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Intelligent transport systems - Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) —

Part 23: Roads and multimodal routes (TPEG2-RMR)

Systèmes intelligents de transport — Informations sur le trafic et le tourisme via le groupe expert du protocole de transport, génération 2 (TPEG2) —

Partie 23: Routes et routes multimodales (TPEG2-RMR)

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Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
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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 204, *Intelligent transport systems*.

A list of all the parts in the ISO 21219 series, can be found on the ISO website.

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Introduction

History

TPEG technology was originally proposed by the European Broadcasting Union (EBU) Broadcast Management Committee, who established the B/TPEG project group in the autumn of 1997 with a brief to develop, as soon as possible, a new protocol for broadcasting traffic and travel-related information in the multimedia environment. TPEG technology, its applications and service features were 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. Originally, a byte-oriented data stream format, which may be carried on almost any digital bearer with an appropriate adaptation layer, was developed. Hierarchically structured TPEG messages from service providers to end-users were designed to transfer information from the service provider database to an end-user's equipment.

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

Subsequently, in March 1999, CEN/TC 278, in conjunction with ISO/TC 204, established a group comprising members of the former EBU B/TPEG and this working group continued development work. Further parts were developed to make the initial set of four parts enabling the implementation of a consistent service. Part 3 (TPEG-SNI, ISO/TS 18234-3) described the Service and Network Information Application used by all service implementations to ensure appropriate referencing from one service source to another.

Part 1 (TPEG-INV, ISO/TS 18234-1) completed the series by describing the other parts and their relationship; it also contained the application IDs used within the other parts. Additionally, Part 5, the Public Transport Information Application (TPEG-PTI, ISO/TS 18234-5), was developed. The so-called TPEG-LOC Location Referencing method, which enabled both map-based TPEG-decoders and non-map-based ones to deliver either map-based Location Referencing or human readable text information, was issued as ISO/TS 18234-6 to be used in association with the other applications parts of the ISO/TS 18234- series to provide Location Referencing.

The ISO/TS 18234- series has become known as TPEG Generation 1.

TPEG Generation 2

When the Traveller Information Services Association (TISA), derived from former forums, was inaugurated in December 2007, TPEG development was taken over by TISA and continued in the TPEG applications working group.

It was about this time that the (then) new Unified Modelling Language (UML) was seen as having major advantages for the development of new TPEG Applications in communities who would not necessarily have binary physical format skills required to extend the original TPEG TS work. It was also realized that the XML format for TPEG described within the ISO/TS 24530- series (now superseded) had a greater significance than previously foreseen, especially in the content-generation segment and that keeping two physical formats in synchronism, in different standards series, would be rather difficult.

As a result, TISA set about the development of a new TPEG structure that would be UML based. This has subsequently become known as TPEG Generation 2.

TPEG2 is embodied in the ISO/TS 21219- series and it comprises many parts that cover introduction, rules, toolkit and application components. TPEG2 is built around UML modelling and has a core of rules that contain the modelling strategy covered in ISO/TS 21219-2, ISO/TS 21219-3, ISO/TS 21219-4 and the conversion to two current physical formats: binary and XML; others could be added in the future. TISA uses an automated tool to convert from the agreed UML model XMI file directly into an MS Word document file, to minimize drafting errors, that forms the Annex for each physical format.

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TPEG2 has a three container conceptual structure: Message Management (ISO/TS 21219-6), Application (several Parts) and Location Referencing (ISO/TS 21219-7[1]). This structure has flexible capability and can accommodate many differing use cases that have been proposed within the TTI sector and wider for hierarchical message content.

TPEG2 also has many Location Referencing options as required by the service provider community, any of which may be delivered by vectoring data included in the Location Referencing container.

The following classification provides a helpful grouping of the different TPEG2 parts according to their intended purpose.

