ITU Symposium on “The Future Networked Car”

Location referencing and maps

Mediamobile

Technology and content expertise

We launched the first RDS-TMC service in France
with Renault

We built the first European Connected Service

BMW ConnectedDrive

We started the first DAB-TPEG Service in Germany

V-Traffic Premium DAB on air since May 2013

Different Channels / Different Benefits



	RDS-TMC	DAB-TPEG	TPEG over IP
Delivery	One-to-many	One-to-many	One-to-one
Informed road network	++	+++	+++
Service accessibility (network cov.)	+++	+++	++
Lifetime access	✓	✓	✗
Costs for user	+++	+++	+
Cost for OEM	+++	+++	+
Interactive	✗	✗	✓
Ease of use	+++	+++	+
Anonymous	✓	✓	✗
Safe for driving	+++	+++	+

Getting the best of both worlds …

…vehicle connectivity will go HYBRID

GSM

Interactive, personal, customisable…

- ANY internet content
- Social & community services
- Personalized data delivery
- eCall

BROADCAST

Fast, reliable, scalable, cost-effective…

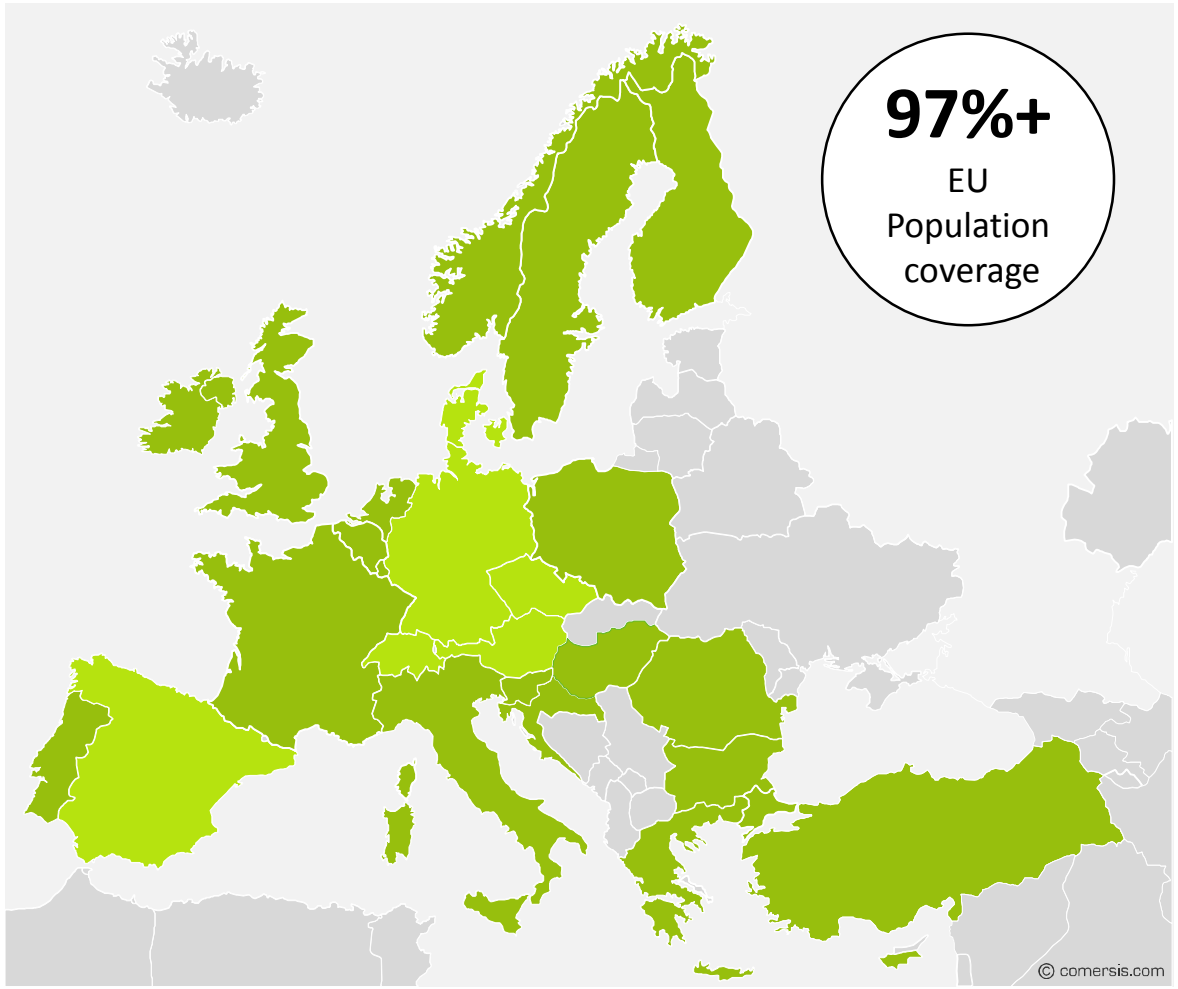
- Always “on”
- No bandwidth saturation
- Works at all speeds
- Anonymous

Two-way-communication

Reaches millions of people simultaneously

V-Traffic Pan-European RDS-TMC

Mediamobile and partners



+15 million licenses already sold

Most successful telematics application – ever !

