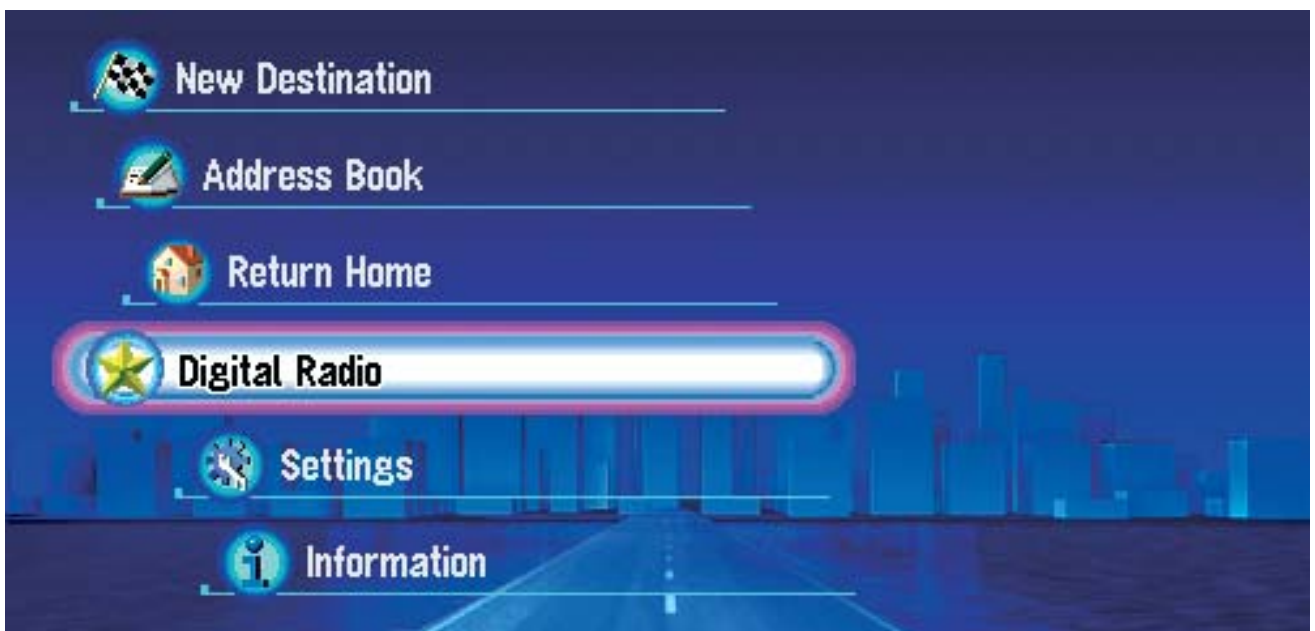


TPEG

Final Project Report (2000 – 2003)



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



ACKNOWLEDGEMENT

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DISCLAIMER

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The TPEG Project

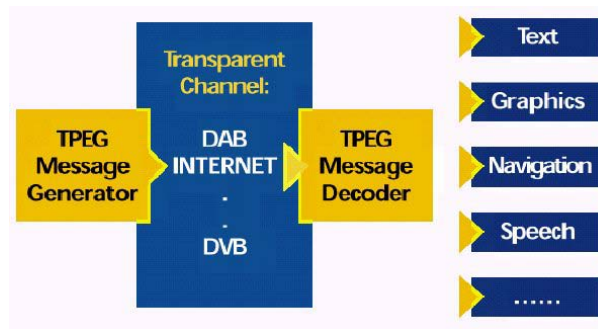
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Original research objectives

What is TPEG

TPEG is an abbreviation for **T**ransport **P**rotocol **E**xperts **G**roup. This Group developed within the EBU (European Broadcasting Union in Geneva, Switzerland) since 1997 a new ISO/CEN standard for the transmission of traffic and travel information within digital broadcast systems such as DAB, DVB and the Internet.



The coding of TPEG is independent of the bearer system and builds in a certain sense on experience gained with the development of RDS-TMC for FM broadcasting, however without the known limitations of that system and specifically without the need to use location code numbers within the road network.

The development of the TPEG specifications involved more than 60 organisations and companies on the European scale. 16 (among them 5 non-funded ones) of them from seven countries committed to be involved in the TPEG Project that was carried out in the years 2000-2003.

The main goals

The major objective of this project was to test and validate the TPEG data stream on the DAB broadcast network and the Internet with specifically developed TPEG software decoders from the Consumer Electronics industry that would permit to test the wide range of TPEG functionalities specified in the European pre-standards of CEN TC 278.

Infrastructures used

Prior to the TPEG Project, there was already a pre-operational TPEG service from the British Broadcasting Corporation BBC that started in 1999, first on DAB and later also on the Internet. Through the TPEG Project's activities TPEG signals were also to be put on air using the Digital Radio DAB infrastructures, already developed in Munich, Stuttgart and other parts of southwest Germany, as well as in Stockholm.

TPEG can support a number of different TTI applications, specifically for all modes of transport (trains, trams, busses, ferryboats, airport arrivals and departures - and not just only road traffic messages).

Many TTI experts consider TPEG as the most innovative technology in Traffic and Travel Information broadcasting that will also support a wide range of receivers, simple ones without a map database and more complex ones as car navigation systems.

The TPEG Project's actual outcome

1. The TPEG Project has built a wide consensus on the new TPEG technology that was never tested and validated before. The experts involved in those tests were largely those who developed the technology. This had the advantage that they had at least a very deep understanding on what the technology would permit to achieve in theory.
2. The TPEG technology offers a vast range of service options. These are all well defined within the TPEG specifications, but not yet sufficiently well documented for those who want to operate such services. This required the *System & Service Guidelines* (D6) and other promotional material, like *TPEG – What is it all about?* (D13) to be produced towards the end of the project.
3. What to test and validate exactly was the task of an extensive *test scenario* writing activity. The results are laid down in *Deliverable 1*.
4. The above points clearly show that there have existed within the TPEG Project the following dependencies:
 - ❑ First, the test and validation scenario had to be defined.
 - ❑ Then, the test scenario required some implementation of test infrastructures, ie. the broadcasters had to put the respective test signals on air, and the manufacturers had to design the TPEG test receivers.
 - ❑ Then, broadcasters and manufacturers would carry out jointly or separately those tests and validate the results. Finally both interest groups would document their findings in Deliverables D3 (broadcasters) and D5 (manufacturers).
 - ❑ The System and Service Guidelines (D6) then took these findings to document the experience gained with the first trial implementations in the UK, Sweden and Germany.
 - ❑ The results of the TPEG technology tests and validation were also documented for the attention of the standardisation committee CEN TC 278 to indicate the possible changes to the TPEG specifications as well as DATEX/TRIDENT used to support TPEG (D8).
 - ❑ The total experience acquired was also used to produce a promotional booklet "*TPEG - what is it all about*" (Deliverable D13) which can later be used to accompany the market launch of TPEG, after the end of the Project. This brochure was produced for the IFA 2003 at Berlin and already used successfully in a number of other international media events.

In addition, it is important to realise, that the EBU agreed to create as from January 2003 an open **TPEG Forum** that will ensure promotion and further development of the TPEG technology beyond the TPEG Project. It will also coordinate the implementation and promotion of the new emerging TPEG services and products. This also includes responsibility for the TPEG standards maintenance and further standards development under CEN TC 278/ISO TC 204.

The TPEG Project was European in coverage, focus and outlook

A range of European Commission policies addressed already previously the provision of better traffic and travel information to the citizen, with the view to promote the growth of the Information Society. These policy objectives also demanded better and more efficient use and integration of the transportation systems and networks. Additionally, they aimed at improved quality of life for the citizen by better protection of the environment and ultimately also improved safety on the roads. The TPEG Project aimed to validate and build a consensus on the European scale and offered an open innovative TTI broadcast technology that supported well all those objectives.

More information transmission capacity than for RDS-TMC is generally available where Digital Radio is already implemented in Europe, due to the large increases in data broadcasting bandwidth, which is possible within a DAB multiplex. The information broadcast, even if massive in quantity, can with TPEG be more focused on the needs of the individual citizen, through the possibilities of filtering that will be offered by TPEG enabled client devices, as TPEG was specifically designed to support a wide range of receivers and filtering options.

