TPEG - an introduction to the growing family of standards and specifications for Traffic and Travel Information services

Bev Marks (European Broadcasting Union specialist)

Wednesday, 10 June 2009 - 16:00

Location: Room 601, Skempton (Civil Eng) Bldg, Imperial College London

Abstract
In this seminar talk, with PowerPoint slides, Bev Marks - the European Broadcasting Union specialist - will describe the origins of TPEG and the published international standards, together with many new TPEG Applications and their reasons for development. TPEG stands for Transport Protocol Expert Group - a slight parody of JPEG and MPEG - but with no less a serious intention of developing Traffic and Travel Information applications, and even more applications so far not approached for the end-user traveller. TPEG satisfies a key requirement for simultaneous delivery from a single service provision activity to the latest broadcast and internet delivery channels. The TPEG Toolkit provides a language independent solution for TTI service providers by describing a "words" table based hierarchical message construct that allows easy translation and extensions.

Bev Marks will describe the latest status within the Traveller Information Services Association (TISA) which has recently agreed with CEN ISO to be the "excellence centre" for ongoing TPEG specifications maintenance and developments. Currently a number of TISA-Specifications are undergoing TISA Membership review prior to delivery for international standardisation - potentially doubling the size of the current TPEG Standards family!
TPEG – an introduction: standards and specifications for TTI services

2009-June

Bev MARKS, Holly Blue Associates
TPEG Expert, EBU Technical and TISA Steering Board Member

www.ebu.ch  www.tisa.org
Introduction: TPEG started back in 1997; What is TPEG technology for? Content and Delivery segments; TPEG Open standards; “toolkit”; Where does TPEG fit?

- TPEG Applications and Messages
- TPEG-Loc Container
- TPEG-RTM Container and Tables
- The TPEG Forum, RTIG and then TISA
- TPEG Spec.s and Standards; TPEG2; XRC; Profiles
- TPEG in Use: UK; World

- with short question opportunity between sections..
TPEG started way back in 1997

- By autumn 1997 – some leading edge EBU Members realised that the Traffic and Travel Information (TTI) service-data technology known as RDS-TMC would not satisfy an increased demand for multi-modal travel information and it would not last for ever!

- RDS-TMC is a single delivery channel (FM Radio/RDS) constrained (and therefore compressed) data solution

- A replacement system must be much more future proof

- Nevertheless RDS-TMC services supporting vehicle based (on-board) Navi-systems are now expanding across Europe!
What is TPEG technology for?

- End-user focussed TTI services …
- Language-independent structured messages…
- Multimodal TTI - with various applications (RTM, PTI etc)
- A toolkit for other Application developers… (PKI, CTT, WEA)
- From the segments of the TTI domain, TPEG technology was originally focussed on the Delivery (Service Provision) segment
- But we gradually began to see an important use for TPEG technology in the Content Collection segment
Content and Delivery segments

Content segment

- EBU TTI Server - pre-edited content
- Bus Operator info (via wire connection)
- Rail Operator info (via wire connection)
- Ferry Operator info (via wire connection)
- Air Operator info (via wire service)
- Road Traffic Information Centres

Delivery segment

- Editing and Message Management
- Uni-directional delivery to end-users

TPEG Service Provider

Message compilation, editing and generation (human mental processes)
RTM content + PTI content (conformance to TPEG specifications)
using TPEG-Loc

Examples of content sources

Examples of TPEG service delivery
TPEG technology: standardised

- TPEG technology allows delivery on different platforms
  - Digital Radio (DAB/DMB), Internet, Digital TV (DVB)
- Applications were originally developed for Digital Radio
  - BINARY STANDARD (**CEN/ISO TS 18234-Series**) Adopted: 2004-08-27
- Applications developed for message generation (& Internet delivery) using XML
  - tpegML STANDARD (**CEN/ISO TS 24530-Series**) Adopted: 2005-02-04
# TPEG Open Standards – Initial Series

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Introduction, Numbering and Versions</td>
<td>Part 1</td>
<td></td>
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<tr>
<td>Syntax, Semantics and Framing Structure</td>
<td>Part 2</td>
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<td>Service and Network Information application</td>
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<td>Part 4</td>
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<td>Part 3</td>
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<td>Public Transport Information application</td>
<td>Part 5</td>
<td>&lt;mapped&gt;</td>
<td>Part 4</td>
</tr>
<tr>
<td>Location Referencing for applications</td>
<td>Part 6</td>
<td>&lt;mapped&gt;</td>
<td>Part 2</td>
</tr>
<tr>
<td>Introduction, common data types &amp; tpegML</td>
<td>- -</td>
<td></td>
<td>Part 1</td>
</tr>
</tbody>
</table>
TPEG “toolkit”- a universal solution..