21 Premium TMC markets covered :

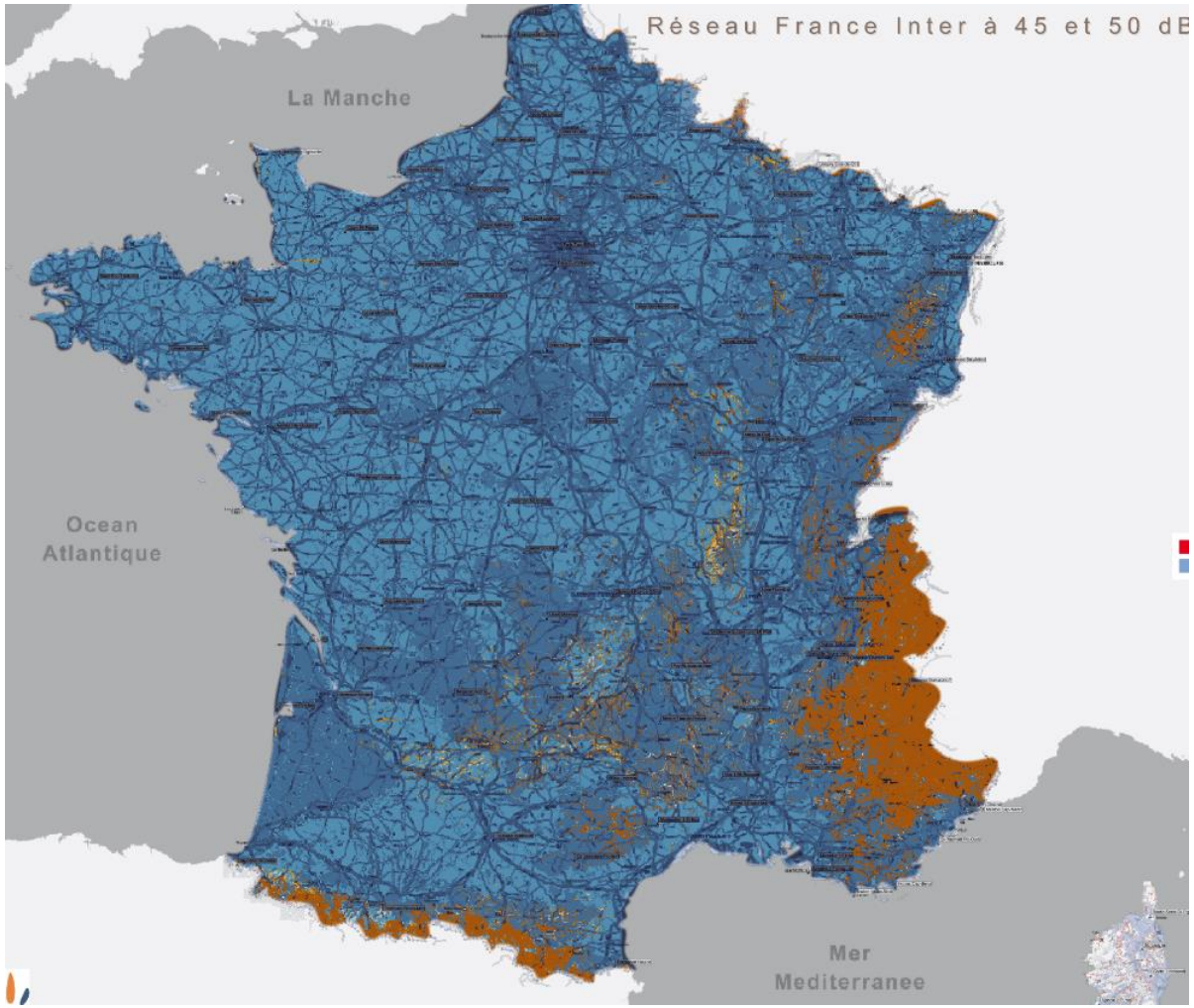
Belgium, Bulgaria, Croatia, Finland, France, Greece, Hungary, Ireland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Romania, San Marino, Slovenia, Sweden, Turkey, UK, Vatican City

Mediamobile & partners (21)

