *Traffic and Travel Information (TTI) — TTI via Transport Protocol Expert Group (TPEG) data-streams — Part 1: Introduction, Numbering and Versions*

ISO/TS 18234-2, *Traffic and Travel Information (TTI) — TTI via Transport Protocol Expert Group (TPEG) data-streams — Part 2: Syntax, Semantics and Framing Structure (SSF)*

ISO/TS 18234-3, *Traffic and Travel Information (TTI) — TTI via Transport Protocol Expert Group (TPEG) data-streams — Part 3: Service and Network Information (SNI) Application*

ISO/TS 18234-4, *Traffic and Travel Information (TTI) – TTI via Transport Protocol Expert Group (TPEG) data-streams — Part 4: Road Traffic Message (RTM) application*

ISO/TS 18234-5, *Traffic and Travel Information (TTI) — TTI via Transport Protocol Expert Group (TPEG) data-streams — Part 5: Public Transport Information Application*

ISO/IEC 7498-1, *Information technology — Open Systems Interconnection — Basic Reference Model: The Basic Model*

3 Terms and definitions

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

NOTE 1   TPEG-Loc is completely focussed on location references for TPEG applications, which are delivering messages to end-users, so for this key operational reason some definitions have a different meaning from that found in other location reference systems.

NOTE 2   Digital map based systems, either on the message generation side or the client end-user side tend to be based upon road mapping rather than, for example, rail track mapping, therefore throughout this specification there is a tendency to use roads as examples. However roads are not necessarily implied, so the use and context of an element must be clarified and this is declared in the coding in 5.3.1.

3.1
additional location descriptions
all information needed to filter, select and process a location in only text-based systems. Information referenced through hierarchically structured text

3.2
connected point
point where several *intersection points* or *non-linked points*, together, make up one connected location. Also the connected points are listed within it

3.3
framed point
a Framed point may be used to describe a point on a network such as a road network or rail network, where the location is not likely to be well known or is a point without a predefined name. The two points either side are used to frame the location with known points

3.4
height
in TPEG-Loc, height is used to describe a point in the vertical plane, relative to the height descriptor as shown in TPEG Table loc04. Height consists of a numerical value, in metres, and descriptor

3.5
intersection point
Point at the intersection of two roads. The given co-ordinate is accompanied by up to three road descriptors to match it exactly on the map

3.6
large area
an area with a large radius of more than one kilometre. The longitude/latitude co-ordinate pair used, does not need to be matched exactly to a road or other object on the map

3.7
location container
in TPEG-Loc, a location container is a concept applied to the location referencing elements, to show how they are grouped together. The TPEG-Loc container comprises a default language code, a location co-ordinates container and an additional location descriptions container

3.8
location co-ordinates
in TPEG-Loc, the location co-ordinates container includes information needed to identify a location exactly in map-based systems and in many cases also in text-based systems. Information includes WGS 84 co-ordinate pair and descriptive information

3.9
location referencing
method for referencing locations to facilitate the exchange of location related information between different systems

3.10
location type
in TPEG-Loc, a location type describes the structure of location referencing data as defined in TPEG Table loc01

3.11
message
collection of coherent information sent through an information channel. Describes an event or a collection of related events, or status information and includes message management information

3.12
network description
network description describes links in networks. It is an element of the additional location descriptions container

3.13
nodal area
area with a small radius, e.g. less than one kilometre. The given co-ordinate should be accompanied by one or more descriptors to match it exactly on a map

3.14
node description
node description describes single points or complex nodes, which are part of a network. It is an element of the additional location descriptions container

3.15
non-linked point
Point that cannot be matched exactly with the road network on a map. Road descriptors therefore do not accompany the point co-ordinate

3.16
position
position defines where an event has taken place in relation to the road: e.g. driving lane 1, hard shoulder, central reservation, etc. The driving lanes are numbered according to the usual local practice, i.e. driving Lane 1 is the lane nearest to the hard shoulder. In countries which drive on the left, driving lanes are hence numbered from left-to-right, and in countries driving on the right, from right-to-left

NOTE   Position is an event element and NOT a location reference element.