- Language independence through Tables concept
- Service provision for map-based and text-based systems
- Client filtering by location co-ordinates and by message content text
- Support for all transport networks (multi-modal and inter-modal)
- Extensible and expandable
  - “toolkit” support for new TPEG Applications …
- Agnostic about bearers
- Every location or area on earth covered with WGS 84 co-ords
Where does Binary TPEG fit? (1)

- ISO OSI Protocol Stack:

Next slide shows the Frame structure..
Where does Binary TPEG fit? (2)

- TPEG Frame structure:

Structure allows for mixing of Services in a data stream!
QUESTIONS?

Next Section will cover: TPEG Applications and Messages..
TPEG Applications (1)

- TPEG Applications are separated for design reasons into different specifications (e.g. Road traffic content differs very much from Public Transport info with timetables etc.)

- Terminology for both: Binary and XML versions:
  - Road Traffic Messages: TPEG-RTM tpeg-rtmML
  - Public Transport Information: TPEG-PTI tpeg-ptiML
  - Location Referencing: TPEG-LOC tpeg-locML
  - Parking Information: TPEG-PKI
  - Traffic Event Compact: TPEG-TEC

- There are already many more abbreviations used in TPEG technology..!
All TPEG Applications have been (endlessly!) analysed to create a simple structure – that embodies user requirements for comprehension and filtering aspects.

Thus a Hierarchical Structure is used to carry TTI content.

More-and-more detail, or less detail, can be used…

Very simple messages can be constructed or very rich content can be delivered.

Language independent… through translatable Tables.

All TPEG Applications use an associated Location Referencing method.
TPEG Messages: a stream

TPEG-Messages were originally designed to be delivered in data streams delivered via DAB, but can also be delivered as files on the Internet.
TPEG Messages: generic structure

TPEG-Message

Message Management Container

Application Container (e.g. TPEG-RTM)

Location Referencing Container
TPEG Messages: a mixed stream

- TPEG-Message
- Message Management Container
- Application Container
  - RTM
- Location Referencing Container
- Application Container
  - PTI
- Location Referencing Container
A TPEG Message - Binary Physical format

- Just a single message – but it does not reveal any functionality, unless you know a lot about the ISO TS18234-Series!

```
2D3C 0100 869B 3E40 C817 3E40 BD55 3E4A
0297 0303 9000 611E 0000 5D03 0108 FFF8
B34B 0057 163D 0205 0703 4138 3202 0C18
0A49 6E76 6572 6761 7272 7902 0A19 0848
6967 686C 616E 6401 08FF F92A 8C00 577C
6F02 0507 0341 3832 020F 180D 4472 756D
6E61 6472 6F63 6869 7402 0A19 0848 6967
686C 616E 6403 0103 8100 0A01 0001 0104
0401 0101 0285 0003 0201 02
```
A TPEG Message - XML Physical format

```xml
<tpeg_message>
  <originator country="UK" originator_name="BBC Travel"/>
  <summary xml:lang="en">A82 Highland - Fallen tree northbound between Invergarry and Drumnadrochit is partially blocking the road. </summary>
  <road_traffic_message message_id="11580" version_number="1" message_generation_time="2003-02-05T07:34:16+0"
start_time="2003-02-05T07:29:25+0" severity_factor="&rtm31_3;"> 
    <location_container language="&loc41_30;"> 
      <location_coordinates location_type="&loc1_3;"> 
        <WGS84 latitude="57.073253632" longitude="-4.783896446"/>
        <descriptor descriptor_type="&loc3_7;" descriptor="A82"/>
        <descriptor descriptor_type="&loc3_24;" descriptor="Invergarry"/>
        <descriptor descriptor_type="&loc3_25;" descriptor="Highland"/>
        <WGS84 latitude="57.334888458" longitude="-4.478613377"/>
        <descriptor descriptor_type="&loc3_7;" descriptor="A82"/>
        <descriptor descriptor_type="&loc3_24;" descriptor="Drunnadrochit"/>
        <descriptor descriptor_type="&loc3_25;" descriptor="Highland"/>
        <direction_type direction_type="&loc2_3;"/>
      </location_coordinates>
    </location_container>
    <obstructions number_of="1"> 
      <position position="&rtm10_1;"/> 
      <object number_of="1"> 
        <object_problem object_problem="&rtm12_2;"/> 
      </object> 
    </obstructions>
    <network_conditions> 
      <restriction restriction="&rtm49_2;"/> 
    </network_conditions>
  </road_traffic_message>
</tpeg_message>
```