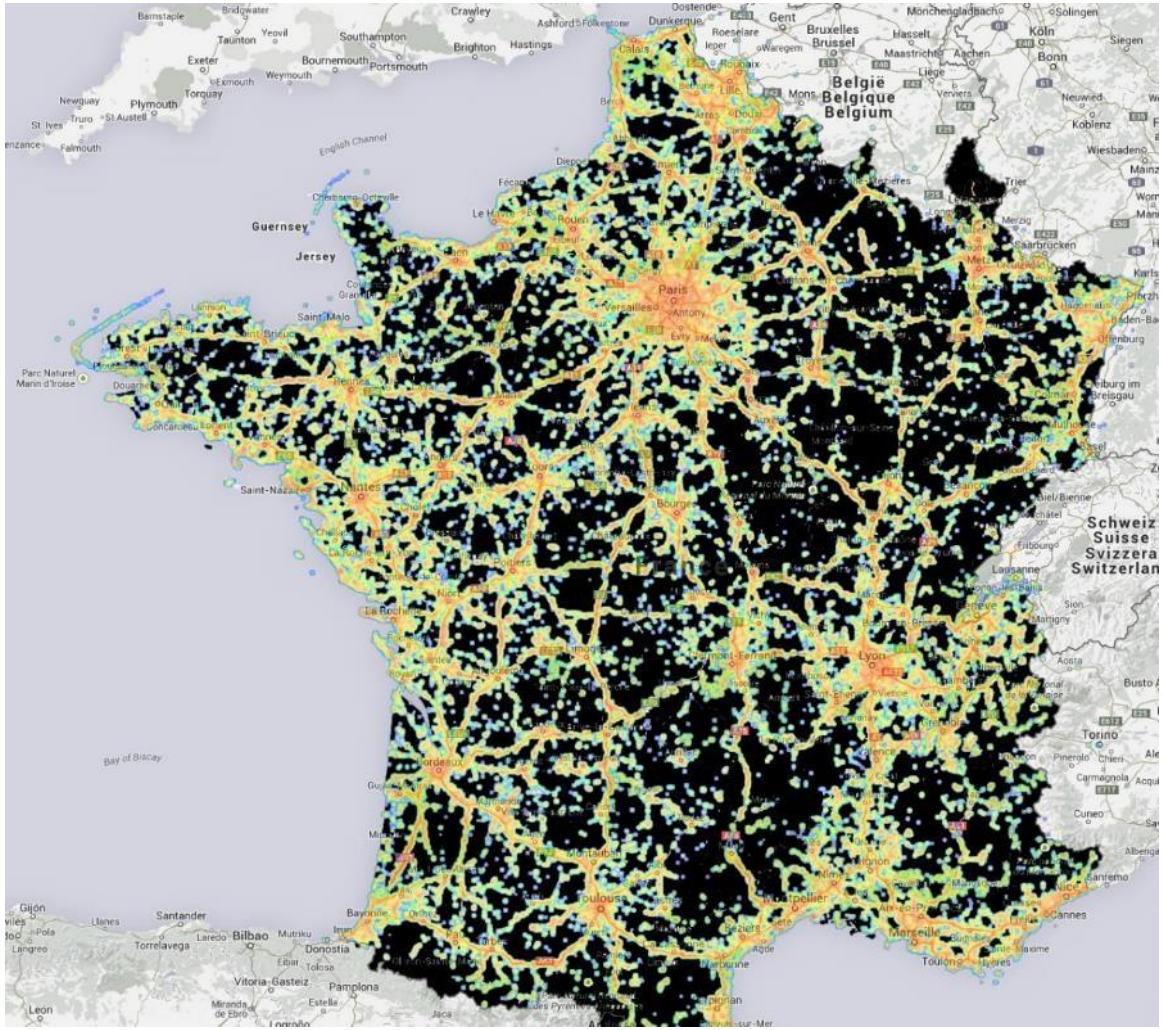
Public services (10)