A number of strategic and practical points needed also to be taken into consideration in the context of the development of a market, using the innovative TPEG technology:

- Rapid evolution and successful digital technology such as DAB needs the availability of a better protocol than RDS-TMC. TPEG has the strong potential to be the standard for the next generation of TTI broadcasting services, and it has the additional advantage of being bearer independent and above all multi-modal.
- As a part of the European Union's single marketplace, better access to and use of travel information for all is integral and central. A key element of improved transportation accessibility and efficient usage is of course the provision of high quality travel information, consistently across Europe, from the suburban commuter to the long distance international traveller. This will also have a very positive impact on safety, as well informed end-users generally will maintain a positive attitude even during temporarily worsened traffic situations.
- For Europe-wide coverage of TPEG services it is essential that wide consensus on adopting and implementing the TPEG technology is achieved. The TPEG Project has much contributed to achieve this objective. This involved the service providers who have to commit themselves to start regular operations using TPEG technology and the industry that must commit to produce TPEG enabled receivers. Only at the European level can one achieve the basis for a European service. Unfortunately there are yet no agreements permitting precisely to forecast the launch of TPEG based TTI services in Europe and TPEG enabled receivers being widely available to end-users.
- In addition, the implementation of the TPEG protocol and services does not purely depend on the technical constraints. Broadcasting legislation still differs in Europe from country to country, and must also be examined to ensure that a common European approach to Europe-wide implementation of openly available language-independent multi-modal traveller information can be adopted and that European recommendations to change national legislation would be made. It is somewhat surprising that big differences in the existing national regulations governing data broadcasting would still exist in Europe. However, it was beyond the scope of the TPEG Project to make any recommendations on achieving a better European harmonisation in this area, and it can only be hoped that perhaps on the level of the European Parliament a sufficiently high awareness would exist already and that from there attempts will be made sooner or later to resolve these matters.
- Furthermore, TPEG is likely to become now a European standard, and in April 2000, the TPEG specifications were already first submitted for standardisation to CEN TC 278 WG 4 and to ISO TC 204. However, the CEN/ISO standardisation process is so slow that even in late 2003 the draft standards were not yet voted. They had only passed the commentary stage, which resulted in a number of minor modifications and improvements. As a results of the TPEG project's dissemination activity, a broad support for the adoption of this new technology as a new European standard has definitely been achieved now. Also the dissemination activities of the TPEG Project and the results from the technological tests and their subsequent validation made within the TPEG Project, have much contributed to building a strong support for standardising TPEG.

Community added value and contribution to EU policies

Europe is clearly leading a very exiting technology, which deserves to be given more attention by the European Commission. All that is needed now are regular TPEG based multi-modal TTI services all over Europe.

New Projects within the 6th Framework Programme and also those Euroregional projects from DG TREN supporting European ITS infrastructure development could well contribute to achieving the objective of European-wide TPEG based mobile services for everyone, already as from around 2005 onwards!

It is worthwhile to recall that an enormous effort had been put so far by the EC into the development of the TMC technology which has been up to now the backbone of the broadcast technology used for the provision of language-independent Traffic and Travel Information services designed to serve the mobile European citizen. TMC, however is restricted to road traffic information, while TPEG today includes PTI (Public Transport Information) and in the future will include several more applications like Parking, Congestion, Weather and Environmental Information etc.

These two broadcast technologies differ like night and day, and the future is clearly in favour of TPEG. However, TPEG is definitely not meant to replace TMC. It is specifically designed for use on digital broadcast systems which provide a transparent data channel. TPEG streams can travel like a fluid in a pipeline, therefore TPEG can be used on all digital broadcast systems like DAB, DVB and also the Internet.

TPEG is being standardised in CEN/ISO, just like TMC, and it is internationally recognised also by Japan and South Korea, just to name a few countries outside Europe.

The potential market for TPEG

The potential market for TPEG based consumer products depends strongly on the TPEG service area coverage achievable with the bearer systems, initially DAB and the Internet (mobile and fixed).

While DAB Digital Radio technology was optimised for mobile reception, even at speeds of 100 km and more, there exists no TPEG data transmission experience yet using the mobile internet, eg. via GSM/GPRS. Additionally the price to be paid by the end-user for the data to be transferred over the mobile internet is still high, even if transmission cost using GSM/GPRS and now also UMTS is decreasing all the time. Also, an internet server may have problems in dealing with very many end-users at the same time.

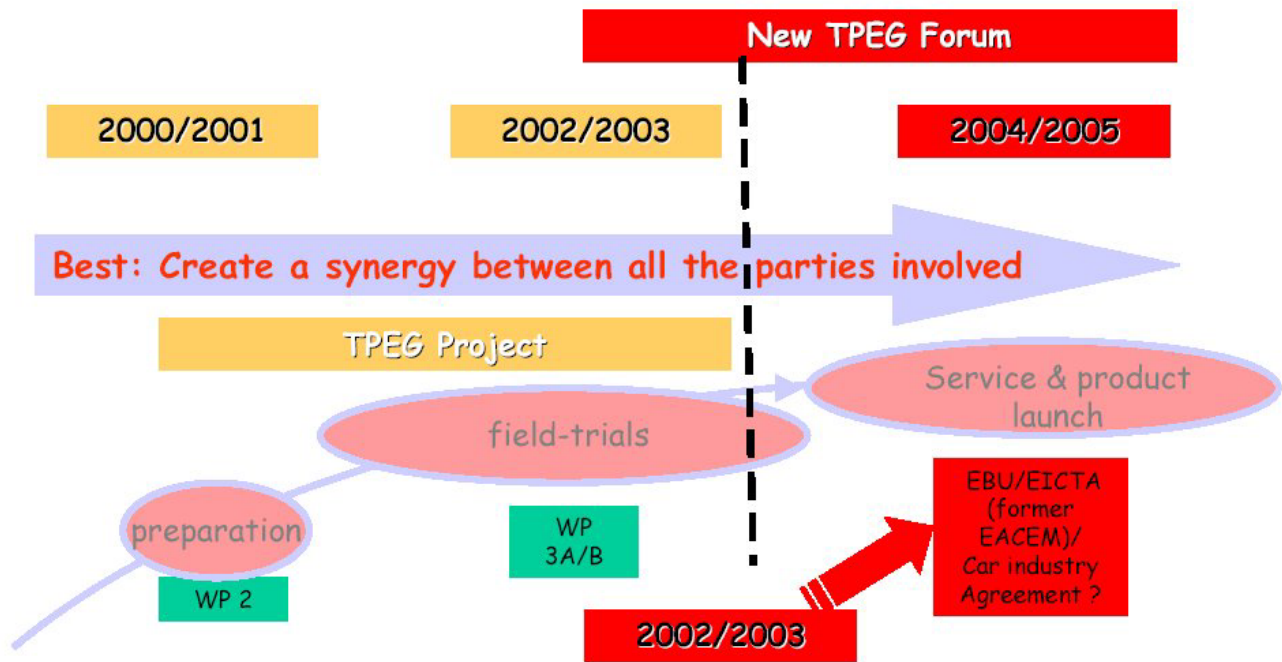
All this suggests that DAB Digital Radio remains the most attractive broadcast technology to be used within the next years for TPEG.

There will also be promoters for DVB-T to be used. However, as for the next years there will be more demand to use this medium for television than anything else, it appears from the present experience that promising DVB-T as another potential bearer for TPEG, will at the end have only the negative effect to slow down the further TPEG development on DAB Digital Radio, and confusion and insecurity over the ongoing DAB implementation will be another undesirable side-effect.

The success of TPEG depends clearly on the availability of reliable and high quality TPEG based traffic and travel information services, which also will have to offer added value in comparison to the already existing TMC services.

There is a proposal from the TPEG Project for initiating a concerted action of service providers and set makers enabling a quick market introduction of the TPEG technology.

European road map for TPEG service & product launch



The kind of synergy all interested parties in TPEG should now quickly aim at is a well timed agreement, where

- Broadcasters commit to roll out-services,
- Receiver manufacturers will start roll-out product from an agreed point of time (eg. IFA 2003, 2005 or 2007,
- And the car industry plans to line – fit such products from an agreed point of time.