— Toolkit parts: TPEG2-INV (ISO/TS 21219-1), TPEG2-UML (ISO/TS 21219-2), TPEG2-UBCR (ISO/TS 21219-3), TPEG2-UXCR (ISO/TS 21219-4), TPEG2-SFW (ISO/TS 21219-5), TPEG2-MMC (ISO/TS 21219-6), TPEG2-LRC (ISO/TS 21219-7), TPEG2-LTE (ISO/TS 21219-24[2]);

— Special applications: TPEG2-SNI (ISO/TS 21219-9), TPEG2-CAI (ISO/TS 21219-10);

— Location Referencing: TPEG2-ULR (ISO/TS 21219-11[3]), TPEG2-GLR (ISO/TS 21219-21[4]), TPEG2-OLR (ISO/TS 21219-22[5]);

— Applications: TPEG2-PKI (ISO/TS 21219-14), TPEG2-TEC (ISO/TS 21219-15), TPEG2-FPI (ISO/TS 21219-16), TPEG2-TFP (ISO/TS 21219-18), TPEG2-WEA (ISO/TS 21219-19), TPEG2-RMR (ISO/TS 21219-23[6]), TPEG2-EMI (ISO/TS 21219-25[7]).

TPEG2 has been developed to be broadly (but not totally) backward compatible with TPEG1 to assist in transitions from earlier implementations, while not hindering the TPEG2 innovative approach and being able to support many new features, such as dealing with applications having both long-term, unchanging content and highly dynamic content, such as Parking Information.

This document is based on the TISA specification technical/editorial version reference:

SP13010/1.0/001

1) Under development.

2) To be published.

3) Under development.

4) Under development.

5) Under development.

6) To be published.

7) To be published.

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Intelligent transport systems - Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) —

Part 23:
Roads and multimodal routes (TPEG2-RMR)

1 Scope

New mobility services like car sharing, car rental or park and ride as well as the integration of different transport modes by multimodal or off-board navigation are gaining increasing importance. Furthermore, the cooperative management of the transport infrastructure requires the provision of precise information and guidance on dedicated routes from a central knowledge base to a traveller's mobile device.

Such use cases are addressed by the TPEG application defined in this document. The Road and Multimodal Routes (RMR) application enables the service provision for road routes as well as multimodal routes including more than one transport mode and parking. For example, an optimal multimodal route may include a drive by car to a train station with parking facility, a train connection to a station nearby the destination and a local public transport ride from the train station to the traveller's destination.

The standardized delivery, via TPEG technology, of routing information has some potential benefits for the users of an RMR TPEG service, for instance:

— Enabling of specialized routing services like scenic routing or Eco routing;

— The best use of the overall transport network, i.e. not only the road network;

— Cost and time savings to traveller;

— Harmonization of in-car navigation and traffic management, e.g. routing advices by variable message signs;

— Personalized service provisioning, i.e. information services considering the specific characteristics of a user.

Some of the use cases above, in particular personalized service, may require a Peer-to-Peer (P2P) communication while others may apply a broadcast communication approach, e.g. city routing.

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/TS 18234-11:2013, *Intelligent transport systems — Traffic and Travel Information (TTI) via transport protocol experts group, generation 1 (TPEG1) binary data format — Part 11: Location Referencing Container (TPEG1-LRC)*

ISO/TS 21219-1, *Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 1: Introduction, numbering and versions (TPEG2-INV)*

ISO/TS 21219-5, *Intelligent transport systems - Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 5: Service framework (TPEG2-SFW)*

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ISO/TS 21219-7, *Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 7: Location Referencing Container (TPEG2-LRC)*

ISO/TS 21219-9, *Intelligent transport systems — Traffic and travel information (TTI) via transport protocol experts group, generation 2 (TPEG2) — Part 9: Service and network information (TPEG2-SNI)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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
message management container
MMC
concept applied to the grouping of all message elements including Message Management Information of a TPEG-message together in one place

3.2
location referencing
means to provide information that allows a system to accurately identify a location

Note 1 to entry: The content of a location reference allows the location to be presented in a graphical or textual manner to the end-user (e.g. coloured network graphs) as well as to be used for navigational systems purposes.