Part of the same message - in XML it reveals functionality, without knowing a lot about the ISO TS24530-Series!
QUESTIONS?
But not too many after the last two slides, please!

Next Section will cover: TPEG-LOC.
TPEG-LOC: Requirements

- TPEG-LOC designed for the whole *end-user* community:
  - With Human readable *and* Machine readable needs

- TPEG-LOC designed for many different client types
  - Digital Radios, Navi-systems, PDAs, Computers, etc.

- TPEG-LOC designed for many different applications
  - Road Traffic Messages, Public Transport Information, Parking Information, Congestion and Travel-Time
    - and more: not yet developed
Here we see the first of many TPEG-Tables in use: `<loc41_n>`

Not guaranteed (some links now broken), but look at: [http://www.bbc.co.uk/travelnews/xml/](http://www.bbc.co.uk/travelnews/xml/) for TPEG Tables and “test translations”

*DO NOT COPY for any development work – master Tables are now held by TISA!*
TPEG-LOC: Container structure (2)

Five TPEG-Tables are used and note the one Table is re-used.
TPEG-LOC: Location types <loc01_n>

- **Large Area** (ie radius > 5km) e.g. for fog reports
- **Nodal Area** (ie radius < 5km) e.g. for a rail terminal
- **Directional Segment** e.g. for a traffic queue
- **Intersection Point** e.g. for a slip road closure
- **Framed Point** e.g. for a rural location between two villages
- **Non-linked Point** e.g. point not on a road network
- **Connected Points** e.g. several non-linked points at an airport complex

*Remember these are designed for human end-users, who often do not have a conceptualised map in their head.*
TPEG-LOC: Features (1)

- TPEG-LOC is scalable for Service Providers to implement what they want:
  - e.g. In the case of the early BBC Travel News implementation, it used only WGS 84 co-ordinates..
- TPEG-LOC provides the opportunity to link to internet mapping resources..
TPEG-LOC: Features (2)

- TPEG-LOC produces human comprehensible information and/or Icons, with filtering, in relation with Digital Maps.

- TPEG-LOC is language independent and designed specifically to cope with multiple language locations, where dual language street signs are found.

- TPEG generally, and TPEG-LOC therefore, provide for much client-product differentiation – fuelling the market for many product types.
QUESTIONS?

Next Section will cover: TPEG-RTM Application…
TPEG-RTM: Requirements

- Derived from RDS-TMC, so should map it well
- Needs to provide richer content possibilities than RDS-TMC
- Table based to allow easy language independence
- Suitable for streaming via DAB, but essentially designed to be a bearer independent design
- Extensible for future developments - especially Table additions
TPEG-RTM: Container structure

Next slide explains…
Here we see the TPEG-RTM “Top Level” Classes derived from RDS-TMC, and with potential for added richness through TPEG-Tables offering more detail.
### TPEG-RTM: Classes/Tables (2)