It is also likely that from the joint approach of the industry within the TPEG Project all Partners will soon be enabled to respond more quickly to market expectations for terminals whenever they are required on the European mass market of electronic consumer products.

Less power consuming DAB modules open additionally a good perspective towards PDA-like TPEG terminals.

Not to forget at the end, a TPEG decoder will be mostly software.

The trend towards using TPEG widely is favourably influenced by the general trend that processing power increases while prices decrease and memory is always getting cheaper as well. Thus to store in a TPEG enabled receiver many (say 300 actual messages on a broadcast carousel) is not a problem and to filter out those few relevant messages for attractive end-user presentation on a PDA or dynamic rerouting in a navigation system is not a big problem either.

The key customer for TPEG terminals (mostly integrated into navigation systems) is the car industry with the following requirements:

- High pan-European coverage,
- Profit perspective,
- Ease of use,
- Extended features compared to TMC services,
- Reliable and on-time traffic and travel information.

UK, and Germany already represent a car industry that could start the launch of commercial products within the European Union on the condition that there will be a firm commitment to fully sustained TPEG based TTI services with a good national coverage on DAB and perhaps also the Internet. There has to be a sufficiently large initial market size for the consumer electronics industry. TPEG/TTI services likely to be operated by the public German (ARD) and UK (BBC) broadcasters have a clear potential to support this market with reliable traffic and travel info and with extended features over TMC, specifically for public transport and inner-urban messages.

First, the industry partners of the TPEG Project required TPEG services for the initial introduction within the economic triangle formed by France, the UK and Germany. However with the problems encountered during the TPEG Project concerning the possible adoption of TPEG in France, this requirement was towards the end of the TPEG Project generally seen as no longer realistic, since France is in any case very late in comparison to many other European countries with its Digital Radio network development, for which always good plans had existed. This will remain so, as long as DAB area coverage remains poor, and then also TPEG will have no chance.

To launch TPEG enabled receivers in Europe, Germany has clearly been identified as the key market within the TPEG Project.

The timely development of DAB broadcast infrastructures Europe-wide may require more EC involvement, as otherwise the new TPEG technology implementation to become available Europe-wide will just not happen.

It will also be useful to continue studies of business models for TPEG service provision. Business models have the potential to encourage the industry with the view that a launch of consumer products for TPEG can be a profitable business.

The EBU sponsored TPEG Forum has promised recently to take now responsibility also for the marketing issues concerning TPEG.

Annex 1: Specific results

1. Dynamic TPEG messages for test demonstrations
2. Distributing TPEG data over Digital Radio DAB
3. Monitoring TPEG implementations on Digital Radio DAB
4. Generating TPEG-Loc code elements on the fly using a digital map database
5. TPEG on the fixed and mobile Internet
6. TPEG message presentation and HMI issues
7. TPEG technology dissemination activity
8. TPEG standards development
9. Analysis of harmonisation requirements regarding TPEG, DATEX and TRIDENT
10. TPEG technology implication on existing regulatory environment

1 - Dynamic TPEG messages for test demonstrations

Summary:

TPEG Project demonstrated how the TPEG specifications could be tested in a Traffic and Travel Information (TTI) message generation environment for both, road-based traffic information and public transport information. An automatic conversion from RDS-TMC to TPEG was achieved and air-traffic arrival and departure information was parsed from the internet and distributed via TPEG. RDS-TMC and TPEG can co-exist. Language-independent TTI was broadcast via DAB and via Internet using the binary version of TPEG.

Impact:

TPEG permits to implement a very innovative European broadcast technology on digital bearer systems (e.g. DAB, Internet) for the delivery of language independent multimodal traffic and travel information to end-users. End-users can use a wide range of receivers that range from Personal Digital Assistants to Navigation Systems.

TPEG permits to reach very economically many people and to distribute messages of a general interest. The end-user may filter the messages according to his/her specific interest. The messages are machine-readable and there exist many possibilities on how to present the messages.

Possible next steps:

Most of the TPEG Project Partners will continue after the end of the TPEG Project to cooperate in the TPEG Forum. They have all now a first-hand experience with the development and implementation of the TPEG technology. Thus, the TPEG Forum groups together a wide range of broadcasters, service providers and the consumer electronics industry.

Any Traffic and Travel Information Service Provider may be interested in the future to try out first TPEG in temporary test and demonstration services, before deciding to use this new technology for outputting real messages within an operational service environment.

The experience gained in the TPEG Forum by those Partners that had a direct involvement in the TPEG Project is that TPEG test services can be implemented without major difficulties by simulating TPEG-RTM messages from automatically converted RDS-TMC messages and creating automatically TPEG-PTI messages from airport arrival/departure information parsed from some airport web sites.

The TPEG Forum Office will provide consultancy and guidance on how to achieve efficiently such a test environment.

2 - Distributing TPEG data over Digital Radio DAB

Summary:

Existing DAB data inserters for TPEG input over the Transparent Data Channel (TDC) mode had to be adapted. Once this had been achieved, TPEG could be implemented on existing DAB Digital Radio very easily. The TPEG Project demonstrated this in Germany, Sweden and the United Kingdom. The major players from the car radio and navigational receiver industry participated in these tests. Up to now, the TPEG specifications recommend the DAB/TDC mode only. However, the experience gained with these tests suggests that using the DAB/MOT mode may even be simpler.

Impact:

TPEG permits to implement a very innovative European broadcast technology on digital bearer systems (e.g. DAB, Internet) for the delivery of language independent multimodal traffic and travel information to end-users. End-users can use a wide range of receivers that range from Personal Digital Assistants to Navigation Systems.

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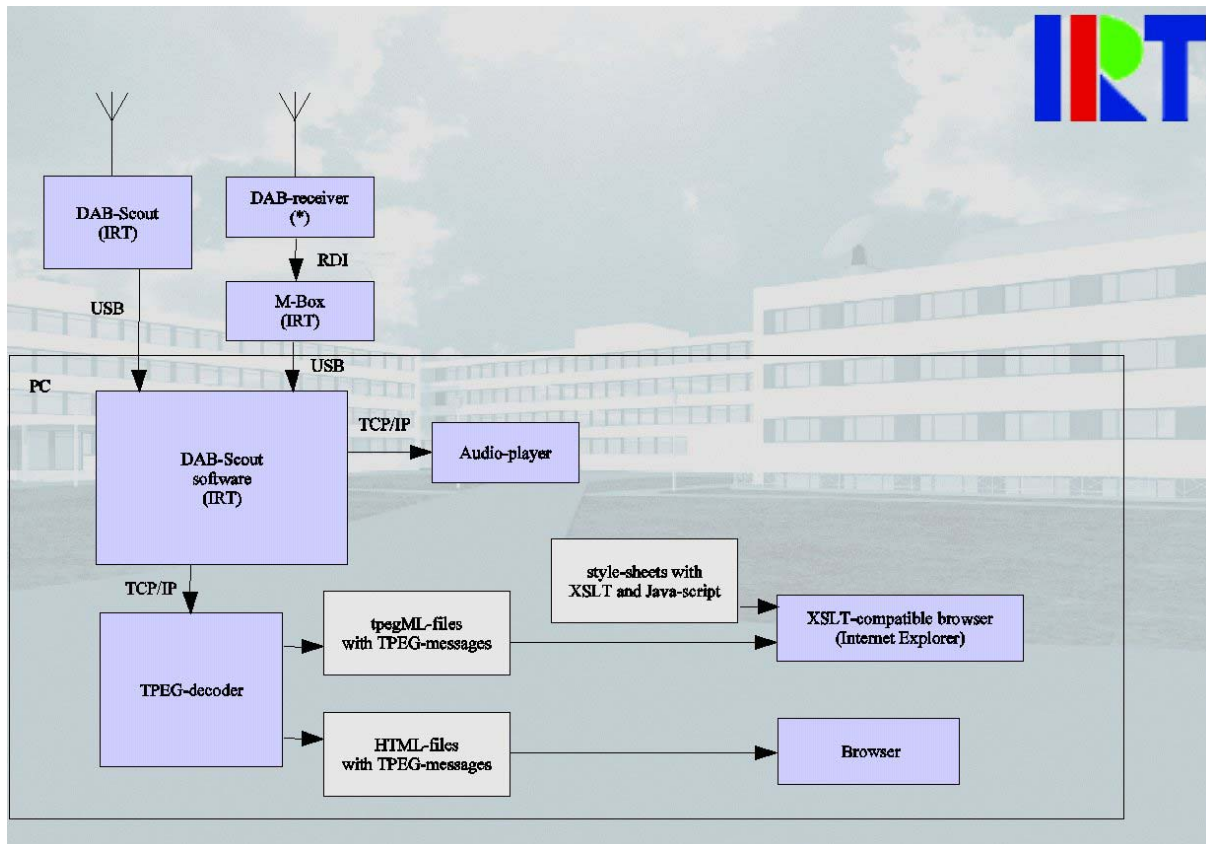
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The TPEG Forum Office will provide consultancy and guidance on how to achieve efficiently such a test environment.

