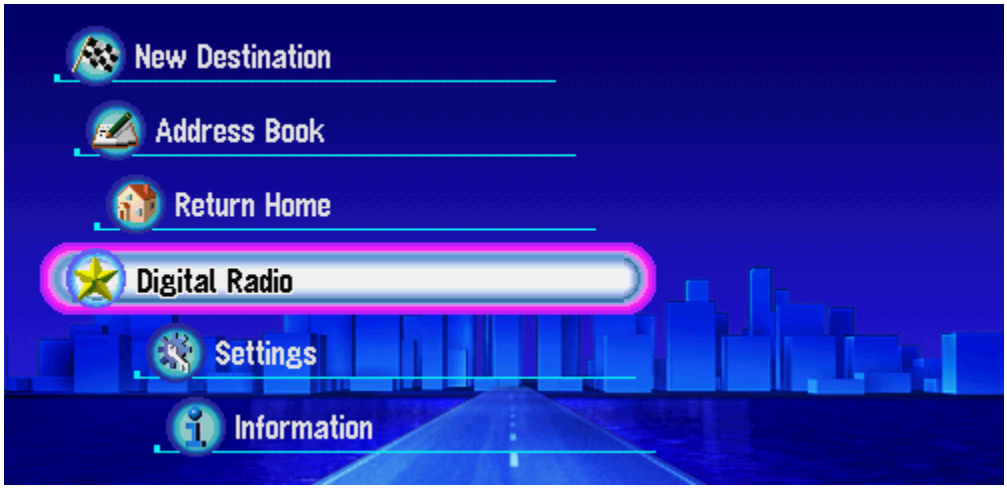
European Broadcasting Union

EBU·UER

TPEG - What is it all about ?



Traffic and Travel Information Broadcasting
Language-independent TTI services for the European Citizen

Information Society Technologies

THE TPEG PROJECT

Contents:

1 A booklet for understanding TPEG quickly!

Introduction

The TPEG Project, which is assisted by funding from the European Commission in their IST programme, has the vital task of disseminating information about TPEG technology. This booklet is the first edition of the Project output designed for newcomers to TPEG technology. We want to introduce the principles of TPEG and provide an "easy read" about TPEG issues, including the present and future applications that form part of the so-called TPEG "toolkit".

TPEG technology was originally motivated by the desire to develop a 21st century multimodal TTI data protocol for delivering content to the end-user. Already it has proved that it can satisfy a wider remit covering content exchange and other applications such as weather information. A common location referencing methodology has been developed to allow any client device to take advantage of the content with no prior installation of a location database.

Language independence has been another prime principle in the design and already the BBCi website carries TPEG content in one of Europe's minority languages: Welsh! Several other languages are also offered by this website. Meanwhile TPEG testing is proceeding at a number of Digital Radio sites throughout Europe, including a demonstration of continuous TTI messages derived from an existing TTI service operation.

TPEG - a strange abbreviation

Nowadays almost everyone has heard of JPEG or MPEG - if one has a digital camera or a digital TV, but few probably know what these abbreviations mean. The "EG" stands for "Experts Group" - the clever people who invent systems and then write the technical standards that are used to ensure that all services and products conform and thus work together. (Incidentally the "JP" and "MP" stand for Joint Picture and Motion Picture, respectively.)

When the EBU experts came together for the first time they were determined to work on systems suitable for broadcasting information to end-users and had a particular focus on Traffic and Travel Information. The idea for TPEG was discussed and it was agreed upon, quite easily, to represent Transport Protocol Experts Group. "Transport" was chosen as a "double entendre"; meaning "Transport" as in the context of traffic and travel, and also meaning "Transport" in the context of moving information (data) from a service provider to an end-user. It was foreseen that TPEG technology would be able to handle information delivery far outside the traditional TTI domain, as well as very effectively within this domain.

So the name TPEG has been retained and these EBU experts were able to have some EG(gs), too!

Development history

In the early days of developing TPEG technology, it was indeed planned to develop applications, which could extend multi-modal information services far beyond anything so far attempted by such technologies as RDS-TMC. As TPEG technology gradually developed, the Road Traffic Message application was joined by the Public Transport Information application and both share a common Location Referencing application.

Today, TPEG technology is already recognised as providing a "tool-kit" for delivering various types of content (with location referencing). Already developments for delivering parking information and congestion and travel time information are underway. In the future it seems quite possible that environmental and weather information will be delivered (transported) using TPEG technology.

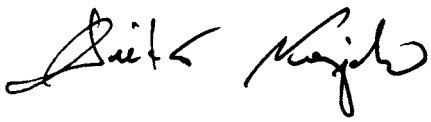
More detailed information

Much more technical information about TPEG technology may be obtained by joining the EBU supported TPEG Forum, which is focused on implementation issues and standards support and development issues.

Like most modern technologies TPEG is littered with many, many abbreviations (!) and they have been collected together in an *Abbreviations and Glossary section* at the end of this booklet. Consult this section to decode any strange terms as you read this book, if we have left any in the text that are not so obvious.

Enjoy the read!

We hope this booklet will give you a good insight into the concepts and principles of TPEG technology and the TPEG "toolkit" that has been built by the excellent co-operation of broadcasters and consumer industry over the last few years.



Dietmar Kopitz
TPEG Project
Technical Co-ordinator

Bev Marks
TPEG Forum
Chairman Standards Task Force

2 Who was involved?

European Commission funding

The TPEG Project obtained EC funding within the 5th Framework programme covering the research and development for new information society technologies. The TPEG Project dealt with the development of language-independent and multi-modal traffic and travel information broadcasting for the European citizen (i.e. covering all forms of transport). The TPEG technology itself started to be developed in a project group of the European Broadcasting Union in 1997. The aim was to develop an open specification, free of IPR, the EBU invited the consumer electronics industry to join the development right from the beginning. The TPEG Project in October 2000 out of this co-operation.

Project Partners

In the TPEG Project three groups of Project Partners were involved. These were:

- Public broadcasters in Germany (SWR and the joint research institute IRT), Sweden (SR) and the United Kingdom (BBC) and last not least, the EBU
- Consumer Electronic Manufacturers: Alpine, Bosch/Blaupunkt, Clarion, Grundig, Panasonic, Pioneer, Siemens-VDO Automotive and Sony
- Other researchers: CETE (France), MVA (UK) and Renault (France)

The Partners have co-operated for three years to define a test environment for TPEG technology, to jointly verify this technology in the areas of service provision and TPEG receiving test implementations.

As a result of the Project activity there was significant feedback to the standardisation process. The Project developed System and Service Guidelines. Results from the TPEG Project development were widely disseminated, especially using the EBU and the TPEG Project web sites.

EBU expertise in the field of broadcasting Traffic and Travel Information

In the domain of Traffic and Travel Information the public broadcaster's remit to deliver services to all European citizens free, at the point of reception, is a key objective. All EBU member broadcasters have realised the importance of delivering TTI services - to provide high quality (accurate and timely information) about multi-modal traffic events, such as: road accidents, roadworks, bus and train operations. With this objective, the expansion of data services has been a critically important technology development area for some years.