3.17
radius of expansion
in TPEG-Loc, a radius of expansion is described by a circle of a certain radius value around a fixed point

3.18
segment
segment marked by two co-ordinates. The direction of the segment is default from first co-ordinate to second co-ordinate. The direction field can change this. Both co-ordinates are accompanied by up to three road descriptors to match them exactly on the map

3.19
TPEG-Loc definitions
see section 5 for further explanations

3.20
WGS 84 usage
in TPEG-Loc, latitude and longitude are the only two elements used from the WGS 84 specification (see bibliography)

4   Abbreviations

For the purposes of this Technical Specification, the following abbreviations apply.

4.1
BPN
Broadcast, Production and Networks (an EBU document publishing number system)

4.2
B/TPEG
Broadcast/TPEG (the EBU project group name for the specification drafting group)

4.3
CEN
Comité Européen de Normalisation

4.4
EBU
European Broadcasting Union

4.5
IC
Inter City (normally railway and bus routes)

4.6
ILOC
Intersection location

4.7
IPR
Intellectual Property Right(s)

4.8
ISO
International Organization for Standardization

4.9
OSI
Open Systems Interconnection

4.10
PTI
Public Transport Information (see CEN ISO/TS 18234-5)

4.11
RFU
Reserved for Future Use (not necessarily abbreviated)

4.12
RTM
Road Transport Message (see CEN ISO/TS 18234-4)

4.13
TPEG
Transport Protocol Experts Group

4.14
TPEG-ilc
Descriptor formed according to TPEG-Loc rules

4.15
TTI
Traffic and Travel Information

4.16
WGS 84
World Geodetic System 1984

5   Location container

Most TPEG applications are designed to deliver TPEG-messages, which consist of three high level containers, each with one or more elements. These containers are for message management, event information and location referencing information. Note some special application messages do NOT include a TPEG-Loc container, such as a cancellation message. It should also be noted that each container does not necessarily have all possible lower level elements included.

Figure 1 shows the structure likely to be used, for example, when a TPEG-RTM (CEN ISO/TS 18234-4) application message is generated to describe a road event and location references need to be given to the end-user.
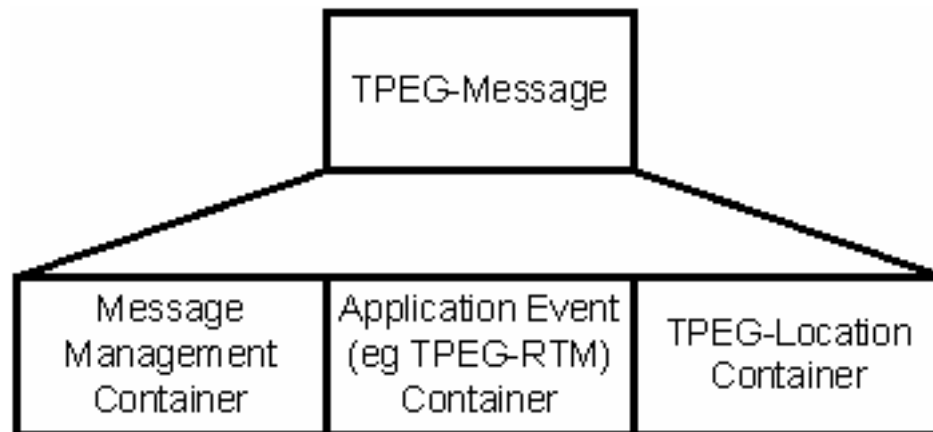

Figure 1 — The TPEG-message container and the three lower level containers

The main purpose of TPEG-Loc is to provide both human understandable and machine-readable elements to any client TPEG decoder. It may be a 'thin' client only able to convey limited location referencing information to the end-user or it may be a 'thick' client using a considerable number of elements and using considerable processing power to filter the information for complex display to an end-user.