3.3
location referencing container
concept applied to the grouping of all the location referencing elements, of a TPEG-message, together in one place

4 Abbreviated terms

ACID	Application and Content Identifier
AID	Application Identification
ADC	Application Data Container
GLR	TPEG LR method 'Geo Location Referencing'
CEN	Comité Européen de Normalisation
EBU	European Broadcasting Union
LR	Location Reference
LRC	Location Reference Container
MMC	Message Management Container
MMR	Multimodal Route
P2P	Peer-to-Peer (communication)
PKI	Parking Information application

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RMR	Road and Multimodal Routes application
SFW	TPEG Service Framework: Modelling and Conversion Rules
TISA	Traveller Information Services Association
TPEG	Transport Protocol Expert Group
TTI	Traffic and Traveller Information
UML	Unified Modelling Language

5 Application specific constraints

5.1 Application identification

The word 'application' is used in the TPEG specifications to describe specific subsets of the TPEG structure. An application defines a limited vocabulary for a certain type of message, for example parking information or road traffic information. Each TPEG application is assigned a unique number, called the Application Identification (AID). An AID is defined whenever a new application is developed and these are all listed in ISO/TS 21219-1.

The AID number is used within the TPEG-SNI application ISO/TS 21219-9 to indicate how to process TPEG content and facilitates the routing of information to the appropriate application decoder.

5.2 Version number signalling

Version numbering is used to track the separate versions of an application through its development and deployment. The differences between these versions may have an impact on client devices.

The version numbering principle is defined in ISO/TS 21219-1 (TPEG-INV).

Table 1 shows the current version numbers for signalling RMR within the SNI application ISO/TS 21219-9:

Table 1 — Current version numbers for signalling of RMR

major version number	1
minor version number	0

5.3 Ordered components

TPEG2-RMR requires a fixed order of TPEG components. The order for the RMR message component is shown in Figure 1. The first component shall be the *Message Management Container (MMC).* This shall be the only component if the message is a cancellation message. Otherwise, the MMC component shall be followed by one or more *Application Data Container* (ADC) component(s) which includes the application-specific information.

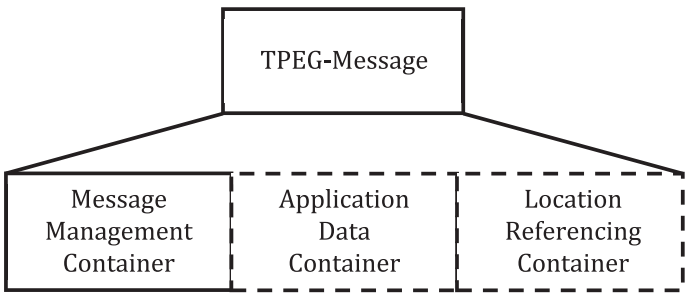

Figure 1 — Composition of TPEG messages

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Note that the definition of the used Location Referencing methods is out-of-scope for the RMR specification and has to be agreed between the service provider and the client supplier.

5.4 Extendibility

The requirement of a fixed component order does not affect the extension of RMR. Future application extensions may insert new components or may replace existing components by new ones without losing backward compatibility. That means a RMR decoder shall be able to detect and skip unknown components.

5.5 TPEG Service Component Frame

RMR makes use of the "Service Component Frame with dataCRC and messageCount" according to specification ISO/TS 21219-5 (TPEG2-SFW).

6 RMR structure

6.1 Message structure

Figure 2 below shows the message structure of RMR. In case of a P2P communication this structure will also be used in the response of the TPEG server.