<table>
<thead>
<tr>
<th>Accident</th>
<th>Activities</th>
<th>Road Conditions</th>
<th>Diversion Advice</th>
<th>Facilities Performance</th>
<th>Moving Hazard</th>
<th>Network Performance</th>
<th>Obstructions</th>
<th>Network Conditions</th>
<th>PTI</th>
<th>Security Alert</th>
<th>Visibility</th>
<th>Weather</th>
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<tbody>
<tr>
<td>rtm01</td>
<td>rtm10</td>
<td>rtm10</td>
<td>rtm01</td>
<td>rtm42</td>
<td>rtm10</td>
<td>rtm10</td>
<td>rtm10</td>
<td>rtm10</td>
<td>rtm40</td>
<td>rtm36</td>
<td>rtm17</td>
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<td>rtm31</td>
<td>rtm45</td>
<td>rtm43</td>
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<td>rtm23</td>
<td>rtm45</td>
<td>rtm41</td>
<td>rtm13</td>
<td>rtm29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>rtm10</td>
<td>rtm20</td>
<td>rtm18</td>
<td>rtm10</td>
<td>rtm10</td>
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<td>rtm21</td>
<td>rtm47</td>
<td></td>
<td>rtm14</td>
<td>rtm30</td>
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<td>rtm47</td>
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<td>rtm22</td>
<td>rtm49</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>rtm20</td>
<td>rtm15</td>
<td>rtm35</td>
<td>rtm33</td>
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<td>rtm01</td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>
A typical TPEG-Table used to give detail to the “Top Level” Class Network Performance is:

If you know RDS-TMC you will recognise this!

TPEG-Table rtm34: network_performance_status

<table>
<thead>
<tr>
<th>Code</th>
<th>CEN-English ‘Word’</th>
<th>Comments</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>unknown</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>stationary traffic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>queuing traffic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>slow traffic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>heavy traffic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>freely flowing traffic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>sheer weight of traffic</td>
<td>Used in scripts</td>
<td></td>
</tr>
<tr>
<td>255</td>
<td>advice</td>
<td>- the table default word -</td>
<td></td>
</tr>
</tbody>
</table>
The **biggest** Table (rtm10: position) has 106 out of 255 possible entries used – to date
- plenty of room for expansion..

The **smallest** Table (rtm46: unverified_information) has just 2 out of 255 possible entries used!

“**ghost drivers**”* were not forgotten.. (rtm36: security_alert_type)
* a term well known in Germany but only used recently in UK broadcasts some 9 years after its inclusion!

These Tables provide “very good mapping” of RDS-TMC *(quote from the IRT)*
QUESTIONS?

Next Section will cover: TPEG Forum, RTIG and TISA.
The TPEG Forum was established by the European Broadcasting Union with the following objectives:

- To encourage implementation of TPEG in services and products
- To facilitate exchange of information about practical implementation of TPEG
- To maintain the existing TPEG standards
- To develop new applications of TPEG and, where appropriate, to develop new specifications

The TPEG Forum was built on the 7 years of work on TPEG by the EBU's B/TPEG group and in parallel 3 years of the TPEG Project.
Working with others in the Traffic and Travel Information domain:

- CEN and ISO for International Standardisation
- Road Traffic Information Group – a joint TMC Forum and TPEG Forum activity – “bringing the development of TTI technology into focus”
- EBU TTI Group – using TPEG in the Content Segment
RTIG – Origins

- Established by an ad hoc meeting held at London airport Heathrow Terminal 4 on 2004-06-11, representing:
  - TMC Forum management
  - TPEG Forum management
- Mutual recognition that co-operation in the individual technologies and their service potentials is necessary
- Nevertheless keeping both Forums independent, but permitting a consensus building dialogue

Notice how the individual Forums were quite at arms length originally!
RTIG – Aims

- RTIG was created to ensure synergy from the development and operation of TMC and TPEG technologies for the best progress and development of future Road Traffic Information (RTI)

- By analysing the fundamental market focussed requirements and their links to TMC and TPEG technologies and services
  - Open to all TMC and TPEG Forum members
  - Joint Chairmen of TMC¹ and TPEG² Forums
  - Supported with Secretariat by ERTICO (with assistance from TPEG Forum Secretariat)

¹ Danny Woolard, formerly ITIS plc ² Bev Marks, EBU
Loc Ref situation is complex and involves “sticky” IPR issues as well as technology challenges

- TPEG Forum offered a solution for RDS-TMC codes in TPEG-Loc
- TPEG Forum suggested a solution for including separately standardised AGORA-C Loc Ref in TPEG
- TPEG Forum proposed a unified solution, but this was still some way off wider understanding/acceptance