France Coverage Comparison - FM vs 3/4G

France Inter 50 dBµV/m

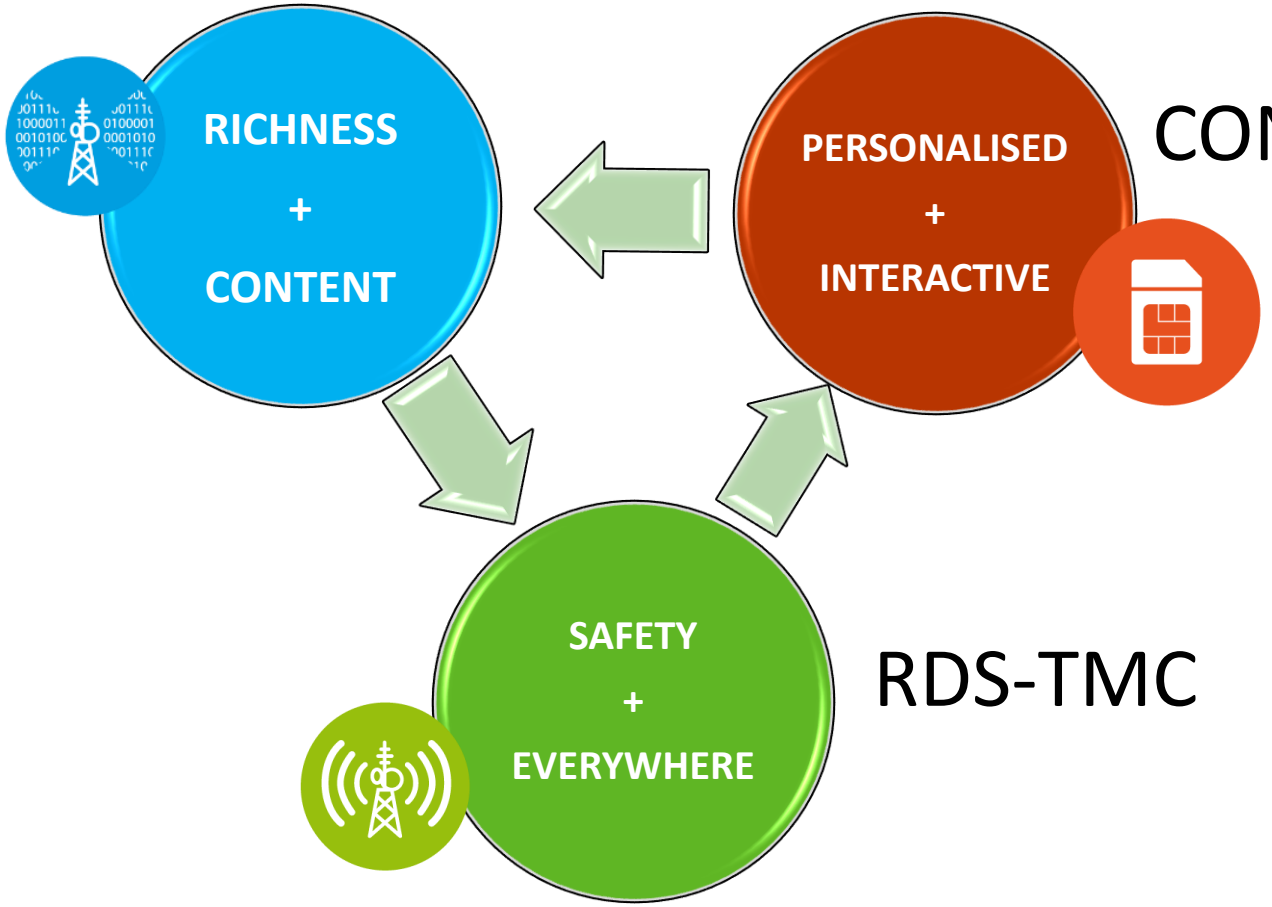


Bouygues 3/4G



V-Traffic – now bringing technologies together

DAB-TPEG



CONNECTED-TPEG

RDS-TMC

Optimising **cost**, **content** and **performance**

The IDEAL Location Referencing Method

What are the requirements for traffic services?

In terms of usage

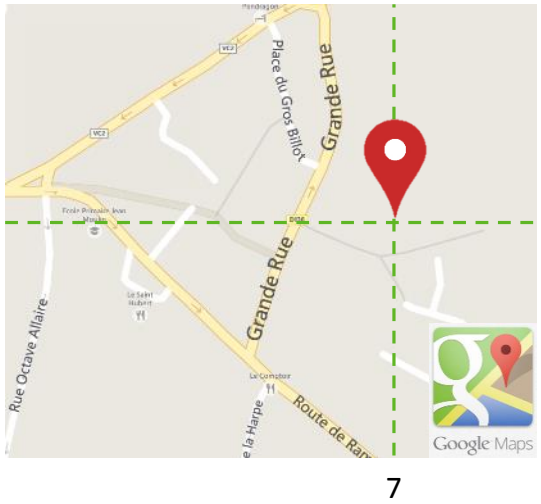
- ✓ Deliver accurate traffic information on every road
- ✓ As precise as possible
- ✓ As fast as possible