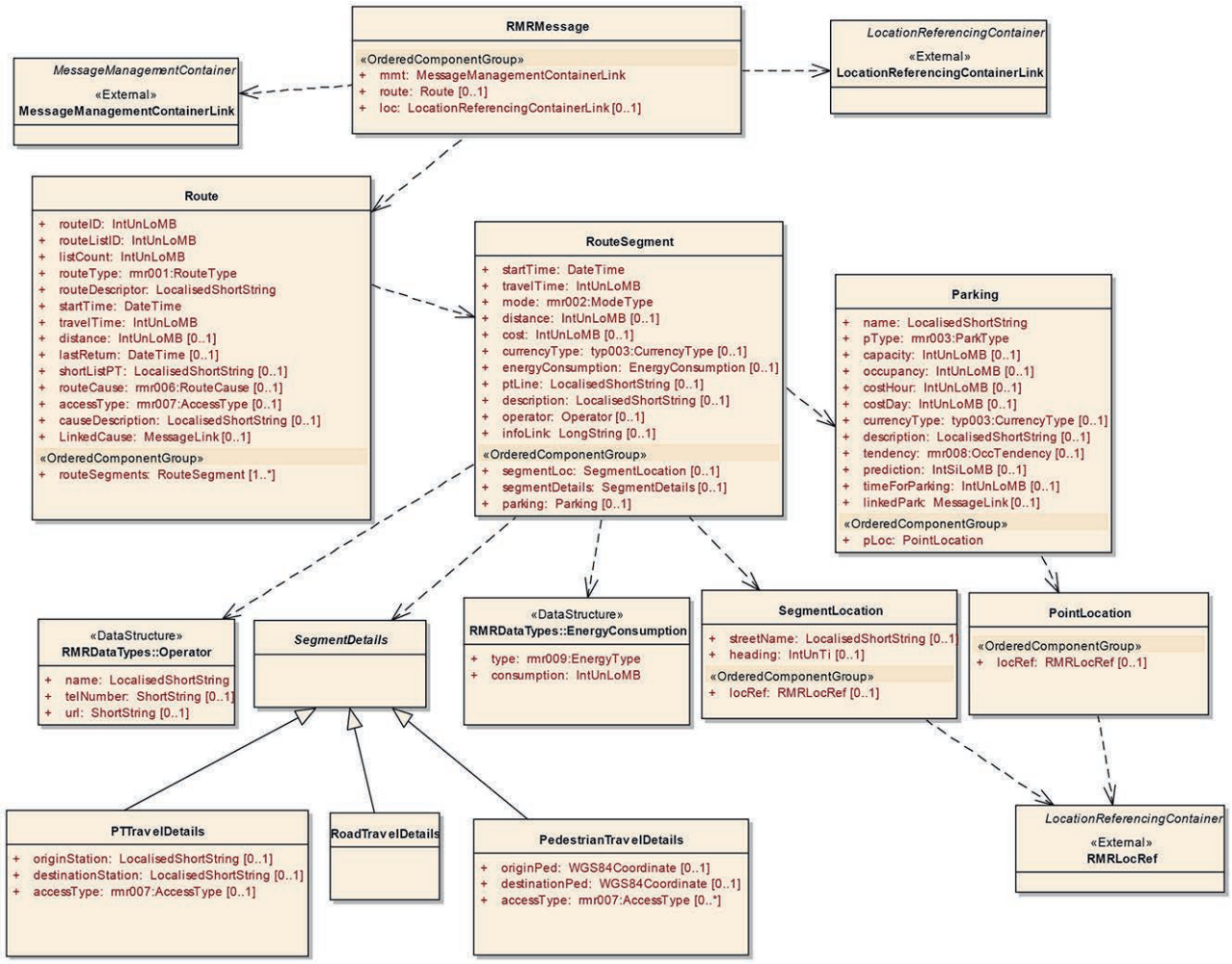

Figure 2 — RMR message structure

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Figure 3 below shows the RMR request message structure. This message type will only be used for P2P communication to request routing information from the TPEG server.