EBU involvement in the development and promotion of TPEG

The European Broadcasting Union is an international association that groups together all national network/public service broadcasters in Europe. The EBU has a very well established infrastructure for co-ordinating broadcast service and technology issues within Europe and further afield.

The EBU is the ideal organisation to assume the role of catalyst for the development of new broadcast technologies and services, providing motivation to deploy innovative harmonised technologies throughout Europe. Apart from the necessary R&D work with a new technology, the EBU is positioned to enable a broad ranging consensus on the complex implementation issues associated with new technology introduction.

The standards development process, which had started in 1997 by the EBU is actually still ongoing. During the TPEG Project many ideas were developed and offered to CEN/ISO for standardisation. Now The EBU is supporting the open TPEG Forum to continue development and maintenance of the TPEG technology specifications and promote implementation of TPEG services.

- TPEG - Project activities lasted three years (2000 – 2003)
- Major achievements were an assessment and verification in the areas of
    - TPEG service provision and
    - TPEG receivers
- There was also feedback to the TPEG standards development process
- Implementation guidelines for the use of the TPEG technology and TPEG services were developed
- Standards and research results were widely disseminated

3 Why TPEG?

TTI domain

Traffic and Travel Information content is delivered to end-users by many mechanisms, especially from the public service broadcasters (PSB) who deploy spoken announcements, RDS-TMC, teletext and the internet to deliver such content. But, of course the content has to be collected and edited according to rigorous standards to ensure it is timely and accurate. TTI service provision is therefore all about collection, editing and delivery of information.

To facilitate a good understanding of the processes, we have coined the idea of two segments which are shown in the figure. The *content segment* covers all possible sources of information that must be collected and processed before the *delivery segment* can be deployed to send the information to the end-user.

TPEG has no need for a location database in client devices

PSBs already collect and deliver wide ranging multimodal content but the possibility for data delivery provided by RDS-TMC had significant limitations, which were identified by the PSBs in the EU supported EPISODE Project. Firstly RDS-TMC is essentially limited to inter-urban road events and *every* decoder client must have a location database to interpret *any* message received. This led to a complex situation for all end-users and is still not fully resolved. This is the reason why RDS-TMC remains largely in the domain of navigation systems.

TPEG technology overcomes this limitation by the introduction of TPEG-Loc, which is a method of delivering very rich location referencing information with *every* message, so that client devices do *no*t need a location database. Navigation systems with digital maps can "machine read" the location content and localise an event directly onto the map display. A text only client device (e.g. a PDA) is able to present locally found names such as a railway station name and a platform number, directly to an end-user as a text message.

Multimodal applications

Another draw back of RDS-TMC is that it only fully covers road events in the inter-urban environment, whereas TPEG-RTM has been designed to cover Road Traffic Messages regardless of location. TPEG-RTM is ideally suited to urban information because of the richness of content that it offers. But furthermore TPEG technology is designed to facilitate many more applications covering many other aspects of the TTI domain. Already TPEG-PTI allows a service provider to deliver comprehensive public transport information about airplane, bus, ferry, tram, and train services. It does not attempt to deliver full timetable information, which can be obtained from many other sources already, but it does allow very detailed service/disruption information changes to be delivered to end-users. With the ability to link information it is possible to deliver various alternate routings to a particular destination.

So TPEG technology extends multi-modal information services far beyond anything so far attempted by such technologies as RDS-TMC and puts the delivery of TTI back on track to be a ubiquitous source of information that fits with the PSB remit.

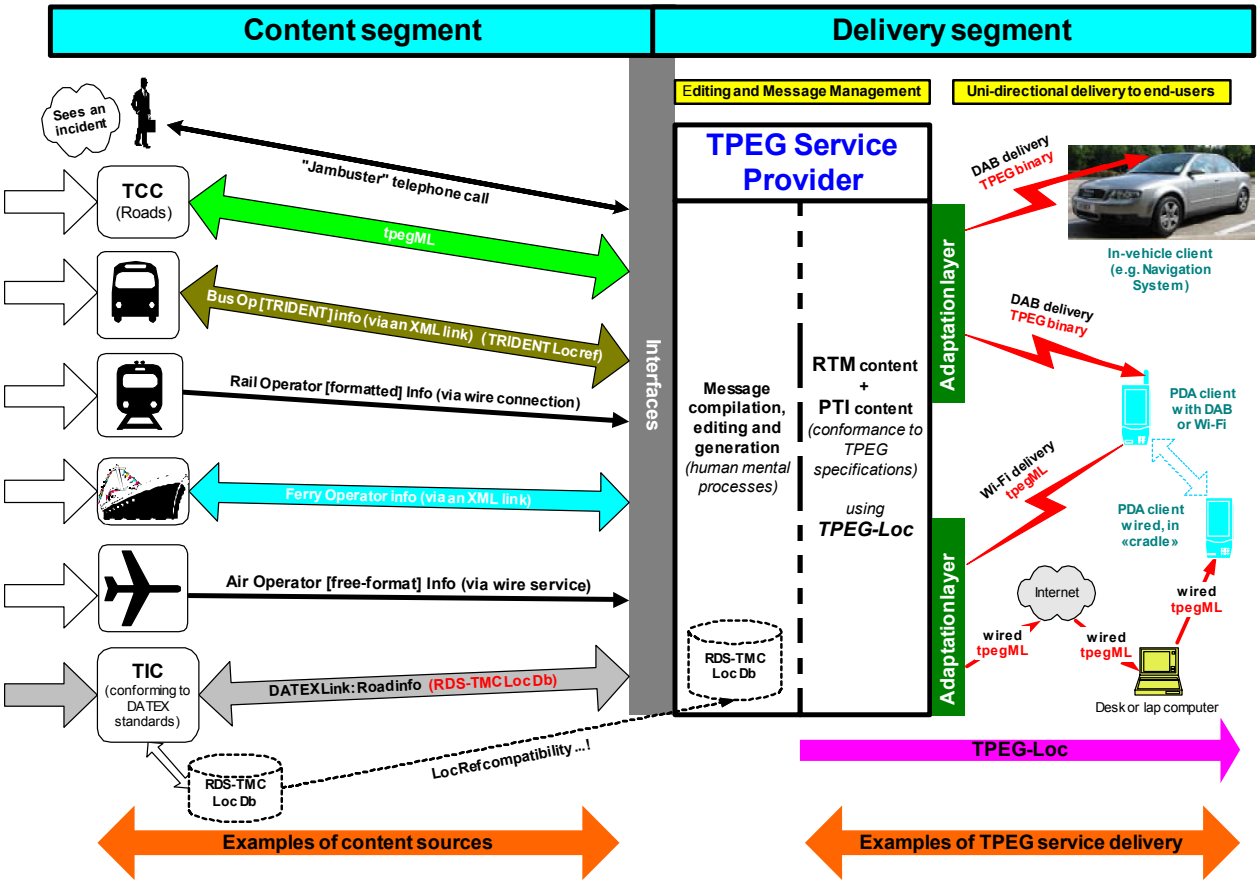
Language independence

RDS-TMC has shown the way for information data delivery serving a mobile end-user who wishes to obtain content when in a locality using a language other than her/his native language. The concept is implemented such that the client device presents information in the language of choice of the end-user. RDS-TMC is limited because it relies upon pre-determined phrases - often not exactly what the service provider would wish to express.