In terms of manufacturing

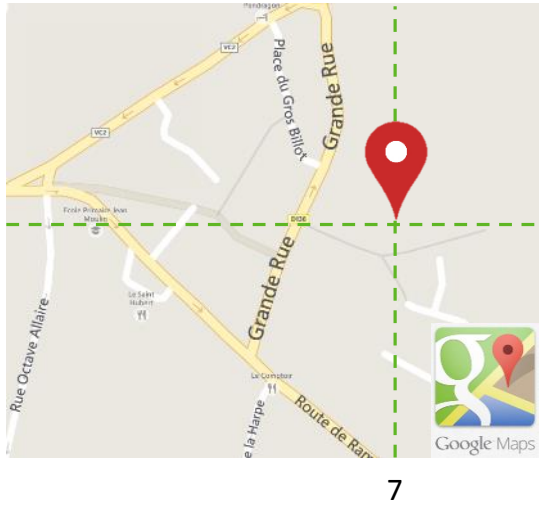
- ✓ Compatible : suitable for all receivers, software, networks
- ✓ Cost efficient (hardware/bandwidth)
- ✓ Solid performance & scalable

Location Referencing - Introduction

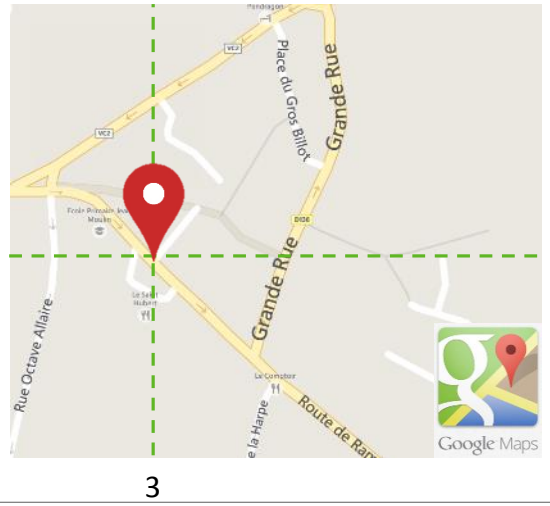
Why geo-coordinates aren't used for location referencing on traffic services



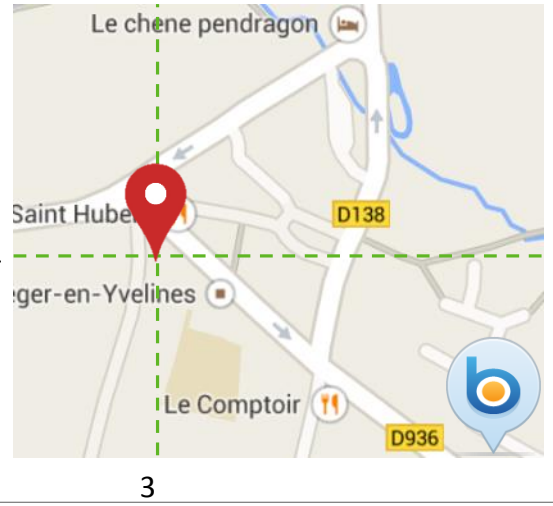
(lat,long) → (lat,long)



- Coordinates don't guarantee matching to road segments



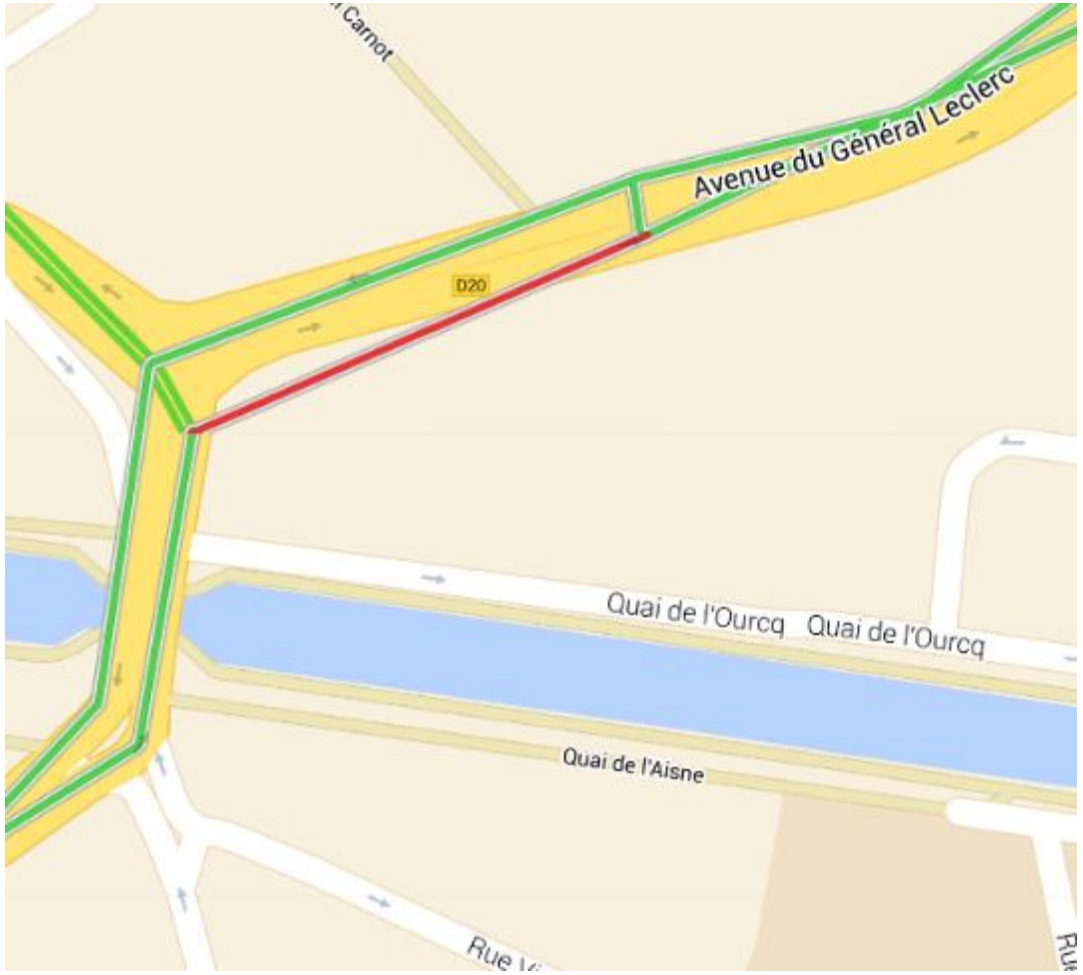
(lat,long) → (lat,long)