The TPEG-Loc concept combines two aspects of location references: both machine-readable and human understandable, are delivered together. Within TPEG-Loc, there is a super-set of the so-called intersection

location, ILOC method[1], which may be used in a terminal client to map match on the fly to an installed digital map regardless of exact compatibility with the digital map being used by a service provider. Additionally, the TPEG-Loc super set of ILOC allows a human readable description to be easily decoded and displayed for an end-user. The rules for this method, within TPEG-Loc, are given in Section 6.

The TPEG-location container shown in Figure 2 provides for extensive location descriptions, which shall be matched by the service provider to local signposts to allow the human user to orient the received information with local visual information.
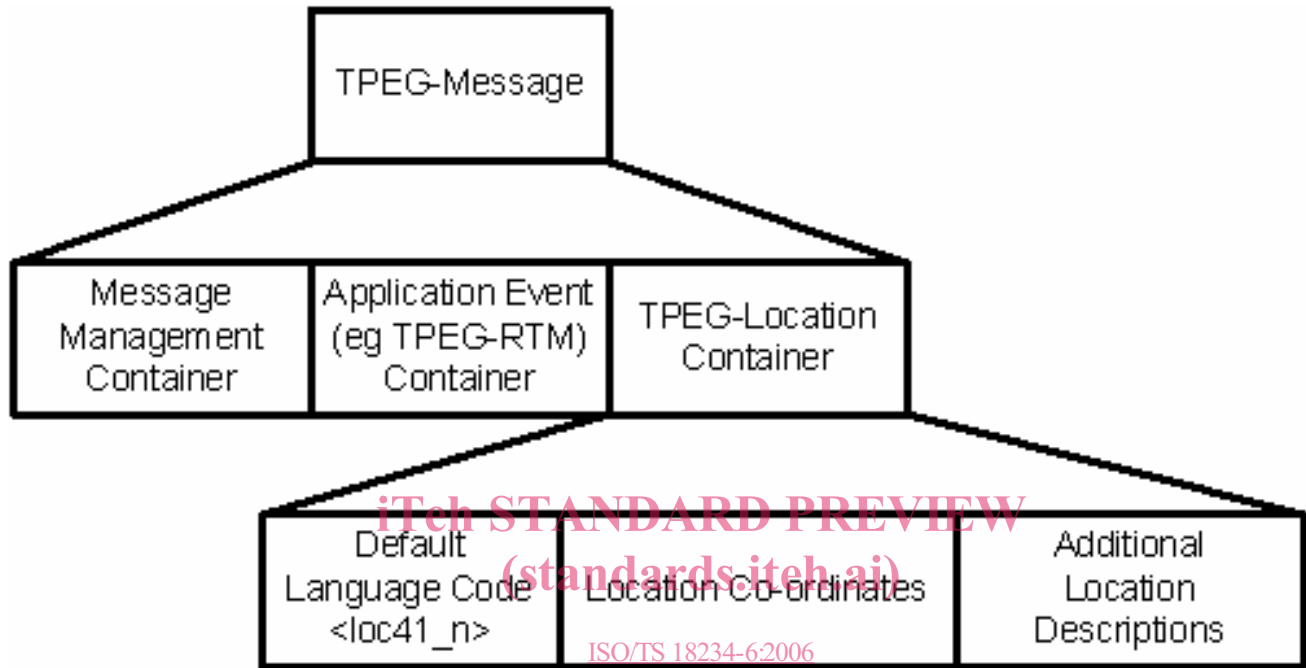

Figure 2 — The TPEG-location container concept

TPEG applications are designed to be language independent, thus a default language code is included within the TPEG-Loc container to determine an overall language for the descriptive elements of the TPEG-Loc information. Further element-related language codes may be used to describe, for example, location names having more than one language description (e.g. Brussels and Bruxelles or Casnewydd and Newport).