TPEG technology goes a step further by "decomposing" the information into essentially single words, which can be more readily translated into various languages. [ref ?] Then the TPEG message construction concept allows for the available information about an event to be assembled into potentially very rich and informing messages, exactly as the service provider would wish.

Filtering

TPEG technology has been developed in the context of broadcast service delivery, where messages are delivered to many, many client devices. At any point in time only some of the end-users would wish to receive particular information (e.g information about severe traffic jams in a city more than 200 km away is not useful). In essence any one end-user would be deluged with too many messages, so TPEG technology offers various filtering mechanisms as an inherent part of the message structure. Filtering is possible on the event content (i.e accidents may be chosen, but diversion advice may not be chosen), mode of transport and by various aspects of location referencing.



- TPEG domain has two big segments: Collection and Delivery
- TPEG allows services to be free of location database synchronism with clients
- TPEG extends applications to multimodal services
- TPEG offers very rich content with language independence
- TPEG facilitates unprecedented client device filtering options for end-users

4 TPEG - design philosophy

Originally when TPEG technology was planned the design philosophy was centred around the concept of delivering information to the end-user, in such a way that no prior set-up would be required when first accessing a service and that client filtering could be applied to the content to finally only present the information that the end-user required.

The expectation of the designers was that TPEG services would eventually become prolific and that TPEG client devices would be many and varied, ranging from so called "thick clients" such as in-vehicle navigation systems through to "thin clients" such as PDAs with some connectivity, wireless or wired. On this basis an end-user could be expected to want to access services in both his home territory and when out and about travelling, including when a long way from home in a territory with another language in use. Thus TPEG technology has two key demands to satisfy: mobility of access and language independence. With mobile client devices it was clear that any location information given to the end-user has to be both human understandable and machine readable. TPEG satisfies this need with the TPEG-Loc methodology, by delivering both types of content with all messages. This also overcomes another challenge found in the RDS-TMC concept with the need for *every* client device to contain a location database - which must be maintained by both service provider and *all* client devices. By using TPEG technology, it is not mandatory for message interpretation to have any location database in the client device, although it is best to keep up-to-date maps in the client device, in the case of navigation systems using dynamically supplied data from a TPEG service.

TPEG technology easily satisfies the language independence requirement by using table code values across the "on-air" interface[1], to deliver much of the content.

The tables are extensible, with legacy compatibility. Every table contains a so called “default word”, which is a generic word for the content of the table and this allows a client device that does not have the most recent table installed to display the “default word” to convey a slightly more general meaning in the case when it cannot display a word for the actual transmitted code value.

For example it is easy to imagine that there may be a call for extending RTM table rtm08 to include two more coded “words” for <car and horsebox> and <car and boat trailer>. This is easily done and the table default word is still helpful to a client device unable to find in memory such “words” signalled by say code values 8 and 9.

Code	CEN-English ‘Word’	Comments
0	unknown	
1	car and caravan	
2	light goods vehicle and caravan	
3	heavy goods vehicle and caravan	
4	car and trailer	
5	light goods vehicle and trailer	
6	heavy goods vehicle and trailer	
7	bus and trailer	
..	~ end of version 3.0 ~	
255	vehicle and trailer	- the table default word -

TPEG table rtm08: vehicle trailer type, as presently specified

[1] In this context "on-air" interface can be considered appropriate to describe the "service provider to end-user" interface regardless of connection type, which may for example be a wired internet connection or a wireless broadcast connection.

Client device “models”

There are various possible client device “models” which the TPEG tables method permits: those with embedded tables and those without tables. Specific TPEG client devices, (i.e. such as DAB based navigation systems) will be manufactured with the TPEG tables already installed, appropriate to the market in which they are sold. Thus they will be able to display all the words up to their time of manufacture and any extended words used by a service after that time will require the client device to resort to the use of the default word.

In the case of non-specific client devices (i.e. devices not built specially for TPEG services and thus not internally equipped with the TPEG tables) then table downloading (of the appropriate language required) at the time of use is implemented, such as when accessing a web based service, delivering tpegML, and using a standard browser to render the content in a suitable language on an appropriate display. This situation will include any extended words and does not require the use of a default word.

Given that the TPEG specifications define, in effect, the "on-air" interface, the concept also embraces the idea that there will, over time, be many diverse implementations of TPEG client devices, used by end-users. Thus another important philosophy has been to assume scalability of content and client devices to be necessary. Thus a service provider may choose from the TPEG toolkit to implement very highly detailed services or rather lowly detailed services, which respectively will use more and less bandwidth and require more and less complex client devices.

One-to-many delivery channels

TPEG technology has, in essence, been designed for one-to-many delivery channels; nevertheless it broadly conforms to the ISO 7-layer protocol stack, thus giving it good compatibility for many future adaptation layers to be developed as needs arise, such as, possibly, for bi-directional bearers such as GPRS.

- Designed for "thick" and "thin" client devices
- No need for preloaded location database
- Message filtering by end-user
- Scalable message content through extensible TPEG tables
- Adaptation to delivery bearers is simple

5 TPEG – Location Referencing

Common Location referencing method for all applications

TPEG applications will generally require a means of identifying location information with reference to events that take place, for example a road bridge closure or a bus service cancellation. This has led to a single approach to the development of Location Referencing for TPEG applications and the method is called TPEG-Loc - it is a method that is shared for even the diverse requirements of TPEG-RTM and TPEG-PTI.

TPEG-Loc, allows the delivery of very rich location referencing information with *every* message, allowing all types of client devices to localise an event and display the localisation as appropriate to the client. Every TPEG message comprises three key parts: Message Management, the Application Event and the Location Referencing. The Location referencing itself is partitioned into many components that are grouped into three high level aspects.

Language independent location referencing descriptions

A key concept for TPEG-Loc is to describe locations as nearly as possible as a traveller would see on signs as he travelled about.

This inevitably means that a language independent approach has to be taken for the end-user and in bi-lingual cities such as Bruxelles/Brussel and Newport/Casnewydd, where there may be service providers targeting their services at a particular demographic/linguistic community. Thus TPEG-Loc makes it possible to indicate a default language code for all the location text string descriptions and individual strings may also be indicated, where for example two road names are being described in two different languages (e.g. rue Berkmans and Berkmanstraat).

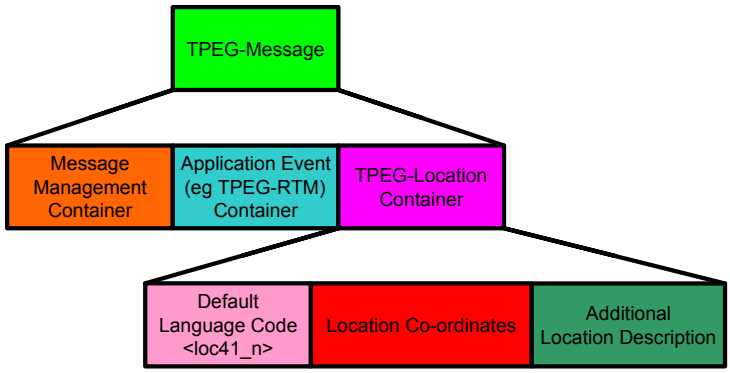
Location Co-ordinates

The TPEG-Loc Location Co-ordinates provides the opportunity to describe locations in a number of different ways, each with specific purposes. These are defined by a table known as the location_type table, which presently defines seven types: *large area, nodal area, segment, intersection point, framed point, non-linked point* and *connected point* location types. A more detailed examination of the *nodal area* shows the individual elements that may be included. Some of these are clearly machine readable, some are clearly human readable, thus meeting another TPEG technology requirement to be useable by all kinds of client devices for end-users.