- Map references can differ between maps

Back to Basics : TMC Encoding Principles

TMC location tables are ‘THE’ automotive industry standard



- Location tables are used as <u>map independent</u> coordinate references.
- Decoding tables provide a common vocabulary to describe traffic situations

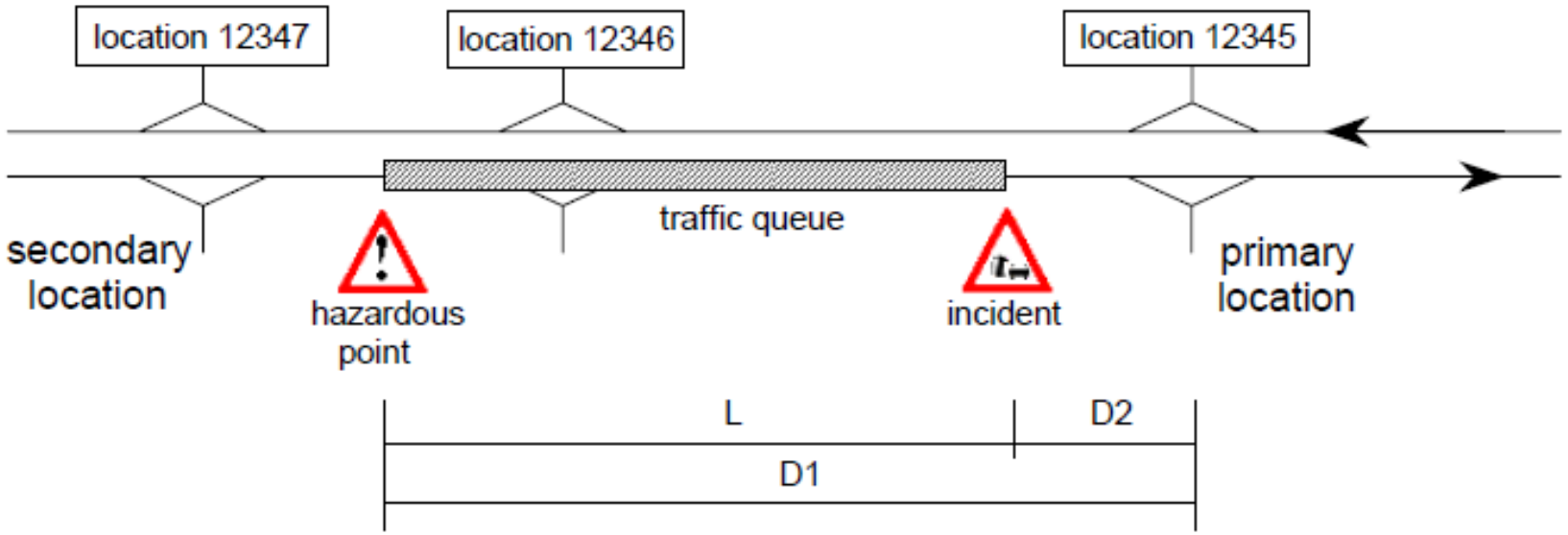
e.g. slow traffic at a junction direction north-east is encoded as “252” “11388” “+1”

252 for type of event = slow traffic
11388 its localization = ave Gén Leclerc
+ for road direction
1 = event length in km

- Standardised, efficient
- Originally designed for TMC broadcasting

TMC Location Referencing Method

PLR = Precise Location Referencing



With PLR offsets on the TMC table you are able to specify the location of an incident, between TMC location nodes.