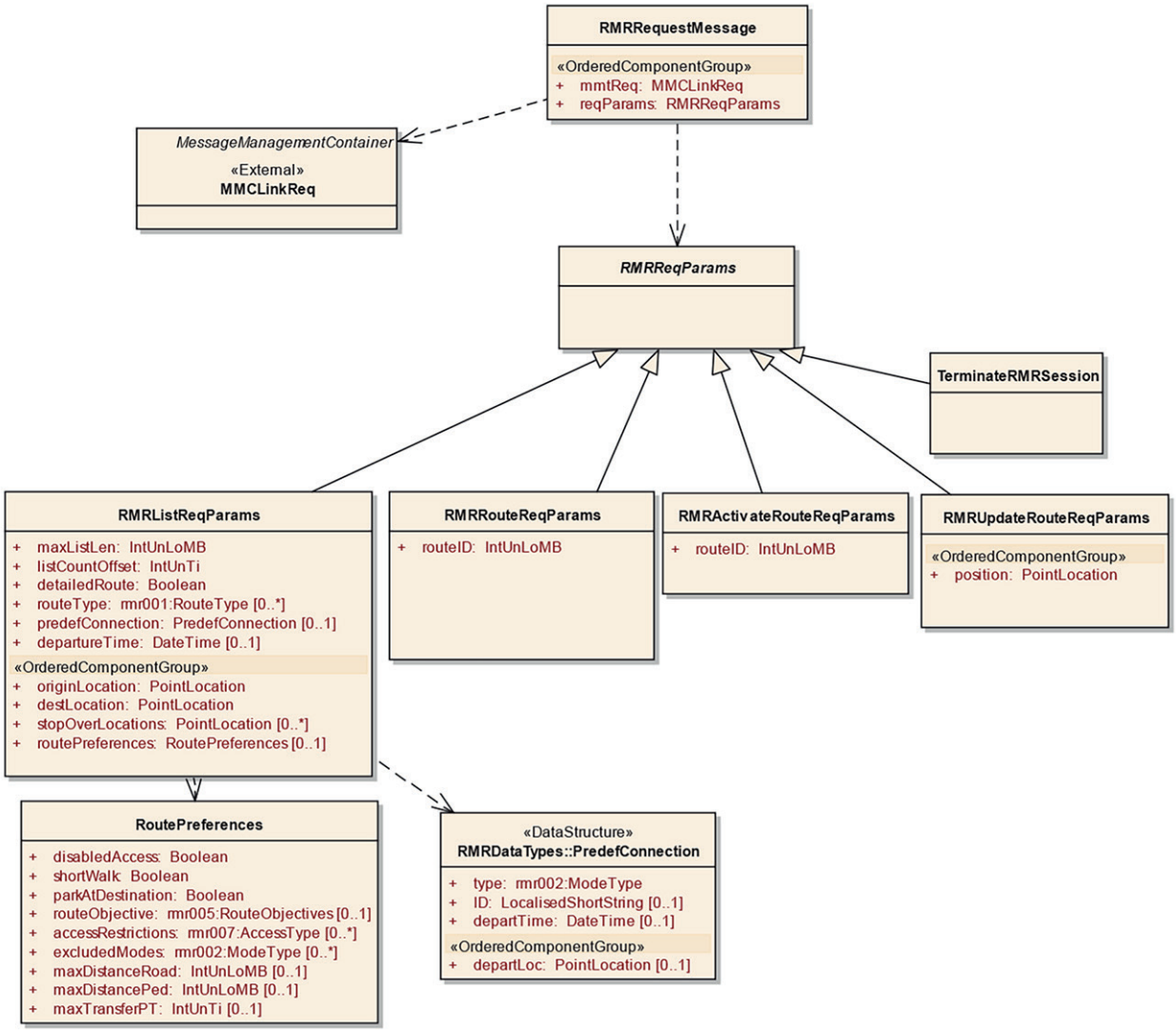

Figure 3 — RMR request message structure

NOTE Figure 4 below shows some examples for RMR.

— The first line describes a route consisting of just one route segment, in this example, travel on a road network;

— The second line shows travel on a road network, ending at a car park and followed by a pedestrian walk to the destination;

— The third line includes additionally a route segment using public transport.

Other combinations of route segments are possible. The RMR service has to take care that the sequence of routes makes sense, e.g. travel by private car is in general only possible for the first part of the travel segment (first route segment).