- TPEG Forum accepted the RTIG input ideas and responded with the plan for development of a worldwide solution…

- Delegates needed to better understand the issues of Loc Ref and the GST IP SAF CHAN Project was informed…
RTIG transformed into TISA

- TPEG Forum and TMC Forum combine in 2007
  - new name / new structure / new organization
  - First General Assembly 2007-11-21 - Berlin at T-Systems

- Traveller Information Services Association
  - market driven / integrated approach / helping transition
  - fee based (€4200/year)
  - independent – but still strongly supported by EBU

- Sectors covering:
  - Content, Services, Standards, Systems Management (e.g. AIDs SIDs etc)
TISA Positioning

- TISA has negotiated with the Standards Organisations to become the worldwide excellence centre for TMC and TPEG
  - Amended and future TISA Specifications being drafted and submitted to CEN and ISO for European and International standardization
  - Potentially some TISA Specifications will be handled by ETSI
- International Standards
  - Provide the Open Standards platform for (worldwide) service/client implementations
Current TISA work on TPEG

- Carried out in the **TPEG Applications Working Group (TAWG)** and its Task Forces
- Driven by Use Case Proposals (from any member)
  - Market driven assessment made widely within TISA
  - Minimum parties to undertake work = 3 or 4
- Current work is shown on the Road Map (next slides)
  - Each TF is designated W-nnn (the potential abbreviation for application in future)
QUESTIONS?

Next Section will cover: TISA Specifications and Standards.. - including Profiles
# TPEG Specifications & Standards - Road Map (1)

## Current CEN ISO Published Standards
- CEN ISO/TS 18234-1 TPEG-INV
- CEN ISO/TS 18234-2 TPEG-SSF
- CEN ISO/TS 18234-3 TPEG-SNI
- CEN ISO/TS 18234-4 TPEG-RTM
- CEN ISO/TS 18234-5 TPEG-PTI
- CEN ISO/TS 18234-6 TPEG Loc (+1)

## CEN ISO/TS 24530-1 TPEG XML
- Intro & tpegML

## Current TISA XML Development Work
- Amendment CEN ISO/TS 24530-1 Intro., cdt & tpegML

## Current TISA Profile Development Work
- TPEG Profiles: Guidelines to general concept
- TPEG Automotive Profile
- Public Service Media Profile

## Current TISA Binary Development Work
- Amendment CEN ISO/TS 18234-1 TPEG-INV
- Amendment CEN ISO/TS 18234-2 TPEG-SSF
- Amendment CEN ISO/TS 18234-3 TPEG-SNI

## Current TISA Adaptation Layer Profile Development Work
- ETSI TS nnn nnn-1 TPEG Adaptation Layer TPEG-DAB/PHDG
- For potential delivery to ETSI
- TFS work-in-progress

## Possible Future Development Work
- CEN ISO/TS 18234-8 TPEG CTT
- Stages of progress: T/RWG (normal)
- TISA member vote: 4 week review (+) = in progress
- Pending publication of TISA IPR rules
TPEG Generation 2..

- TPEG2 - UML modelled for each application
  - Easier for non-technical experts to assist the analysis processes that will define the hierarchical structures
  - Each application will have a single model from which both Binary and XML physical formats will be derived
    - Other physical formats could also be derived from the same model
- TISA has added huge value by defining specific TPEG conversion rules from UML to Binary and XML
  - allowing, effectively, automatic Specification generation
TPEG Specifications for TPEG Generation 2

- ISO/TS 21219-1: TPEG2-BMV
  - Planned for 2009-Q3
  - No UCP
  - Maps content from TS18234-1

- ISO/TS 21219-2: TPEG2 UML modeling rules
  - Planned for 2009-Q2
  - No UCP
  - Work-in-progress

- ISO/TS 21219-3: TPEG2 UML to binary conversion rules
  - Planned for 2009-Q1
  - No UCP
  - Work-in-progress

- ISO/TS 21219-4: TPEG2 UML to XML conversion rules
  - Planned for 2009-Q2
  - No UCP
  - Work-in-progress