Example of the TMC Location Table in France

Setra v9.2 versus v10

New location table for France (v10)

- Paris, Lyon, Marseille, Nantes have been more detailed
- Nice, Strasbourg, Montpellier, Lille, Grenoble, Angers, Aix, Clermont-Ferrand, Tours, Orléans, Rouen have been newly encoded
- Inter city roads have been created : 82 National roads, and 585 Departmental roads

- Now: +26k location points (+65%)
- 185 000 km roads covered (+49%)

Table certified by Tisa 4/3/13

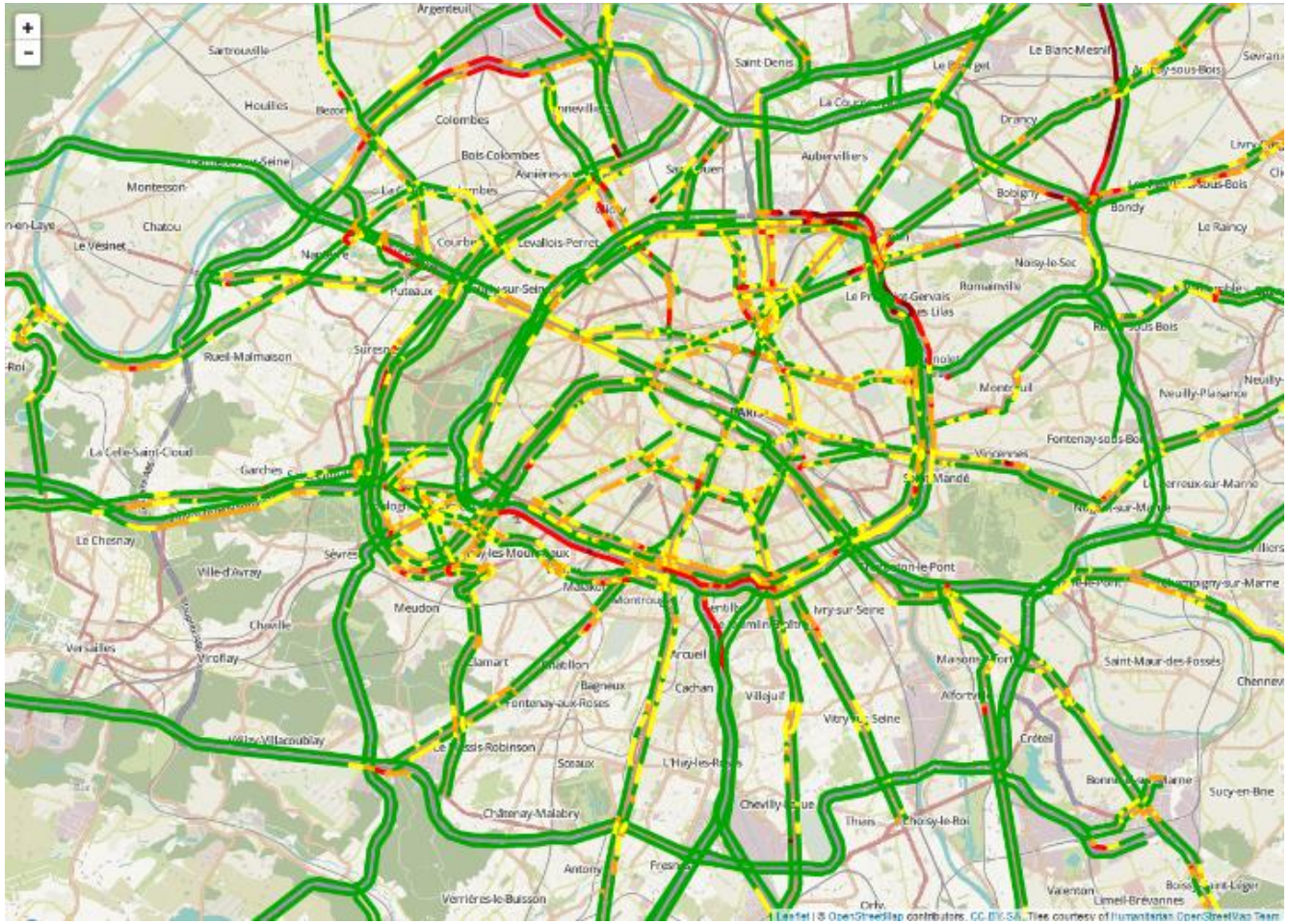
	Setra 9.2	Setra 10.1	increase
Ref points	15 731	25 984	65%
TMC segments	27 689	44 512	61%
Road coverage	123 861	184 913	49%

Today ALL TPEG services make use of the TMC LR

- TPEG-TEC : traffic events (accidents, roadworks, traffic jams …) with Precise Location
- TPEG-TFP (Traffic Flow) : making use of a combination of the TMC AND metric offsets.