The TPEG Forum groups together a wide range of Partners from broadcasters, service providers and the consumer electronics industry. Most of these Partners have a first-hand experience with the development and implementation of the TPEG technology.

3 - Monitoring TPEG implementations on Digital Radio DAB



Summary:

Implementing TPEG within the DAB multiplex can be complex, if there is no monitoring receiver available that will permit to verify the DAB parameters put on air. To help to overcome this problem, one Project Partner developed a very powerful monitoring receiver (DAB-Scout), not only for DAB in general, but also for TPEG services carried over DAB. The receiver was produced in a small quantity (hardware and software) and successfully tested by several Project Partners. A very innovative feature is that the DAB receiver hardware is connectable via USB to a Windows Notebook on which the analytical software is implemented.

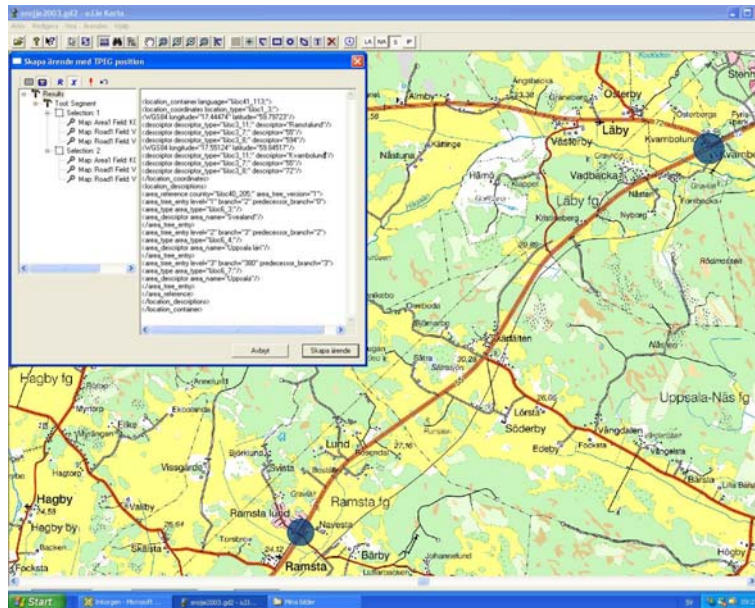
Possible next steps:

Any Traffic and Travel Information Service Provider may be interested in the future to try out first TPEG in temporary test and demonstration services, before deciding to use this new technology for outputting real messages within an operational service environment.

The TPEG software products of the IRT are actually supporting the TPEG applications Road Traffic Message (RTM) and Public Transport Information (PTI).

The Java based TPEG-Decoder allows the monitoring of TPEG messages in combination with digital receivers (e.g. DAB-Scout). Output formats are tpegML and HTML.

4 - Generating TPEG-Loc code elements on the fly using a digital map database



Summary:

The TPEG specifications contain a very innovative method for Location coding, offering a large number of options to be used. Swedish Radio tested these options. It was demonstrated that specially developed software permits to generate the TPEG location codes on the fly using an already existing digital map database. This offers a realistic perspective for very powerful TTI services to be produced that will contain a lot of information. The end-user could use a TPEG receiver (with powerful filtering options) to easily retrieve the information he/she is specifically interested in.

Impact:

Swedish Radio investigated how to adapt the SR Traffic and Travel Information message generation system oJJe to TPEG, putting special attention to using the digital map database of Sweden, which is an integral part of the oJJe system for an operator friendly generation of the TPEG Log elements.

The first results obtained within the TPEG Project were very promising, but there is more research necessary to fully achieve all possible options.

Possible next steps:

There is interest to share the experience gained with other Partners from the Service Provision side trying to achieve a similar objective.

5 - TPEG on the fixed and mobile Internet

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

o Location Type: route, westbound

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

o Restriction: closed



Summary:

The TPEG Project demonstrated various ways on how to implement language independent TTI on the Internet. Two different approaches are very interesting. The first, chosen by the BBC, is for the Internet being mainly used by a fixed connection. The second, developed by Sony, offers a possibility to use TPEG on a mobile receiver via GSM/GPRS or UMTS.

Impact:

The tpegML specifications offer the potential to present TPEG messages on the Internet, mainly for fixed PCs using an Internet browser with XML capabilities. Under these circumstances there is no special TPEG decoder required to present all messages that are output by the Service Providers in a primitive form.

To use TPEG on the mobile Internet, the binary version of the TPEG specification is recommended. Reception of TPEG in a vehicle with an Internet receiver connecting via GSM/GPRS to the TPEG server to download the messages at intervals, is an issue that still needs further research.

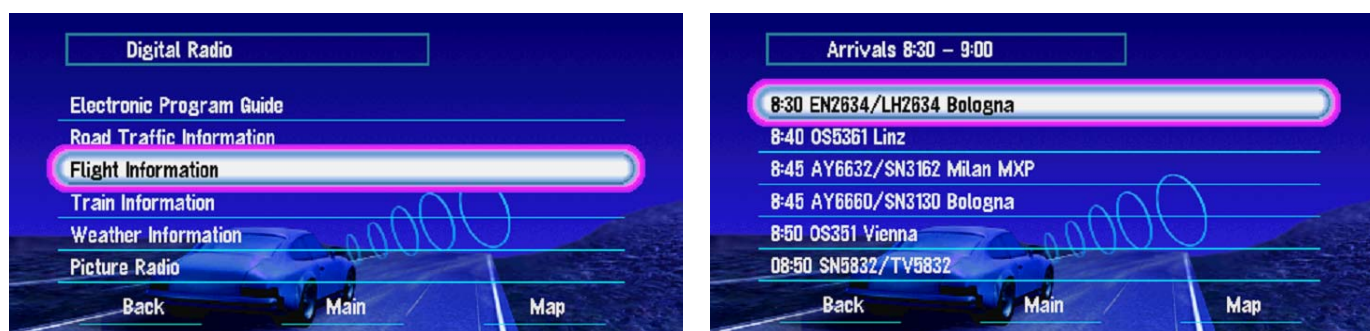
Possible next steps:

There is interest to share the experience gained with other Partners from the Service Provision side trying to achieve a similar objective.

TPEG, which can be seen as a data service on the mobile internet will require additional research to be carried out by the car industry and the consumer electronics industry. It will be necessary to investigate whether an end-user can reliably receive the TPEG data at all vehicle speeds, whether the cost for receiving the data is acceptable to end-users and whether the internet server can cope with massive demand during peak traffic hours. What maximum delays in providing the information via downloading will be acceptable to the end-user?



6 - TPEG message presentation and HMI issues



Summary:

The TPEG Project investigated various ways on how to best present TPEG messages to the end-user using text based presentation, pictograms and speech output. The Project Partners exchanged very openly their experience gained. This will certainly have a very positive impact on the design of real TPEG receiver software to enable integration of TPEG into commercial products (such as Personal Digital Assistants, navigational receivers, etc.).

Impact:

There exist effectively two kinds of Human Machine Interface (HMI) that require more research to be done.