It is important to note that the location co-ordinates container mixes location co-ordinates and human readable description elements together to achieve the mix of both machine and human readable aspects. Whereas the additional location descriptions container is designed to facilitate human readable aspects alone, by providing extended descriptions that are essentially designed for human readability.

5.1 Location container concepts

The TPEG-Loc concept is easily described by the use of diagrams in this section, before more technical descriptions are given in later sections.

These diagrams are intended to provide a first appreciation of the structure, before going onto the coding architecture and finally coding detail.

The text in the boxes represents the name of the coding element and corresponds to the coding architecture definition explained in 5.2 and coding detail, which is described in 5.3.

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[1] For further reading: EVIDENCE: Detailed ILOC Location Referencing Rules Specifications Version Nr 1.0, dated 28.06.1999, (also logged as EBU B/TPEG PG 99/102)

Text in the boxes that is written in brackets defines the data type for this coding element:

(code)   the element is coded (language independently) through the use of a TPEG-Loc table

(text) or (string)   the element is a string

(number) or (radius) the element is a (language independent) number with a numeric value

In case of descriptors, the text in brackets gives a hint about the string or descriptor type, e.g. (area name), (TPEG-ilc1), (node name).

All "Descriptors" in TPEG-Loc are composed of a descriptor_type (table loc03), a text string and a language code. *The language code is only used if the string is not written in the default language.* All "descriptors" in TPEG-Loc may be repeated to deliver names of the same place in multiple languages.

EXAMPLE   Brussels and Bruxelles, Casnewydd and Newport.

NOTE   The dotted notation for an element box is used to indicate that an element is optional. The shadow notation is used to indicate that an element may be repeated.

A shadowed element box may be repeated according to the service provider requirements to describe locations in more detail or according to the definitions given by the different concept diagrams.

5.1.1   Location co-ordinates

The location co-ordinates container includes all elements required to describe a location, for both human understandable and machine-readable needs. The elements can be grouped together in a number of ways according to the type of point, segment or area to be described. The most commonly encountered combinations are shown in the following sections.

The location co-ordinates method is used to describe any kind of geo-referenced location information in TPEG. It has a universal structure visualized in Figure 3 and defined in 5.2.2 and 5.3.1.2.

This universal method must be applied dependent upon the various TPEG location types (see Table 1 below) and according to the definitions given in 5.1.1.1 to 5.1.1.7. The concept diagrams are an indispensable part of the location co-ordinates definition, because they specify the permitted *usage, order* and *number* of descriptors for a specific TPEG-Loc table loc01 value. *It is important to note that in TPEG-Loc the elements WGS 84 and Descriptors, are fixed **related-elements** and may not be mixed, regardless of order.* (This element usage differs from the general declarative concept, where the order of transmission is theoretically unimportant.)

Each descriptor usually occurs just once according to the TPEG-Loc table loc01_n diagrams, but can be repeated if the service provider wants to transmit the same name in more than one language. Each descriptor must be labelled with "descriptor type" and the codes specified through the TPEG-Loc table loc01_n diagrams and "table loc03". (The repetition of a specific descriptor type only makes sense if the service provider wants to transmit the same name in different languages, otherwise a repetition would imply a contradiction.)

NOTE   To understand the location co-ordinates definition, the reader must take into account Figure 3, Table 1, 5.2.2, 5.3.1.2, 5.1.1.1 to 5.1.1.7 and Table loc03. There is a close relationship between the coding, the TPEG-Loc table loc01 value, the TPEG-Loc table loc01_n diagrams and Table loc03.

Table 1 shows an extract from the TPEG-Loc table loc01, which acts as an "internal index" to the following concept diagrams covering the needs of location co-ordinates elements.