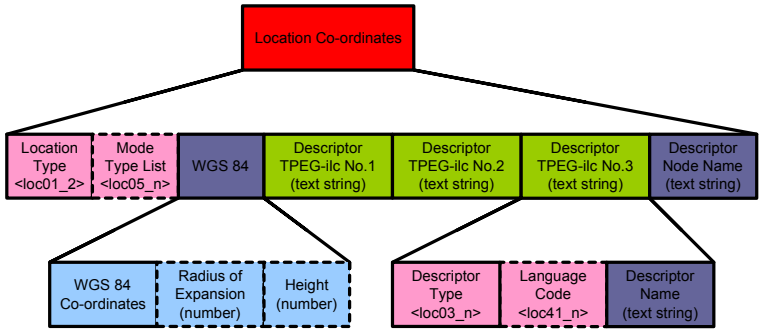
Additional Location Description

The TPEG-Loc Additional Location Description also provides the service provider with further important tools, that are very useful in certain client devices.

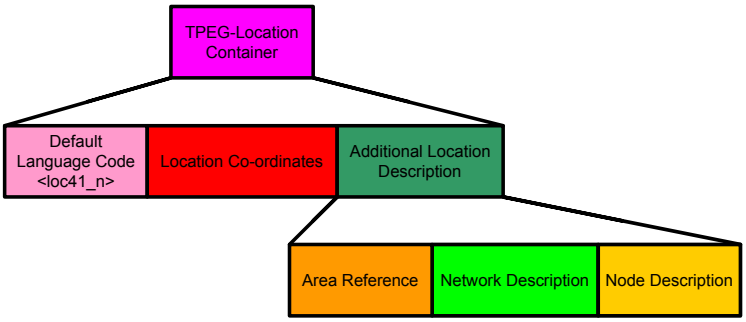
The *Area Reference* is a potentially powerful tool which allows locations to be related in a tree structure to one another, so that client device filtering of messages with narrowly defined locations only are presented to the end-user. The *Network Description* is another useful filtering tool - an end-user can limit displayed messages to just those of, say, a tram network. The *Node Description* allows a service provider to describe many aspects of a node, such as an airport, where many floor levels and entrances and exits need to be explained.



The TPEG-Loc container - related to overall message structure



Location Co-ordinates - the elements of a Nodal Area (i.e. radius < 5km)



Additional Location elements: Area reference, Network and Node descriptions

- TPEG-Loc provides filtering of content to be displayed
- TPEG-Loc provides language independence and language specific descriptions

6 End-user friendly location concepts

Introduction

TPEG-Loc is built on the principle that location references are generated when needed and not taken from predefined location information stored in a database. This means that service providers require a digital map covering their TTI service area. Most service providers presently use predefined locations, like those needed for RDS-TMC, so they have not yet implemented digital maps within their TTI message generation system.

Swedish Radio (SR) uses a custom developed system to handle information about events and disturbances, mainly traffic information. Since much of the information is located outside any predefined locations, a digital vector map was integrated in the message generation system called oJJe.

The availability of this map made it possible for SR to develop a map tool, which can generate locations, on the fly, according to the structured requirements of TPEG-Loc.

Swedish Radio - **map tool for generating location references**

At the moment, the map tool can generate the following location types:

- ***Intersection Point*** - giving the co-ordinates and presenting the road numbers of up to three roads at the intersection according to the tpeg-ilc structure and the name of the municipality where the intersection is situated. It is also possible to add a node description where the direction and distance to the nearest city or town is given as reference object.
- ***Nodal area*** - which at the moment is generated in the same way as *Intersection Point,* but without the possibility for a Node Description.
- ***Segment*** - which consists of two Intersection Points.
- ***Large Area*** - which at the moment just gives the county name of the marked area.

All locations except *Large Area* also contain an automatically generated ***Area Reference*** on three levels, i.e. ***Region, County and Municipality***.

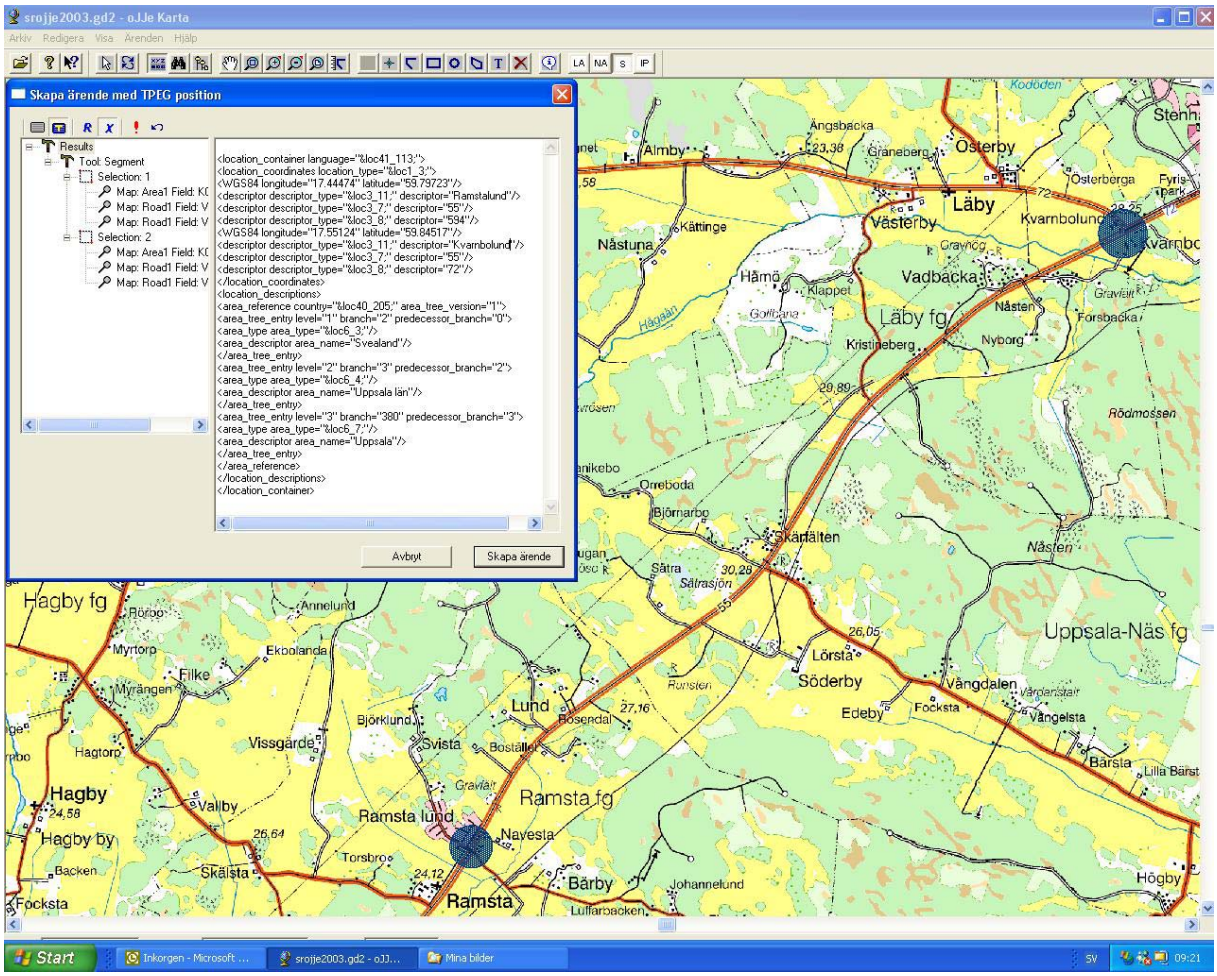
To generate a location reference, the cursor of the pointing device is placed on the exact point of the position and the left hand button on the mouse is then pressed. The co-ordinate for the point is then automatically generated. By moving the cursor with the left-hand button pressed, the cursor is moved until the generated circle covers the chosen area.