One concerns the Service Provider. Here the problem to be investigated further is of whether a message input operator could not use an interface that permits him/her to edit a new message in the form of (structured) text that then could be automatically converted into the TPEG message format.

The other concerns the end-user. There the problem is to find the best way to present the information and filtering options and avoid distraction from the driving task. The solutions one can imagine will be many, and a lot depends also on the processing power of the TPEG decoder engine.

Possible next steps:

There is interest from the many Partners that were involved in the TPEG Project to share the experience gained with other Partners from the Service Provision, the car and consumer electronics industry trying to achieve a similar objective.

7 - TPEG technology dissemination activity



Expo 2000
Hannover



ITS 2001
Bilbao



ITS 2000
Torino



TPEG 2001
Stockholm

Summary:

The TPEG Project has held a number of open Workshops in Germany, Sweden and Switzerland to promote the innovative TPEG technology on a European scale. This has attracted many potential future TPEG service providers and manufacturers of commercial products to which TPEG can be added at a later stage to upgrade an existing service or product. The interest generated goes nowadays far beyond Europe and includes already South Korea and Japan. Such support from outside Europe is essential, as on the standardisation level TPEG aims not only at CEN approval, but also ISO approval. South Korea has started already a national TPEG Project to test and to adapt the technology to its own broadcast environment. Japan is particularly interested in the tpegML version, and in the development of a new TPEG application providing Parking Information. In Europe, there were also some cross-relations developed to support TPEG implementation outside the TPEG-Project, specifically through the EBU funded TPEG Forum.

Impact:

There is now also demand for training courses to be given on TPEG technology.

There is a need to develop further the knowledge and understanding of business models that will support the growth of TPEG Service provision on a European scale.

It will also be useful to involve marketing experts in the development of commercially viable TPEG based TTI services.

Possible next steps:

There is interest from the many Partners that were involved in the TPEG Project to share the experience gained with other Partners from the Service Provision, the car and consumer electronics industry trying to achieve the implementation of sustained TPEG based TTI services.

8 - TPEG standards development

Topic	Binary Specifications EBU BPN 027 series	Mapping	XML Specifications EBU BPN 036 series
	CEN ISO TS 18234 series		ISO TS 24530 series ¹
Introduction, Numbering and Versions	Part 1		--
Syntax, semantics and Framing structure	Part 2		--
Service and Network Information application	Part 3		?
Road Traffic Message application	Part 4	<mapped>	Part 3
Public Transport Information application	Part 5	<mapped>	Part 4
Location referencing application	Part 6	<mapped>	Part 2
Parking Information	tba	<tba>	Part 5
Congestion and Travel-time information	tba	<tba>	Part 6
Environmental Information Alerts	?	<?>	? ²
Weather Information	?	<?>	?
Introduction, common data types and tpegML	--		Part 1
Key: Existing specifications shown in green Specifications under development shown in blue Future specifications, with agreed Work Items, shown in red tba – to be announced			

TPEG technology - a family of specifications and standards

Summary:

The TPEG specifications, which are openly published by the EBU over the Internet, are in the process of becoming CEN/ISO standards. The TPEG Project tested and validated them and this may well have the effect that minor improvements will still be added, as a result to the work carried out in the Project.

Possible next steps:

There is a need to continue the development of new TPEG applications like Parking Information, Congestion and Travel Time Estimation, Weather Information and Environment Information Alerts. The System and Service Guidelines will need to be updated as well, to cover the newly developed applications.

There is more research to be done and the Partners of the TPEG Project, now grouped together in the TPEG Forum, are much interested to continue the exchange of experience in all the above areas. However, without further funding from the EC, the progress made may be slow as the human resources available to support the work objectives have become quite scarce, specifically on the European level.

¹ The tpegML specifications at time of printing have still to be formally accepted as CEN Work Items

² Not yet submitted to CEN/ISO for Work Item status consideration – part of a potential European Project

9 - Analysis of harmonisation requirements regarding TPEG, DATEX and TRIDENT

Summary:

The TPEG specifications are designed to communicate TTI to the end user (delivery segment). On the other side, the message generation process uses very much the content collection segment. Some legacy issues were identified relating to DATEX and TRIDENT. These specifications will need to be harmonised with TPEG, if the intention is to use them all together on the European scale.

Impact:

TPEG is a technology designed for delivering messages to the end-user. However a TPEG Service Provider may also use a the DATEX/TRIDENT specifications that are designed for collecting and exchanging messages.

If all the three specifications, TPEG, DATEX and TRIDENT shall co-exist, there is a need to harmonize the specific data terms and elements used. A newly designed Data Dictionary could be a useful basis for all of them.

Possible next steps:

There is more research to be done and the Partners of the TPEG Project, now grouped together in the TPEG Forum, are much interested to continue the exchange of experience in all the above areas. To progress this work with a certain priority may require to fund the work of the experts involved.

10 - TPEG technology implication on existing regulatory environment

Summary:

The TPEG Project has identified some problems relating to the implementation of data broadcast services on DAB, nationwide. In some EU countries, this may require changes to be suggested to the regulatory environment. Harmonisation in this domain will certainly be useful and require further EC or European Parliament involvement. Also, the timely development of DAB broadcast infrastructures Europe-wide may require more EC involvement, as otherwise the new TPEG technology implementation to become available Europe-wide will just not happen.

Impact:

TPEG is a technology that needs a digital bearer system to be implemented. Two solutions appear to be attractive within the short term

- the fixed and the mobile internet,
- Digital Radio DAB.

To implement TPEG based data services on a nationwide scale in all EU countries may require harmonisation of the regulatory framework.

The TPEG Project has identified some of the problems, but to solve them may require action on the level of the EC and/or the European Parliament.

Possible next steps:

There is more research to be done and the Partners of the TPEG Project, now grouped together in the TPEG Forum, are much interested to continue the exchange of experience in all the above areas.

Annex 2: Project Publications

D1: Definition of the test environment & Supplement “who does what, when & where”

The Definition of the Test Environment creates the basis for the TPEG Project, which aims at:

- Validation of implementation issues over a period of 3 years (autumn 2000 – autumn 2003).
- Preparation for service and receiver market take-up.
- Build wide consensus on TPEG standards (CEN TC 278 / ISO TC 204)

The TPEG technology validation tests described in this document will be further developed and results achieved during the tests to be made will be reflected in the TPEG System and Service Guidelines to be at a later (Deliverable no. 6).

D2: TPEG Test Signals on Air: Description of the test sites

Within the TPEG-Project the testing of the TPEG transmission is the key issue. To achieve this goal, real TPEG messages have to be produced and delivered through a transmission channel. For mobile users it is essential to get traffic and traveller information at any place at any time. An obvious solution is the usage of a digital broadcast system. A well established and fairly European wide existing system is DAB (Digital Audio Broadcasting), also known as Digital Radio. TPEG is a new technology for delivering messages to end-users and has certain advantages compared to already existing TTI services like bearer independence and language independence. Furthermore the TPEG standard is self-sufficient, structured and future proof. The submitted Deliverable 2 is about the implementation of test sites that collect, generate and transmit messages coded according to the TPEG specifications. Three project partners operate a TPEG message generation system at the moment. These are the Sveriges Radio AB (SR) for Sweden, British Broadcasting Corporation (BBC) for the United Kingdom and the Institut für Rundfunktechnik GmbH (IRT) for Germany. The focus of this Deliverable is the on-air delivery of TPEG via DAB, although the TPEG transmission via the Internet is also supported.

D3: TPEG Service Provision: Assessment of the Project objectives

Within the TPEG-Project experiences with broadcasting TPEG-data were made by Sveriges Radio AB (SR) for Sweden, British Broadcasting Corporation (BBC) for the United Kingdom and the Institut für Rundfunktechnik GmbH (IRT) for Germany. All TPEG-test services were broadcast over DAB (Digital Audio Broadcasting) and over the internet, but the focus remained of course on DAB. To show both, the full functionality of TPEG and real content provision of traffic announcement in TPEG, it was necessary to use different tools and interfaces to existing traffic information centres. Due to the need to keep the expenditure limited, it was necessary in some test cases to use software that was not designed for TPEG, and to implement instead only some adaptive tools. One part of the TPEG-knowledge gained is a result from implementing TPEG applications; the other part is from the TPEG-know-how gained from the validation tests made during running these TPEG-test services. The experience gained from the validation tests is documented in this Deliverable.