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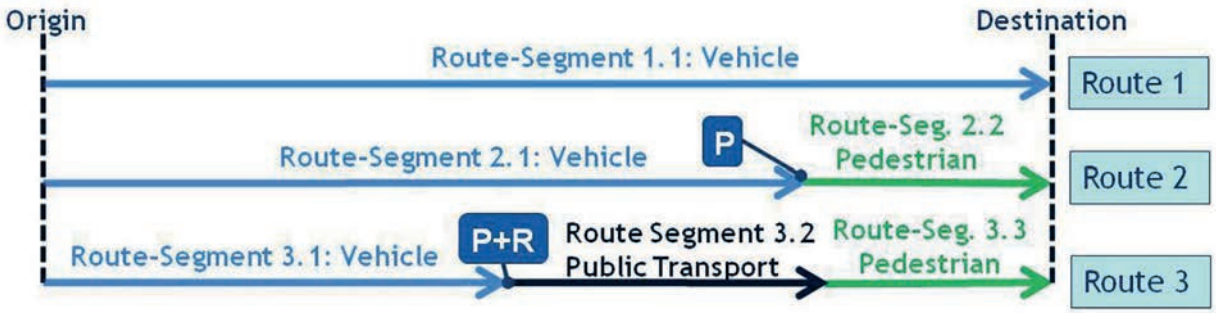

Figure 4 — Examples of RMR

6.2 Scenarios, features and requirements

6.2.1 General

An RMR message (see Figure 2) includes:

— One MMC only in case of a cancellation message;

— Otherwise:

  — one MMC, with a message ID unique for the route transmitted in this message;

  — one ADC with all required information of one route; and

  — optionally one Location Reference Container (LRC) describing the overall location of the route. As the particular route segments contain dedicated LRCs the general LRC on the message top level is of descriptive nature and may be used to provide a graphical representation of the overall route, e.g. by a GLR location reference.

6.2.2 Broadcast scenario

In a broadcast transmission, messages are sent from the TPEG server to a number of TPEG client devices. Thus, only the message structure described in Figure 2 is applicable for this scenario while requests are not possible. In this case, an RMR message shall include all service information required by the client.

6.2.3 P2P scenario

6.2.3.1 P2P transmission without request messages

In this scenario, the client only uses the general request mechanisms as defined in TPEG over HTTP 0 and does not send dedicated request messages on TPEG level (Figure 3). Thus, the same requirements as for the broadcast scenario apply.

6.2.3.2 P2P transmission with request messages

The request by dedicated TPEG RMR request messages enable a number of features, which are particularly important for personalized services:

1. Request for a route list:

   — The RMR client transmits with its request an RMR request message with an 'RMRListReqParams' component included. This component contains a number of parameters that define the user's characteristics and preferences concerning a road or multimodal route.

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— The RMR server stores the request parameters of the client for this session and provides in its response a list of routes that fulfil the user's requirements delivered in the request message. The list enables the user to select a suitable route.

— The route list consists of a number of RMR messages but should provide restricted details. As a minimum requirement the components 'Route' and 'RouteSegment' shall be present in the messages delivered by the RMR server. Each list has a RouteId unique for this service.

— The client may request further route list entries by using the attribute 'maxListLen' and listCountOffset' (see also 7.1.3).

2. Request for detailed route information

— The RMR client may request detailed route information by one or several requests. For that, it transmits the 'RMRRouteReqParams' component with its RMR request message including the RouteId of the route of interest.

— The RMR server responds with an RMR message with the detailed information about the requested route. The RMR server shall use the same message ID as for the related route in the route list.

3. Selection of a route

— The RMR client may select or activate a route of the route list. For that, it transmits an 'RMRActivateRouteReqParams' component with its RMR request message including the RouteId of the selected route.

— The RMR server activates the route and is now able to keep the route up-to-date by sending updates. The RMR client can request this information by additional requests for detailed information (see list item 2 above).

4. Update of the route

— The RMR client may request updates of the information of the selected route information. For that, it transmits the 'RMRUpdateRouteReqParams' component with its RMR request message including its current position. The update may be requested iteratively.

— The RMR server responds with an RMR message with the detailed information about the currently activated route. The RMR server shall use the same message ID as for the related route in the route list.

5. Terminate a session

— The RMR client may actively terminate an RMR session by sending a 'TerminateRMRSession' component with its RMR request message.

— The RMR server may terminate the session and can release the user data transmitted by the route list request (see list item 1 above).