The digital vector map used is built from a multitude of map layers, where each layer contains different kinds of information. The lower layers generate contours of the country, lakes etc. By choosing adequate map layers, the area covered by the circle will filter out relevant information for that point, for example ***Road numbers, Street names, Community names etc***.

It is possible to choose, which map layers (e.g. national roads, city streets etc.) are to be used for each type of location and there are possibilities to define and edit specific map layers to obtain relevant information automatically. Even the type of location such as different ***Road objects*** *(roundabout, bridge, fuel station, etc)*, ***Buildings*** *(church, hotel, town hall, etc)*, and ***Geographical sites*** *(airport area, harbour, marina, fair ground, etc)* can be utilized by referring to TPEG table entries in the actual map layer. All these entries, of course, generate language independent terms that can then be presented to the end-user in the language of his/her choice, provided their client device implements this functionality.

The output from the map tool produces the actual location in tpeg-locML format.

The following figure shows the map picture and the resulting tpeg-locML code for a ***Segment location*** type:



*The **Segment** tpeg-locML information that is generated by the map tool, is shown in the box: From the intersection of road 55 and 594, Ranstalund, to the intersection 55 and 72, Kvarnbolund, on road 55, in the municipality of Uppsala, in the county of Uppsala, in the region of Svealand, in Sweden – all that is normally needed by an end-user, is included.*

- TPEG-Loc referencing supports strong filtering capability
- Area Referencing information is a key to searching for what is required
- The end-user does not need map data in their (receiving) client device
- The internet already offers map referencing services that may be used to access a map of the location being referenced

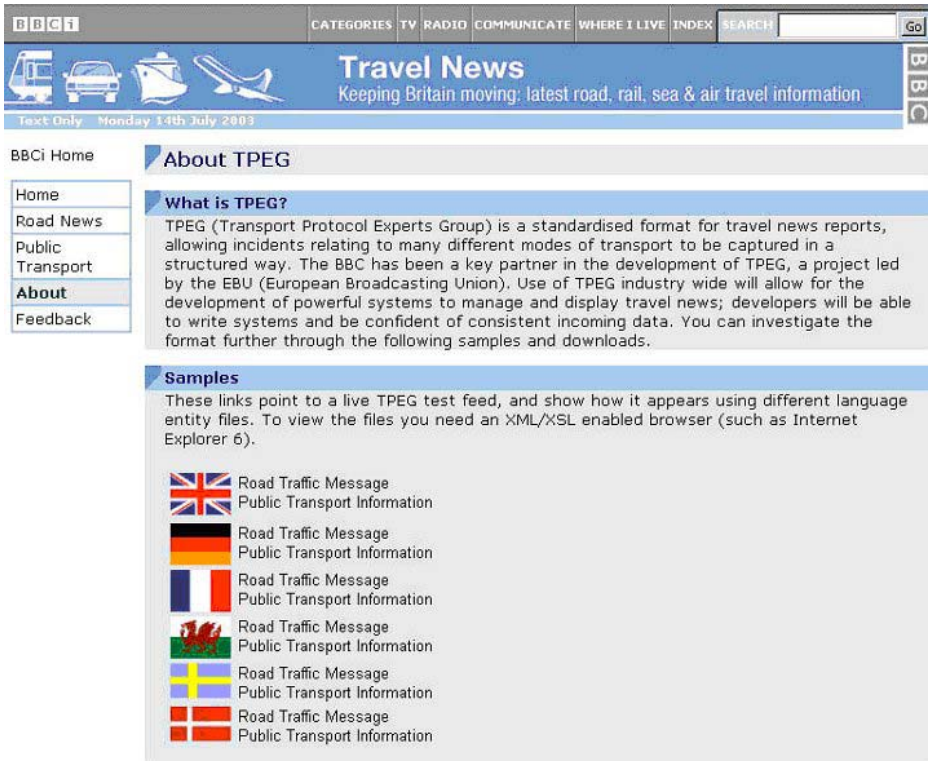
7 TPEG - via the internet

The BBCi trial implementation

In the UK, the BBC has been running a trial TPEG service on the internet for more than a year:

www.bbc.co.uk/travelnews/xml

Two TPEG applications are implemented using the XML versions of the TPEG specifications, tpeg-rtmML and tpeg-ptiML. TPEG-RTM (binary) is also distributed simultaneously over a BBC Digital Radio multiplex. The BBCi Travel News portal allows an end-user to select either the Road Traffic or Public Transport database of information, for display in one of a number of languages.



Reasons for doing this:

- Delivery of tpegML formatted data is very easy
- The tpegML data is *also* the source of the binary TPEG service
- Thus a single generation leads to both services
- Both tpegML and binary TPEG are language independent

An end-user simply "clicks" on the chosen language service and the "raw tpegML data" as shown in the box below is delivered to the client browser, *together* with the correct language entity file. The browser then renders the XML data into the display as seen in the two examples below, which show the same message in both English and Welsh.