Table 1 — Index to concept diagrams following this section

Table code	Description
loc01_01	large area
loc01_02	nodal area
loc01_03	segment
loc01_04	RFU
loc01_05	intersection point
loc01_06	framed point
loc01_07	non-linked point
loc01_08	connected point

The overall TPEG-Location Container concept was shown in Figure 1, in 5.1, above. The location co-ordinates container part is expanded out as shown in Figure 3. This figure indicates the complete concept and shows the lower layers of the concept diagram describing elements in terms of the rules established in this section.
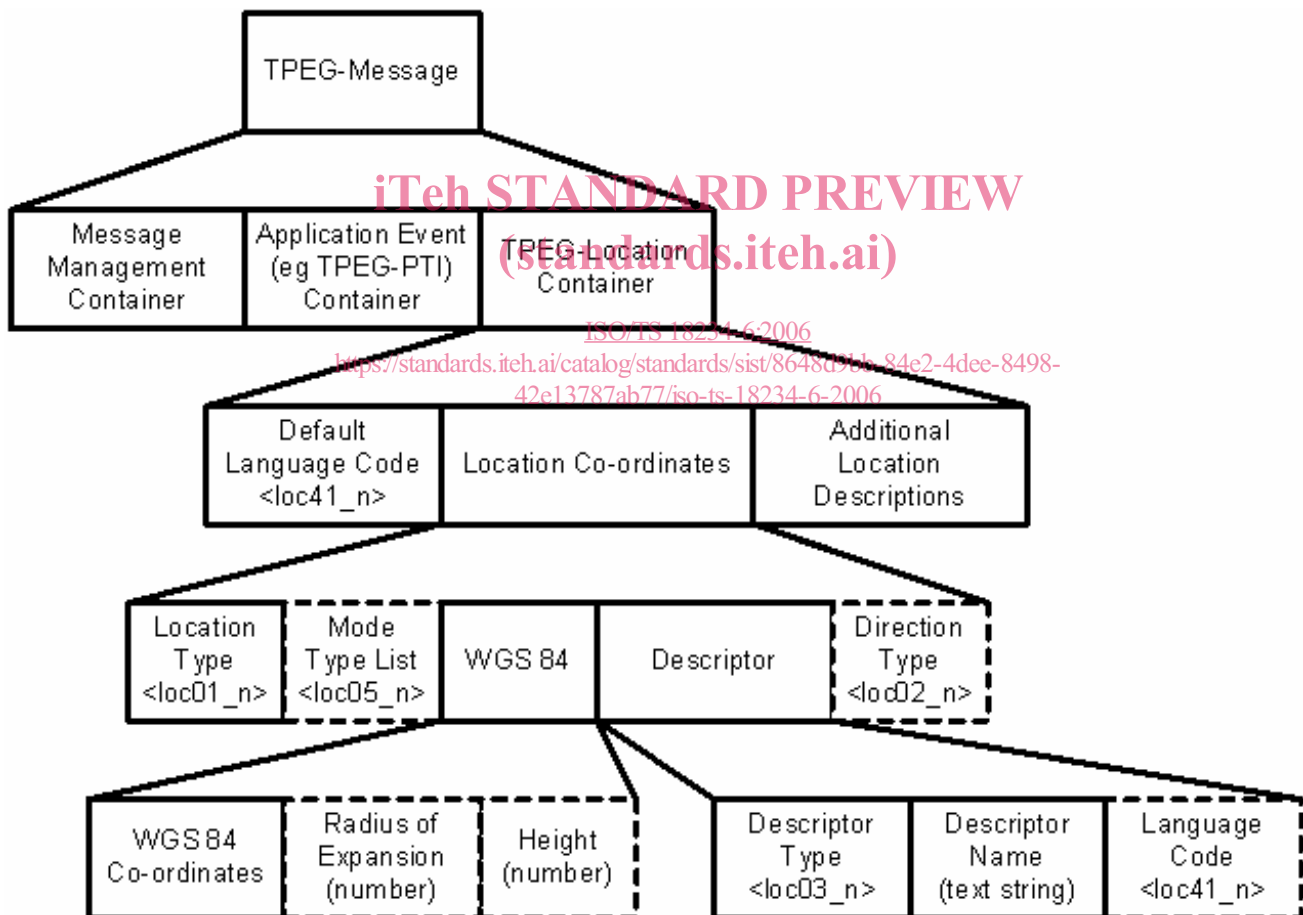
Figure 3 — Location container overall concept