D4: TPEG receivers: Documentation & description of the decoder software

Deliverable 4 describes the joint TPEG receiver development activity undertaken by the industry group within the TPEG Project. The work is based on the agreement of a common TPEG reference terminal model, which is described in Section 1. Section 2 describes the TPEG decoder APIs (API: Application Programmable Interface) that provide a TPEG client access to the SNI (SNI: Service and Network Information for a TPEG service) and message databases of the TPEG server. These APIs are part of the reference model, which was jointly developed by the industry group. The implementation of these concepts is then described in Sections 3 to 7. Here, the manufacturers involved have started pre-product developments that the TPEG Project planned to use for testing and validating the TPEG technology, as implemented by the broadcasters. It is obvious from Sections 3 to 7 that each manufacturer had finally chosen its own approach towards implementing the common reference model within a TPEG test receiver/decoder. This approach was also largely influenced by the kind of first TPEG receiver product that the particular company would be able to market at a later stage (and beyond the time-frame of the TPEG Project). The particular TPEG test decoder implementations are described in the following order: Sony (for Internet delivery via GSM), Clarion (for DAB), Panasonic (for DAB), Pioneer (for DAB) and Siemens-VDO (for DAB).

D5: TPEG receivers: Assessment of the Project objectives

Deliverable 5 describes the assessment of the project objectives with the individual terminals as carried out by the industry group. This work is based on the Testing Synopsis document produced in collaboration of all Project Partners before. From this list of tests all the requirements for Test Streams were derived (see Section 2). These jointly developed Test Streams and regular signals on air in Sweden, Germany and the UK served as the crucial element of the test environments of the industry group members. At one industry site Test Streams, other TPEG files (recorded elsewhere or distributed via Internet) as well as ETI files (complete DAB Ensembles) were put on air - via DAB - for test campaigns of the whole group. The individual requirements for and characteristics of the two bearer systems for the distribution of TPEG content in question are described in Sections 3 and 4. Furthermore different Transport Protocols are discussed and evaluated. The individual tests executed by the Partners are explained in Sections 5 to 9 (up to now three of the five partners were able to demonstrate operational equipment). Logically this is accompanied by an analysis of the TPEG transmissions of all providers including even external ones like the Belgian VRT and RTBF (Section 10). Already in this section the first part of the conclusions for future TPEG transmissions is outlined. All further decisive recommendations for an operational TPEG environment are summarised in Section 11 - possibly the most relevant clause of this document. The core result of the TPEG Project is that the high potential of TPEG could be proven, but on the other hand also the deficiencies of the Standards and the implementations became obvious. TPEG did not reach market-maturity yet. Therefore it will be very important to forward all the issues discovered within the Project to the TPEG Standards Task Force.

D6: System & Service Guidelines

In the TPEG specifications there was simply no possibility to detail all the concepts and assumptions made underlying the design-process of the TPEG technology. This is one of the major reasons why now Guidelines are needed in addition to the Specifications. They can provide significant support to the implementation process of this new technology. This Deliverable documents most of the experience gained during the test and validating work done over the three years of this Project. As the implementation process will continue, more experience will be gained, and it will be very useful therefore to continue the development of these Guidelines. The TPEG Project did not really cover yet the operational domain, where TPEG will also need to be integrated into the already existing environment of TTI service provision.

These first version Guidelines deal with the following topics:

- TPEG design principles for end-user focus,
- Concept of extensible TPEG Tables,
- Legacy issues relating to RDS-TMC,
- DAB adaptation for TPEG,
- TPEG adaptation for the internet,
- Service and network information, - Message management,
- Client requirements,
- Location referencing and use of digital maps,
- Message presentation and HMI aspects
- Message generation aspects.

D7: The Goals of the TPEG Validation - Submission to CEN TC 278

TPEG is a new technology for delivering messages to end-users (simultaneously via digital radio and TV and the Internet) by means of language independent data. The European Broadcasting Union (EBU) supports the development of TPEG technology by the CEN/ISO TC 278 WG4 Project Team. Their first specifications are being voted as ENV/TS standards. Meanwhile the European Commission is supporting the "TPEG Project" which is underway to validate the concepts. It already has a number of transmission/service tests sites across Europe. The objectives to be achieved by these validation tests are to verify that the specifications permit, within a complete transmission chain, to correctly implement all features and functionalities that are foreseen. To achieve this goal, broadcasters and manufacturers collaborate in the TPEG Project to carry out the necessary tests together, and to reach ultimately a consensus over the validity of the set of TPEG standards. In cases where it is found that the standards need to be corrected, feedback will be provided to CEN/ISO TC 278 (Deliverable 8). In addition, based on the experience gained by using the standards in a real operational environment, guidelines for the implementation of the new technology will be drawn up (Deliverable 6).

D8: Results of the TPEG Validation - Submission to CEN TC 278

Since 1997, the TPEG specifications have been developed within a standardization group called B/TPEG Plenary Group & CEN TC278 WG4 Project Group 7. The group was set up by the EBU (European Broadcasting Union) and most members came from the broadcasting field and from almost all car radio manufacturers around the world. The group has developed the specifications with little feedback from practical implementations. Therefore the TPEG Project was formed in 1999 to test the functionality of the protocol. Generally speaking, the protocol has functioned as expected. Therefore, from a strictly technical point of view, it can be seen now as a success. However, during the implementation of the test platforms, the different partners have observed a number of shortcomings and inconsistencies, where enhancements would still appear to be feasible. The TPEG Project has also concluded, that the tpegML specifications can be used for data exchange in the area of message content collection. However, in a more general context, DATEX and TRIDENT are the European protocols that were specifically designed for this purpose. To support TPEG message delivery to end-users adequately, it appears to be necessary now, from the TPEG Project's point-of-view, that the DATEX and TRIDENT specifications will need to be upgraded, to be capable of transporting all TPEG required data elements, and specifically those necessary for location information data.

D9: Recommendations to the Data Exchange Community

The TPEG Project has developed a new protocol for broadcasting traffic and travel related information to end-users. It is expected to be the "after RDS-TMC" technology, providing a bearer independent solution and extending the application domain to public transport. Within the information chain, from the data collection to the end user data presentation, the TPEG Project is clearly positioned in the delivery sector, and therefore it cannot directly address the "data exchange community". However, the information to be delivered has also to be collected by the TPEG service providers, either directly from the source or, through existing traffic/travel centers using increasingly the DATEX/TRIDENT protocols. This definitely requires for future developments a high degree of compatibility and harmonisation to be achieved. The objective of this Deliverable is to identify significant the elements impacting on compatibility issues (i.e. data definition, location referencing, protocols) and used all along the information chain, specifically for the attention of traffic/travel information centres used by the data exchange community. It is also shown where the TPEG elements used for traffic/travel messages addressed to the public by the broadcasting community are not yet supported by DATEX/TRIDENT. Some major inconsistencies are then highlighted, and as a conclusion some recommendations concerning any future projects are also given.

D10a: Report on Annual Project Workshop 2001 at IRT Munich

This report contains

- The List of Workshop Participants
- The nine presentations made at the Workshop
- A summary of the observations made during the Workshop discussions

D10b Report on Annual Project Workshop 2002 at EBU Geneva

This report contains all presentations made at the Workshop and an Executive Summary.

26 participants from several European and Asian countries attended the Workshop.

Key issues from the Workshop were:

- The strong potential of the TPEG technology is confirmed.
- A market launch of the TPEG technology will fall outside the scope of the TPEG Project.
- The key market in Europe is Germany.
- A product launch will require a strong involvement of the car industry.

D10c Report on Annual Project Workshop 2003 at IRT Munich

This report contains all presentations made at the Workshop and an Executive Summary.

The Workshop was attended by 70 participants from 11 European countries and South Korea.

Key issues from the Workshop are:

- The strong potential of the TPEG technology is again confirmed.
- A market launch of the TPEG technology will now fall outside the scope of the TPEG Project.
- TPEG is already adopted by some companies that were not involved with the TPEG Project.
- Confirmed: The key market in Europe is Germany.
- Confirmed: A product launch will require a strong involvement of the car industry.