Standard PDAs with an XML enabled internet browser, like the Compaq IPAQ, can be easily used to display the tpegML messages

```
<?xml version='1.0' encoding='ISO-8859-1'?>
<?xml-stylesheet type='text/xsl' href='rtm_nt_a.xsl'?>
<!DOCTYPE tpeg_document PUBLIC '-//EBU/tpegML/EN' 'tpegML.dtd'>
<tpeg_document generation_time='2003-07-14T10:00:1+1'>

<tpeg_message>
<originator country='UK' originator_name='BBC Travel'/>
<summary xml:lang='en'>M4 Berkshire - Closed westbound between J13, Newbury and J14, Hungerford, after a
vehicle overturned. Long delays.</summary>
<road_traffic_message message_id='90267' version_number='1' message_generation_time='2003-07-14T09:36:15+1'
start_time='2003-07-14T09:34:50+1' severity_factor='&rtm31_5;'>
<location_container language="&loc41_30;">
<location_coordinates location_type="&loc1_3;">
<WGS84 latitude="51.4529" longitude="-1.31053"/>
<location_descriptor descriptor_type="&loc3_7;" descriptor="M4;"/>
<location_descriptor descriptor_type="&loc3_8;" descriptor="A34;"/>
<location_descriptor descriptor_type="&loc3_24;" descriptor="Newbury"/>
<location_descriptor descriptor_type="&loc3_32;" descriptor="13"/>
<location_descriptor descriptor_type="&loc3_25;" descriptor="Berkshire"/>
<WGS84 latitude="51.4534" longitude="-1.48208"/>
<location_descriptor descriptor_type="&loc3_7;" descriptor="M4;"/>
<location_descriptor descriptor_type="&loc3_8;" descriptor="A338;"/>
<location_descriptor descriptor_type="&loc3_24;" descriptor="Hungerford"/>
<location_descriptor descriptor_type="&loc3_32;" descriptor="14"/>
<location_descriptor descriptor_type="&loc3_25;" descriptor="Berkshire"/>
<direction direction_type="&loc2_9;"/>
</location_coordinates>
</location_container>
<network_conditions>
<restriction restriction="&rtm49_1;"/>
</network_conditions>
</road_traffic_message>
</tpeg_message>
```

BBC Travel News

Road Traffic Messages for the UK

25 messages on: 2003-07-14 at: 10:00:1+1 (+1=BST/+0=GMT)

Please note this is an experimental service only!

Latest traffic news at the top

90267 (1) ; Severity: **very severe**
Start on: 2003-07-14 at: 09:34:50+1 (+1=BST/+0=GMT)

- *Location Type:* route, westbound:

Text Descriptor	WGS84 co-ordinates
road number: M4; *Junction with:* A34; *town name:* Newbury *junction name:* 13 *county name:* Berkshire	Latitude: 51.4529 Longitude: -1.31053 Click here for a map
road number: M4; *Junction with:* A338; *town name:* Hungerford *junction name:* 14 *county name:* Berkshire	Latitude: 51.4534 Longitude: -1.48208 Click here for a map

- Restriction: closed.

BBC Travel News

Negeseuon Trafnidiaeth Ffyrdd i'r D.U.

25 Adroddiadau wedi ei greu ar: 2003-07-14 am: 10:00:1+1 (+1=BST/+0=GMT)

Gwasanaeth arbrofol yw hwn!

Negeseuon diweddara ar y top

90267 (1) ; difrifoldeb: **difrifol iawn**
Dechrau ar: 2003-07-14 am: 09:34:50+1 (+1=BST/+0=GMT)

- *Math leoliad:* rhan, i gyfeiriad y gorllewin:

Disgrifiad Testun	WGS84 cydgysylltiedig
tpeg-ilc enw 1: M4; *tpeg-ilc enw 2:* A34; *enw tref:* Newbury *enw cyffordd:* 13 *enw sir:* Berkshire	Lledred: 51.4529 Hydred: -1.31053 Cliciwch yma i weld map
tpeg-ilc enw 1: M4; *tpeg-ilc enw 2:* A338; *enw tref:* Hungerford *enw cyffordd:* 14 *enw sir:* Berkshire	Lledred: 51.4534 Hydred: -1.48208 Cliciwch yma i weld map

- Cyfyngiad: ar gau:

- tpegML on the internet can be decoded by end-users with any XML enabled browser
- tpegML messages are human understandable and machine readable
- tpegML messages are usable with and without navigation systems

8 TPEG - over the mobile internet

Introduction

The mobile internet as a possible bearer for binary TPEG data is quite different from broadcast bearers. This is due to the fact, that the internet is an interactive medium with communication in both directions. In order to achieve an efficient two-way communication, the internet is built as a hierarchical structure of subnets, where each client may be addressed individually. While broadcasting is certainly the most cost effective data distribution medium, because of the one to many relation between transmitter and receiver, the mobile internet can currently only be efficient, if the data transfers to those clients, requesting the data, are reduced by using an appropriate distribution technique. In broadcast systems, reliable data transmission is realized by redundant transmission where all data is repeated frequently within a data carousel. On the mobile internet this kind of distribution is definitely not efficient at all, since it will produce a lot of redundant information. Reliability in the internet is usually achieved by acknowledgement messages on successful transmissions. Retransmission is used only on request, when the initial transmission fails. In terms of payment, customers will be charged for the amount of data transferred; this is already the case with GSM/GPRS and is also true for UMTS.

A cost comparison for distributing data

Assume for example that we want to distribute 1 Mbyte of data to a relatively small number of end-users (1, 10 or 100), and then let us see, what this will cost using different distribution media.

The assumptions made are:

- **GSM/GPRS or UMTS now costs € 5 or more per Mbyte**
- **DAB network cost is derived from the cost for distributing one audio programme, while using then the PAD mode for data distribution with a capacity of 64 kbps**
- **All costs are pure transmission cost and do not include labour or service charges**
- **All cost figures are expressed in € (EURO)**

	Floppy disk	GSM or UMTS	DAB **64 kbps**
Cost per end-user	1.5	5	1
10 end-users	15	50	1
100 end-users	150	500	1
Cost per end-user / **100 participants**			0.01

This simple cost comparison makes it very evident that broadcasting, as a distribution medium for data, can't easily be beaten in terms of cost effectiveness. It is simply the medium to be used, if we want to reach many mobile end-users. For TTI data services this is of course the case!

To distribute binary TPEG on the mobile internet in an efficient way, the following requirements were identified within the TPEG Project:

1. *Avoid repeated transmissions of the data in a carousel and do not use streaming*
2. *Limit the data transmitted to a geographical area of interest to the end-user*
3. *Distribute data by multicasting, if possible*

The first requirement can be met easily by moving to a file based distribution, which uses the possibility of database updates. It is also quite easy to satisfy the second requirement by providing the data in service components that are related to geographical areas and to signal this fact within TPEG-SNI, which is then mandatory for those applications with a geographic definition. Of course this also requires providing each component in a separate file for download. The third requirement is currently problematic, since the required multicasting solutions are not yet available on current networks. Moving away from multicasting requires both, a lot of additional development and server load. Therefore, it is now proposed to go for a *polling solution* with current networks, and extend this later to multicasting, when the technology becomes available.