- ISO/TS 21219-5: TPEG2-SSF
  - Planned for 2009-Q3
  - No UCP
  - Maps content from TS18234-2-Amend

- ISO/TS 21219-6: TPEG2-SNI
  - Planned for 2009-Q2
  - No UCP
  - Maps content from TS18234-3

- ISO/TS 21219-7: TPEG2-LLC
  - Planned for 2009-Q2
  - No UCP
  - Maps content from TS18234-11

- ISO/TS 21219-8: TPEG2-XRC
  - Planned for 2009-Q1
  - No UCP
  - Work-in-progress

- ISO/TS 21219-9: TPEG2-LOC
  - Planned for 2009-Q2
  - No UCP
  - Upgrade over TS18234-6

- ISO/TS 21219-10: TPEG2-CAI
  - Planned for 2009-Q2
  - No UCP
  - Maps content from TS18234-10

- ISO/TS 21219-11: TPEG2-RTM
  - Planned for 2009-Q1
  - UCP issued
  - Upgrade over TS18234-4

- ISO/TS 21219-12: TPEG2-PTI
  - Planned for 2009-Q2
  - No UCP
  - Upgrade over TS18234-5

- ISO/TS 21219-13: TPEG2-PKI
  - Planned for 2009-Q1
  - No UCP
  - Maps content from TS18234-7

- ISO/TS 21219-14: TPEG2-PPC
  - Planned for 2009-Q2
  - No UCP
  - Maps content from TS18234-9

- ISO/TS 21219-15: TPEG2-TEC
  - Planned for 2009-Q1
  - No UCP
  - Work-in-progress

- ISO/TS 21219-16: TPEG2-FPI
  - Planned for 2009-Q2
  - UCP issued
  - TF established

- ISO/TS 21219-17: TPEG2-WEA
  - Planned for 2009-Q1
  - UCP issued
  - TF established

- ISO/TS 21219-18: TPEG2-TFP
  - Planned for 2009-Q2
  - UCP issued
  - TF established

- ISO/TS 21219-19: TPEG2-???
  - Planned for 2009-Q2
  - UCP issued
  - TF established

NOTES:
1. There is NO Part number mapping from ISO 10224 Series
2. Generic UCP for "top row" development work to be drafted
3. TISA membership
4. 4-week reviews
TPEG-XRC – a planned new facility

One of the key original concepts of TPEG was that it should be extensible. We have invented a new container that will soon be developed to add new functionality!

XRC allows messages from same or differing applications to cross reference each other, regardless of MGT
TPEG Profiles

Notice how SNI is a requisite and how the specific location referencing method is fixed.
QUESTIONS?

Next Section will cover: TPEG in use now..
EBU TTI Message Exchange System:

- Uses tpeg-rtmML at its core
- EBU members deliver tpegML content to Server in Geneva and EBU members can access cross-border information, in their own language regardless of input language, already edited for broadcast!
  - To an ftp server to ingest into own message generation system
  - Or via private webpage for instant viewing
TPEG in use: UK

- BBC have a long standing TPEG-RTM test running on DAB (but probably not current standard usage?)
- Traffic Master & ITIS conducting TPEG Binary tests on DAB
- BBC uses tpeg-rtmML to receive data from content provider, Trafficlink. tpeg-rtmML is used for processing and delivery to public-facing (web, mobile & interactive tv) services
- UK Highways Agency using tpeg-locML to deliver content to Google Maps and TomTom, for GPRS service
TPEG in use: World

- **Europe**: EBU Members exchanging tpeg-rtmML content: ORF Austria, BBC, WDR Germany (ARD collective) & others, Radio France, NRK Norway (converted to RDS-TMC format for delivery, also), SRG SSR idée suisse (with Viasuisse) and VRT Belgium

- **Germany**:
  - BR (Munich area) conducting TPEG Binary tests (e.g. TEC) on DAB …

- **USA**:
  - Ibiquity testing TPEG services using HD Radio’s Advanced Application Services (e.g. TFP)

- **South Korea**:
  - KBS delivering TPEG services via DMB (e.g. RTM, SNI, CTT, etc)
THANK YOU FOR YOUR ATTENTION TO THIS PRESENTATION…

SOME MORE QUESTIONS?

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