D11 General Project Description

This is a brief description about what the TPEG Project is all about.

The TPEG Project aimed at:

- Validation of implementation issues over a period of 3 years (autumn 2000 – end of 2003).
- Preparation for service and receiver market take-up.
- Build wide consensus on TPEG standards (CEN TC 278 / ISO TC 204).

D12a Initial Dissemination and Use Plan

The document describes how the Project results can be used in the European context.

D12b Final Dissemination and Use Plan

The document describes how the Project results can be used in the European context. Problems related to the regulatory environment are identified in this document.

D 13 TPEG - What is it all about?

This is a brochure designed to widely publicize TPEG to non-specialists and possible users of the new technology.

D14 Technology implementation plan

This is an electronic document elaborated for the European Commission. Its content has been largely re-used in this Final Report.

Note:

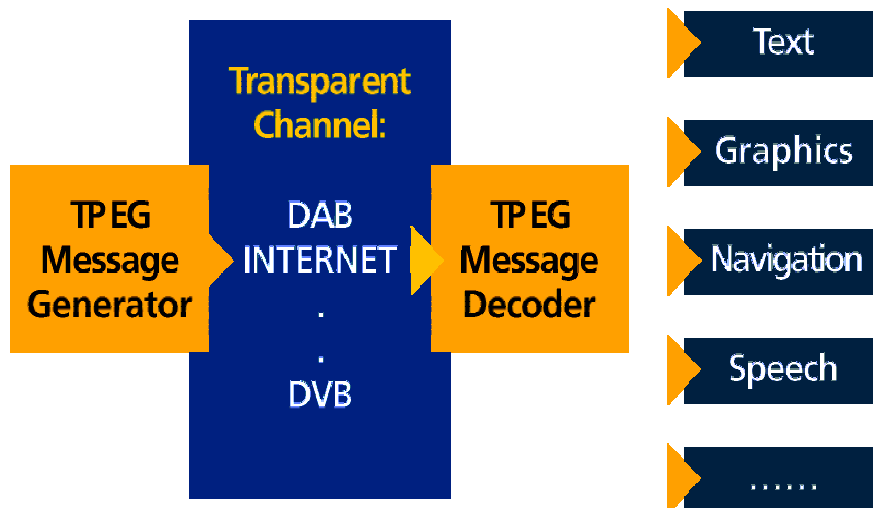
TPEG is an open and IPR-free technology, promoted by the European Broadcasting Union (EBU). All publications of the TPEG Project are therefore freely available to anybody.

An order form can be downloaded from the TPEG Forum web site <http://www.tpeg.org>

Annex 3: The “Quick Guide” to TPEG

JPEG, MPEG and now also TPEG – why?

TPEG is likely to be another milestone in the development of digital data and broadcast technology. It stands for *Transport Protocol Experts Group*. Since, 1997, this group worked under the auspices of the European Broadcasting Union (EBU) and now within the EBU sponsored TPEG Forum. Throughout, the objective has been to develop a new and open international standard for broadcasting language independent and multimodal traffic and travel information. It covers all modes such as road, bus, train, ferry, air traffic and may be distributed over a wide range of digital media (Digital radio/DAB, Internet, DVB, etc.). Language independence means that most message elements are coded by numbers which then permit a presentation by the client device into any language, either as text, or a spoken message or a message represented by a graphical symbol, e.g. inserted into a map display.



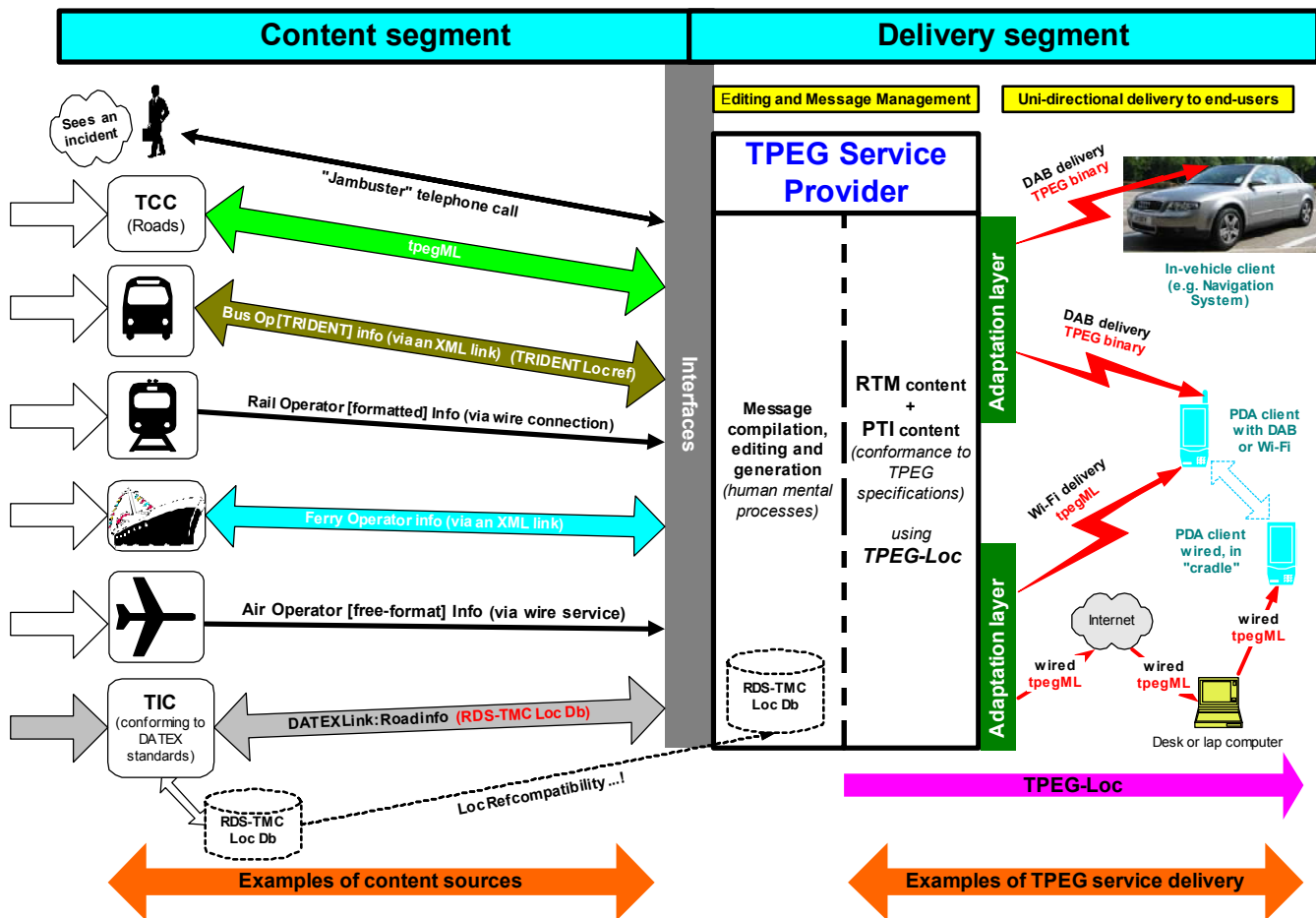
Traffic and Travel Information (TTI) is one type of information that continuously comes out from market research as strongly desired by the European citizen. This is further recognised by the significant support the European Commission gives to research and development in this domain. The TPEG Project is also EC funded. It has the task to validate, with strong industry involvement, the specifications developed by the EBU's TPEG group, to build a consensus on the upcoming new standards and to prepare for an introduction of this technology into new services and products. A likely launch platform for these innovations will be the next IFA in 2005. Test services have already started in the United Kingdom, Germany, and Sweden and now also in Korea. TPEG is also studied as a potential future TTI technology in Japan.