Since the internet is interactive, it is possible to send an individual request for all data in the carousel at the client startup (pull mode). After that, only new and updated events and event deletions have to be transmitted to the client (poll mode), at a regular request interval. *The data to be distributed to the mobile end-user can thus be reduced by a factor of about 600, which is very important in terms of distribution cost as far as the individual client is concerned.*

Example

Assuming, a TPEG service with 100 messages, and assuming furthermore that all of these messages are generated during 24 hours, an average rate of approximately 4 new messages per hour will be the result. Taking into account that most of the messages are generated during the peak hours, when people are on the road, a rate of 20 messages per hour could be a reasonable estimate, thus resulting in a new or updated message every 3 minutes. Another issue is the update cycle for the polling mechanism. For the TPEG Project tests (at Sony in Germany) a polling interval of 3 seconds was selected. Given a real world service with 5 service components, the file *versions.txt*, which has to be polled, is approximately 100 bytes long. Including the headers for TCP/IP of approximately 50 bytes, a total of 150 bytes of data had to be downloaded per polling interval. If a driver uses his car 2 times a day for 1 hour, the amount of data to be downloaded is calculated as follows:

	Kbyte
2 times x 10 Kbytes for loading the complete database	20
2 hours x 20 messages x 100 byte per message for update	4
120 min. x 60/3 sec. x 150 byte	360
Total per day	**384**

Without this mechanism developed for mobile internet distribution, the amount of data is calculated as follows:

120 min. x 60/3 sec x 10 Kbytes for loading the database	**24 000**

- Binary TPEG for the mobile internet requires a TPEG decoder in the client
- The technique considered here is certainly of interest in areas not yet covered by digital broadcasts

9 TPEG clients – how they will be used

- Implementing TPEG on existing clients only requires software
- TPEG is designed to support a wide range of clients devices
- TPEG clients devices may have a map databases or not
- The first TPEG enabled clients devices on the market are most likely to be PDAs and navigation systems, simply requiring software updates

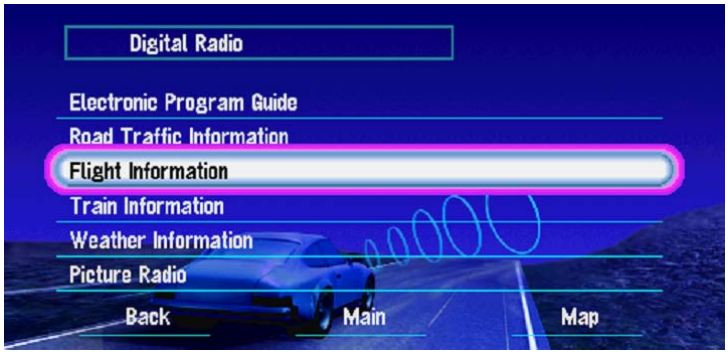
Introduction

TPEG technology is so new there are currently no commercial TPEG receiver products on the market. It would have made no sense to develop commercial products while standardisation and validation is undertaken. Nevertheless, the simplicity of the TPEG data structures should *now* allow very rapid development of consumer products.

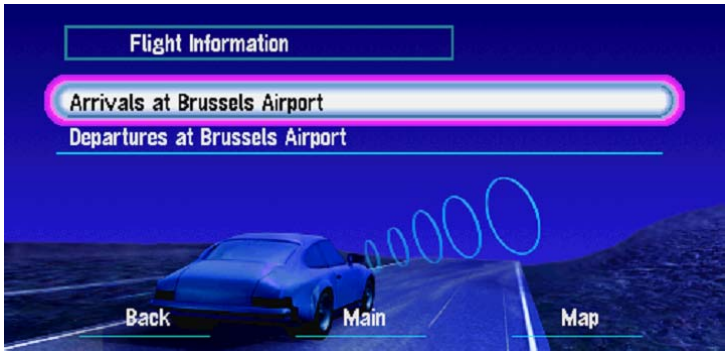
Scenario for using TPEG technology in a Digital Radio supported navigation system

Within the TPEG Project, Pioneer Technology Belgium carried out a feasibility study about the possible integration of TPEG based functionalities, in a Navigation system. The results can be summarized as follows:

The end-user drives from Gent to Brussels airport Zaventem to pick up a friend arriving from Bologna. The road traffic information is delivered via TPEG-RTM and automatically filtered to be of interest for the area of the journey.

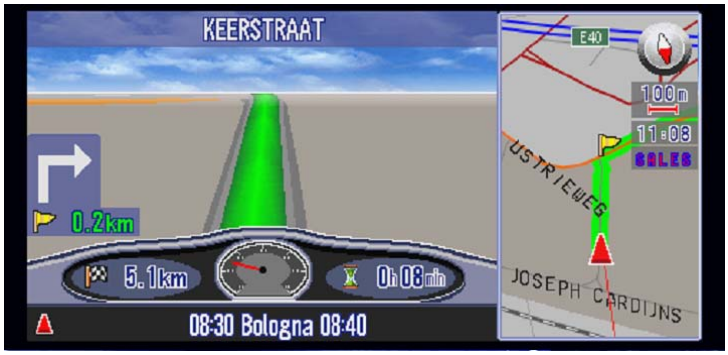


On the approach to the airport, the end user wants to check Flight information *which is delivered via TPEG-PTI.*



Two choices exist.

There are two incoming flights from Bologna. The correct one is the EN/LH flight. It is still on time, but let's monitor it now, while we approach the airport.



Back to road navigation. The flight monitor now shows a 10 minutes delay, which is fine, as we still have 8 minutes to get to the airport. It is very relaxing to drive like that!

A scenario for using TPEG within a PDA receiving TPEG from the internet via GPRS

Sony Corporate Laboratories Europe made case study of the following scenario within the TPEG Project:

The TPEG client decoder (for the applications SNI/RTM/PTI) is just a be a piece of software which can be installed on a PDA. Perhaps it could be made available later to end-users for free. Thus decoded TPEG messages can at best be displayed as overlays using GPS and map software (both of which are common options for PDAs already). Otherwise, the messages can be shown as simple text messages. Multi-language support will be available through the TPEG Tables translations. More work still needs to be done to add enhanced filtering and message presentation. The GSMphone connects with the PDA via Bluetooth. Testing with a real service (if available) will be possible.

10 Future TPEG applications

Introduction

TPEG specification development work is now undertaken within the TPEG Forum, which is co-ordinated by the EBU. The TPEG Forum has two key working groups, which are called task forces. The one that develops the specifications is the Standards Task Force (STF). It is identical with the corresponding CEN and ISO working groups dealing with TPEG standardisation. The other task force is the Implementation Task Force (ITF). It deals with TPEG implementation issues and all Use Cases identified by those who either implement or plan to implement TPEG and who seek requirements not yet fully covered by the TPEG specifications or Guidelines. Thus, either through ISO/CEN work items or requests made by the ITF, the STF deals with the development of new applications.

The following new applications have already been identified and in some cases work has already started on their development.

Parking Information (PKI)

After the successful standardisation process for the multi-modal travel related TPEG applications for Road Traffic Messages (RTM) and Public Transport Information (PTI) a crucial element is still missing, but urgently needed – the information about available spaces for leaving a vehicle when it is not needed. This application is vital for "connecting" both individual road traffic and the public transport systems.

When starting the development of this new TPEG application, the developers could immediately make use of the TPEG "Tool kit" which determines the message structure and offers an immediate solution for message management and location coding. The principle to be followed here is, that these latter two should ideally be identical with the already defined applications.

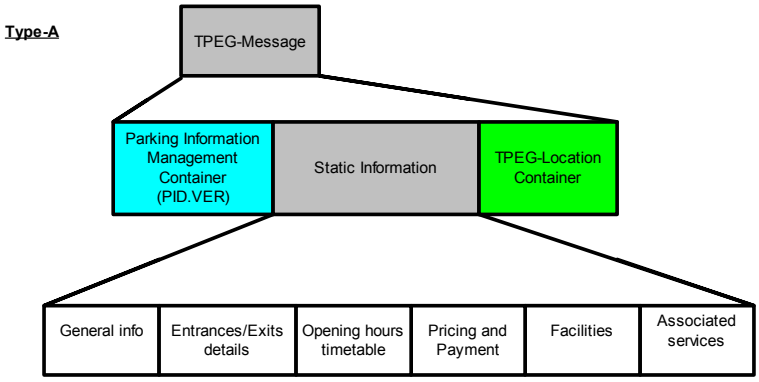
For Parking Information two message types were identified, one that is relatively static (Type A) and which gives information about the parking facility that is of a general nature. The other (Type B) is the dynamic information that in essence gives the number of still available spaces. This information is already often shown in many European cities on VMS panels.