NOTE This document defines only a basic mandatory set of request parameters. An implementation can add vendor-specific attributes to the request components.

Figure 5 below shows a typical sequence of an RMR session.

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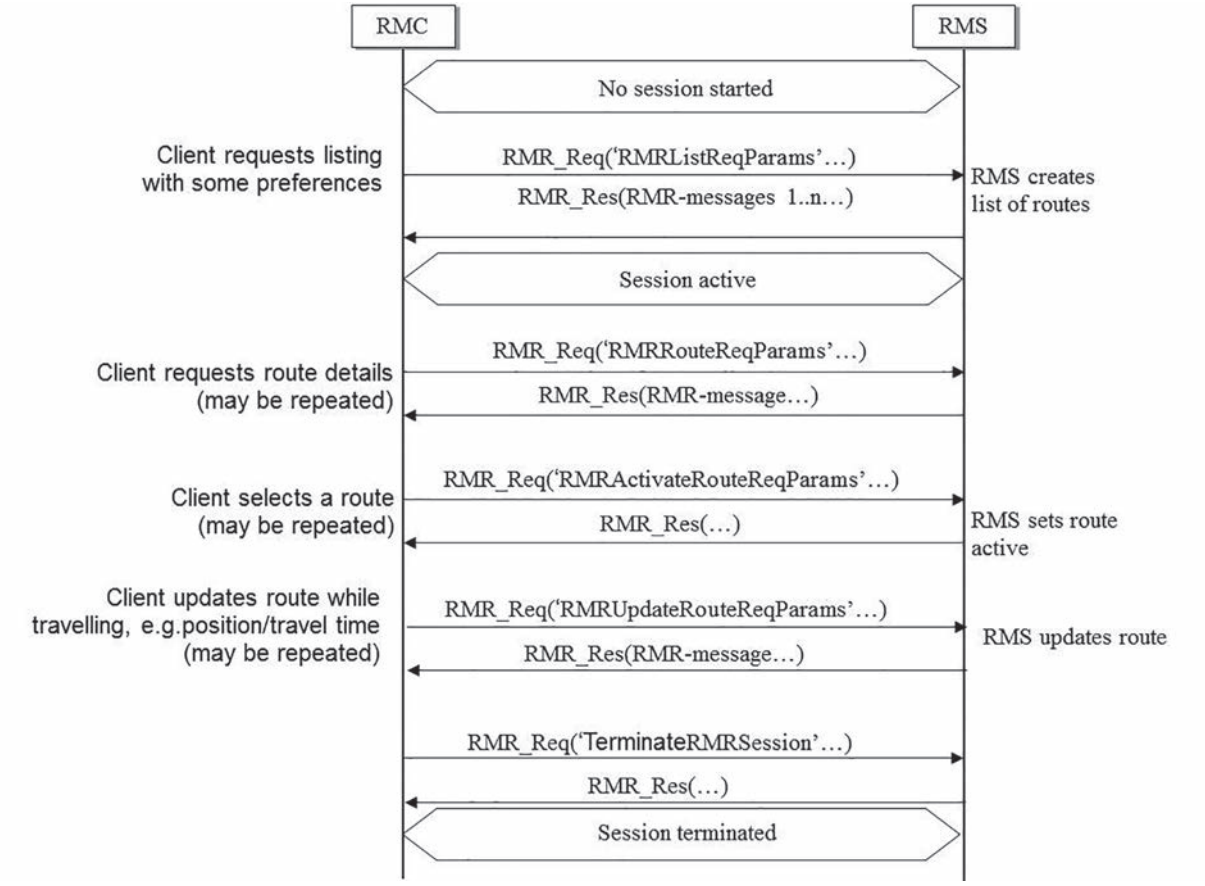

Figure 5 — Typical sequence of an RMR session (RMC/RMS = RMR client/server)

7 RMR Message components

7.1 RMRMessage

The description of the RMR message (see Table 2) contains a road route or a multimodal route.

The RMR message may be sent by an RMR server on request of a client device (P2P communication) or may be sent by broadcast if only a limited number of routes have to be transmitted.

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