Generally, Public Service Broadcasters in Europe already provide free-to-air TTI through conventional channels such as radio, tv, teletext and in the domain of language independence more recently also RDS-TMC. TPEG technology is built on the experience so far gained with RDS-TMC, but goes some giant steps further. TMC is for road traffic only, mostly inter-urban. TPEG offers fully multimodal information for both urban and rural situations. The messages distributed with this protocol are machine readable (e.g. to be used in navigation systems) and can also be processed for convenient presentation to humans. Many filtering possibilities exist to ensure that the end-user gets only those messages in which he or she is really interested.

TPEG may also be used, as a second step, by commercial service providers to offer TTI services with a range of differing payment methods, on a pay per occasion or even a subscription basis.

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*.

Already developments for delivering *Parking Information* and *Congestion and Travel-Time information* are underway. In the future it seems quite possible that *Environmental Alarms* and *Weather Information* will be delivered (transported) using TPEG technology.



The TTI Content and Delivery segments - TPEG is designed for the Delivery segment, but it is potentially useful in the Content segment, as well.

TPEG allows multimodal, language independent, content to be delivered to all client types, i.e. in-vehicles, in-hand on a PDA (DAB or Wi-Fi) or on the desktop or laptop.

More information

The TPEG Project has produced a detailed information booklet - individual articles can be downloaded from the TPEG Project website at URL: www.tpeg.org. The title of this booklet is **TPEG – What is it all about?** and for the moment it exists in English only.


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. Contact tpeg-info@ebu.ch for more information.

The open TPEG specifications can be downloaded from the EBU website at URL: www.ebu.ch/departments/technical/broadcast_technology/b_tpeg_project.php

The Partners of the EU funded TPEG Project (2000 – 2003) were:

- ◆ Public broadcasters in Germany (SWR and the joint research institute IRT), Sweden (SR) and the United Kingdom (BBC) and last but 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)

Annex 4: The TPEG Project's Press release 2004



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Moving ahead with standardised traffic and travel information

2004-01-30

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A breakthrough broadcast technology designed to deliver Traffic and Travel Information (TTI) has been tested and validated by the TPEG project. Project partners have further developed a new and open international standard for broadcasting language independent multimodal TTI to be distributed over a wide range of digital media.

Use of TPEG industry-wide will allow the development of powerful systems to manage and display travel news. In addition, developers will be able to create systems and be confident of consistent incoming data. The project, which ends in December 2003, builds on the work of the European Broadcasting Union's (EBU) Transport Protocol Experts Group (TPEG), which developed specifications with a view to industry standardisation by CEN and ISO. TPEG is also the name of the transport protocol specifications, already internationally recognised by Japan, Korea and the US.

With strong industry involvement in the 16-member consortium from seven European countries, the IST programme-funded project aims to build a consensus on the upcoming new international standards and prepare to introduce this leading edge technology into new services and products. Market research indicates that European citizens are eager to access TTI services.

A giant step further
TPEG is about collecting, editing and delivering information. Public Service Broadcasters in Europe already collect and deliver wide ranging multimodal content and provide free-to-air TTI through conventional channels such as radio, TV, teletext, and more recently in the domain of language independent RDS-TMC (Radio Data System-Traffic Message Channel). However, the possibility for data delivery provided by Europe's first TTI data technology through RDS-TMC was significantly limited. TPEG technology is built on the experience gained so far with RDS-TMC, but goes a giant step further.

TMC is for road traffic, while TPEG offers fully multimodal information for both urban and rural situations. The messages distributed through this protocol are machine readable, which means they can be used in navigation systems. Messages can also be processed for a convenient presentation to users.

In addition, many filtering possibilities exist to ensure users receive only those messages in which they are interested. TPEG may also be used by commercial service providers to offer TTI services with a range of differing payment methods, on a pay-per-use or even a subscription basis.

TPEG "a real benefit"
TPEG, which is easily implemented using only software, covers all modes of transportation - road, bus, train, ferry, and air traffic - and may be distributed over the full range of digital media, including digital radio DAB (digital audio broadcasting), Internet and DVB (digital video broadcasting). TPEG services are designed to support a wide range of different receiver types: Digital radio, with or without navigation systems; portable travel assistants, with or without a map database; multimedia broadcast receivers; as well as personal computers, notebooks, and PDAs or mobile phones using the Internet.

Language independence means that most message elements are coded by numbers that permit their presentation by the client device into any language, either as text, a spoken message, or a message represented by a graphical symbol (for example, inserted into a map display).

Test services were underway in the UK (country wide), Germany and Austria (from Heidelberg to Salzburg), Sweden (Stockholm), Switzerland (from Geneva to Basel) and now in South Korea, where a national TPEG project started in 2002. TPEG is also being studied as a potential future TTI technology in Japan. Users during the testing phase, such as BBCi, the BBC's Internet and interactive services, report a high level of satisfaction.

"TPEG has given the BBC a standard around which to build our travel and news data infrastructure," says BBC Managing Editor Anthony Pearson. "It gives us location-based data and language independence, a real benefit to us. For example, we can now provide content in Welsh with no additional overhead."

The links on BBCi's site point to a live TPEG test feed and show how it appears using different language files (English, Danish, Dutch, French, German, Swedish, and Welsh). Users can choose either the Road Traffic Message or the Public Transport Message. An XML/XSL enabled browser, such as Internet Explorer 6 is needed to view the files. Information can be accessed from PCs, laptops, pocket PCs, Internet-enabled mobile phones and PDAs.

Future applications

Work on the development of new applications and maintenance of the already existing specifications is continuing within the TPEG Forum, coordinated by the EBU, through the Implementation Task Force. It is exchanging experience from the first implementations and also fixing the priorities for the development of new applications and adaptations to be made within the existing specifications by the Standards Task Force.

TPEG applications can make use of digital radio DAB and the Internet today. However, in some countries digital radio will still take a few years before achieving national coverage across Europe. As a result, the technology still has a relatively short time-window for further validation and consensus building with the industry before full market maturity is achieved on the European scale. A range of TPEG applications will then give all European citizens the ability to receive significantly enhanced multimodal TTI.

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. Developments for delivering parking information and congestion, and travel time information are underway. In the future, environmental alarms and travel weather information could also be delivered.

"The TPEG standard will allow us to interface easily with other TTI systems in the future and will hopefully provide a standard around which the commercial sector can build products and services. The more devices our audience can use to access our content, the better," says Pearson. "I would like to see TPEG expanded beyond road and public transport data to include weather, events and other travel related data."

Pioneer Technology Belgium carried out a feasibility study about the possible integration of TPEG-based functionalities in an in-vehicle navigation system. In the simulation, the end-user drives from Ghent to Brussels airport to pick up a friend arriving from Bologna. The road traffic information is delivered via TPEG-RTM. On the approach to the airport, the end user checks flight information, delivered via TPEG-PTI. The incoming flight can be monitored as the driver approaches the airport. The flight monitor shows a 10-minute delay, which is just fine, as the driver is eight minutes away. In future, the availability of parking at the airport could also be checked.

"A well-timed pan-European approach for service and coverage development is now one of the most important tasks to follow the TPEG project," says Dietmar Kopitz, who coordinated the TPEG project for the EBU. "This process must involve the broadcasters, the electronic industry and also the car industry. A synergy for their objectives of using the new powerful TPEG technology is simply a necessity and prerequisite for the successful market launch of this new European technology. This will also have to include issues concerning a successful migration from RDS-TMC to TPEG."

Source: Based on information from TPEG

Notes to editor:

The IST Results service gives you online news and analysis on the emerging results from Information Society Technologies research. The service reports on prototype products and services ready for commercialisation as well as work in progress and interim results with significant potential for exploitation.

Subject: Information Processing Information Systems; Information Media; Transport

Country: European Union; Switzerland

Institution: Industrial Association; Large Company; Medium Company; Private Research; Public Research

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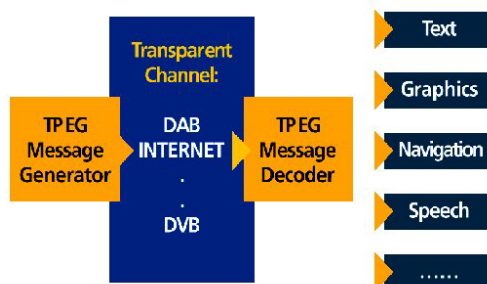


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16 Partners
from seven countries