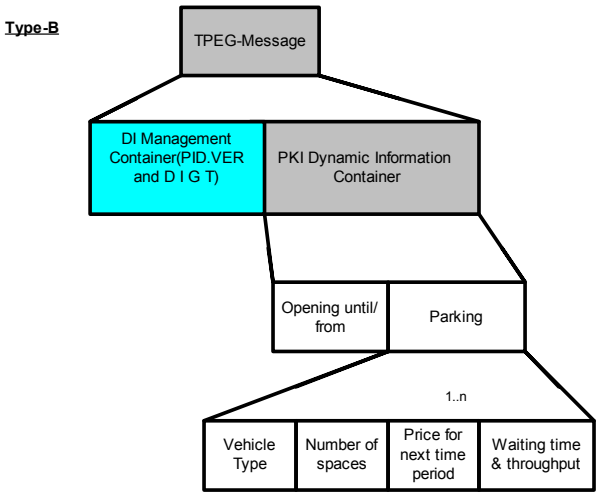
tpeg-pkiML goes however many steps further over such already existing implementations, e.g. the information can be given for each ***vehicle type*** *(car, bus, heavy goods vehicle, etc.).*

To give an example, a realistic scenario for an event participant car driver would be the following: *Where* are the parking facilities related to the *event*? Are there still *empty spaces*? What does it *cost* to park there? Can I *pay* by *credit card* or do I need *cash* and if so, in what *currency*? *How long* is that parking *open*? Is there a *shuttle* that takes me directly to the event? Can I use *public transport* to get to the event? Does my parking ticket give me any *discounts* or even a free ride on the public transport system? Does the parking have public *toilets*? Can *disabled* people use it? Are there any associated *shops, restaurants, fuel station, car wash, hotels, etc.* To identify those facilities, TPEG Tables can be used, which will make all those terms language-independent!

We can imagine a similar scenario for the bus driver. However he will be interested only in empty spaces on parking for buses.

A quite different scenario can be imagined for long distance truck drivers, e.g. crossing the Alps. For certain tunnels, the truck will have to be put on a train, and because of that there can be a *waiting time* of several hours. The *space* on the train will require an *advance booking* to be made, *where and how*? Apart from that, the truck driver has similar questions to those already mentioned. The ***message structure diagram*** below identifies those functionalities that will still need to be developed (the target date for a new technical specification TS/ENV to be output for voting is summer 2004).





Congestion and Travel Time estimation (CTT)

From an end-user point of view, there is already evidence that congestion and travel time information is strongly desired both for city travel and for motorway journeys. Monitoring tools already exit, using data generated by inductive loops, floating vehicle data or even mobile telephone users, to permit such forecasts to be made quite reliably, by using computer modelling. The TPEG Forum now plans to start the development of this application in 2004.

Travel Weather information (TWI)

Major road accidents are known to be caused by rapidly changing local weather conditions, such as rapidly forming fog. In the minds of various experts this creates immediately the “Use Case” for the development of a new TPEG application. So far, the TPEG Forum has not yet found the resources required to develop several important new applications simultaneously. Therefore, work on this application is only expected to be undertaken in late 2004/early 2005.

Environment Information Alerts (EIA)

The UK National Environment Agency has already drafted an outline tpeg-eiaML specification, using tpeg-locML unaltered, to facilitate their need to convey environmental details, such as localized flooding to many end-users. Validation on the European scale is now planned as an upcoming new European Project.

11 Abbreviations and Glossary

Abbreviations

Abbreviation	Explanation
BBC	British Broadcasting Corporation - UK broadcaster
BBCi	The BBC internet service
CEN	Comité Européen de Normalisation
DAB	Digital Audio Broadcasting (also known as Digital Radio)
DATEX	Data Exchange - protocol for exchanging traffic management information
EBU	European Broadcasting Union
EC	European Commission
IPR	Intellectual Property Rights
IRT	Institut für Rundfunktecnik - Austrian, German, Swiss broadcasting Research and Development institute
ISO	International Standards Organisation
IST	Information Society Technologies – a wide ranging European Union programme
GPRS	General Packet Radio Services
JPEG	Joint Picture Expert Group
Loc Db	Location Database - as used in RDS-TMC to pre-define locations
MPEG	Motion Picture Expert group
PAD mode	Programme Associated Data – a DAB / Digital Radio data delivery mode
PDA	Personal Digital Assistant
PSB	Public Service Broadcaster
RDS	Radio Data System
RDS-TMC	RDS-Traffic Message Channel - a feature of RDS
Rx	Receiver
SR	Swedish Radio - Swedish broadcaster
SWR	SüdWestRundfunk - German broadcaster
TIC	Traffic Information Centre
TCC	Traffic Control Centre
TCP/IP	Transmission Control Protocol / Internet Protocol
TPEG	Transport Protocol Experts Group
TPEG Forum	The EBU supported TPEG Forum
TPEG-Loc	Location referencing - a TPEG Binary application
tpeg-locML	Location referencing - a TPEG XML application
tpegML	TPEG XML highest level application
TPEG-PTI	Public Transport Information - a TPEG application
tpeg-ptiML	Public Transport Information - a TPEG XML application
TPEG-RTM	Road Traffic Message - a TPEG Binary application
tpeg-rtmML	Road Traffic Message - a TPEG XML application
TPEG-SNI	Service and Network Information - a TPEG Binary application
TS	Technical Specification - a CEN standard - voluntary status
TTI	Traffic and Travel Information
UMTS	Universal Mobile Telecommunications Service
Wi-Fi	Wireless Fidelity - the popular term for IEEE 802.11b wireless connections, operating in the 2.4 GHz range, at data speeds up to 11 megabits/s
XML	Extensible Mark-up Language

Glossary

Concept	Explanation
Content segment	This term is used to describe the TTI content collection and collation activity.
Delivery segment	This term is used to describe the delivery of TTI to the end-user and includes editing content to be comprehensible to the end-user as well as considering the many delivery media options.
TTI Domain	This term is used to describe the whole Traffic and Travel Information activity, including content collection, editing and delivery to the end-user.
Client device	This term is used to cover all possible types of TPEG reception and decoding situations (e.g. a “car radio with included TPEG decoder” or a PDA with attached DAB receiver running TPEG decoding software)
Broadcast service delivery	This term is used to allow consideration of both wireless and internet delivery of TPEG services.
Thick client	This term is used to describe a TPEG client device which has considerable processing power, memory and display capability, such as an in-vehicle navigation system.
Thin client	This term is used to describe a TPEG client device which has limited processing power such a small purpose specific product with simple text only display of application messages.
Mobile internet	This term is used to describe the techniques of delivering TPEG Binary files via the internet to client devices.

THE TPEG PROJECT

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