5.1.1.1 Large area

Where type is defined by TPEG Table loc01_1

A large area may be used to describe a location such as a conceptually large area (e.g. the Black Forest) where messages covering the large area need to be conveyed, such as network restrictions due to wide ranging weather conditions. A large area can be defined to describe 'area locations' from a village or town up to counties, countries and large fuzzy regions.

EXAMPLE   The following hierarchy of information may be needed to describe a location such as the Black Forest (based on Bad Rippoldsau-Schapbach):

```
location_co-ordinates
    location_type: large area (loc01_1)
    point
        WGS 84
                longitude: E 8.32826
                latitude: N 48.42844
                radius of expansion: 50 km
        descriptor
                type: area name (loc03_1)
                text: Black Forest
                language
                        language_code: English (loc41_30)
        descriptor
                type: area name (loc03_1)
                text: Schwarzwald
                language
                        language_code: German (loc41_40)
```
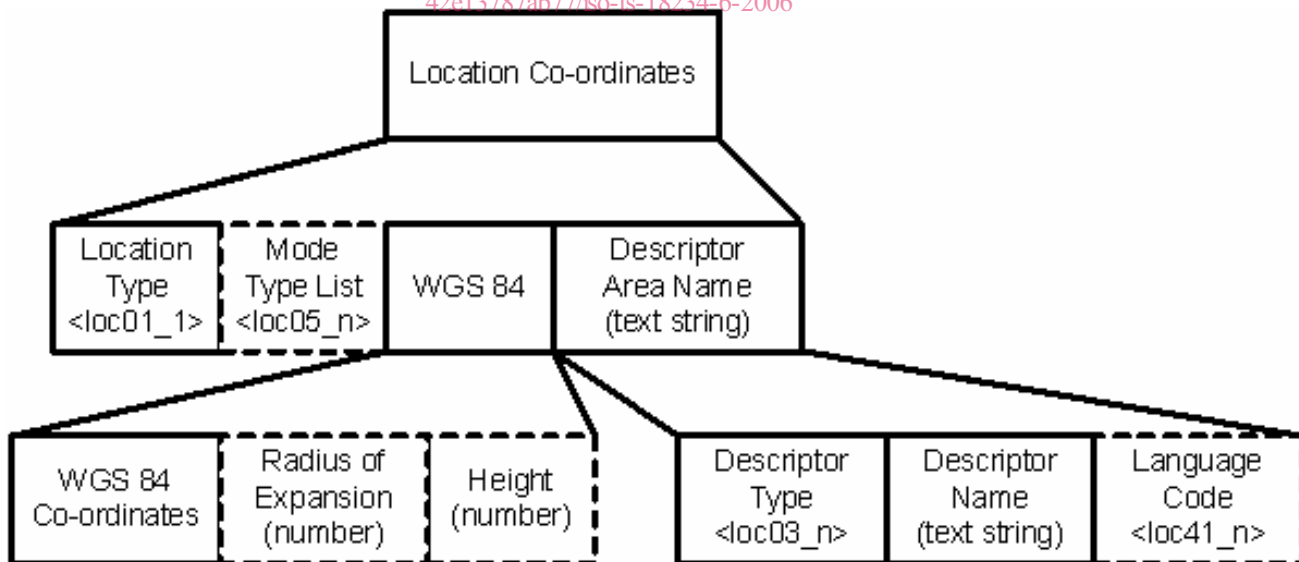

Figure 4 — Location co-ordinates container – Large area elements