Advantages:

- ✓ TMC link aggregation (reduces the number of messages)
- ✓ Excellent accuracy (down to 10 meter)
- ✓ Optimal efficiency



TMC Location Referencing Limitations

1. TMC LR covers a portion of the road network (varies by country)
2. Location Table maturity & development varies from one country to the other.
3. In some countries only private tables exist e.g. UK

In order to overcome the intrinsic limitations of pre-coded location tables, several Dynamic Location Referencing methods(DLR) has been developed, with distinctive pros and cons.

The number of co-existing and competing DLR technologies is an issue when making a choice of technology.

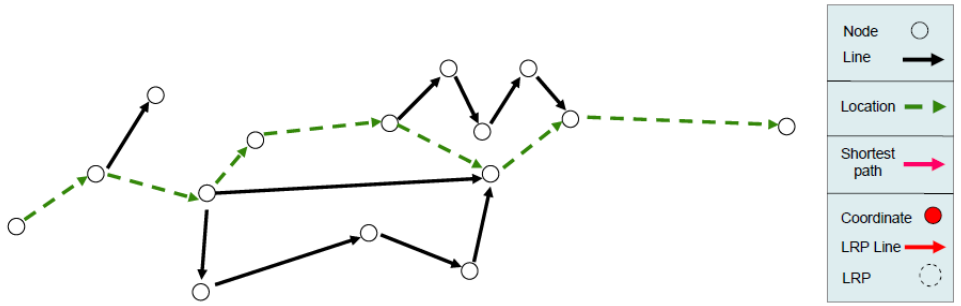
For this presentation we take the example on TPEG-OLR (OpenLR™ version specified by TISA)

How to deal with traffic info events located outside of the Location Table?

TPEG-OLR Location Referencing Method

Basic principles

- Basic idea: a concatenation of a shortest path between location reference points (LRPs) covers the location completely
- At least two LRP needed for start and end of the location
- Intermediate LRPs serve as a guide for the route calculation



*Abstract from "**OpenLR™ initiative" presentation** Version: 19/10/2009 _ Copyright © 2009-2012 TomTom International B.V.*

OLR defines an algorithm for dynamically generating location references :

PROS:

- Covers the complete road network
- Compact format for transmission (compared with other DLRs)
- Can handling map differences caused by different map vendors or versions
- No pre-coded data inside the receiver except the map itself.

CONS:

- Requires a map inside the end user terminal
- 100% data volume overhead between OLR and TMC
- Necessitates a more powerful end user terminal in terms of memory and processor performance

Data VOLUME Determines Cost & Speed Performance

TMC Location reference

```
<lrc:method>
  <lrc:optionTMCLocationReferenceLink>
    <tmc:locationID>11285</tmc:locationID>
    <tmc:countryCode>15</tmc:countryCode>
    <tmc:locationTableNumber>32</tmc:locationTableNumber>
    <tmc:direction>false</tmc:direction>
    <tmc:bothDirections>false</tmc:bothDirections>
    <tmc:extent>1</tmc:extent>
  </lrc:optionTMCLocationReferenceLink>
</lrc:method>
```

OLR Location reference

```
- <lrc:method>
  - <lrc:optionOpenLRLocationReferenceLink>
      <olr:version>1.0</olr:version>
    - <olr:locationReference>
      - <olr:optionLinearLocationReference>
        - <olr:first>
          - <olr:coordinate>
              <olr:longitude>228098</olr:longitude>
              <olr:latitude>2049987</olr:latitude>
            </olr:coordinate>
          - <olr:lineProperties>
              <olr:frc olr:code="3" olr:table="olr001_FunctionalRoadClass"/>
              <olr:fow olr:code="3" olr:table="olr002_FormOfWay"/>
            - <olr:bearing>
                <olr:value>102</olr:value>
              </olr:bearing>
            </olr:lineProperties>
          - <olr:pathProperties>
              <olr:lfrcnp olr:code="3" olr:table="olr001_FunctionalRoadClass"/>
            - <olr:dnp>
                <olr:value>96</olr:value>
              </olr:dnp>
              <olr:againstDrivingDirection>false</olr:againstDrivingDirection>
            </olr:pathProperties>
          </olr:first>
        - <olr:last>
          - <olr:coordinate>
              <olr:longitude>134</olr:longitude>
              <olr:latitude>-83</olr:latitude>
            </olr:coordinate>
          - <olr:lineProperties>
              <olr:frc olr:code="3" olr:table="olr001_FunctionalRoadClass"/>
              <olr:fow olr:code="3" olr:table="olr002_FormOfWay"/>
            - <olr:bearing>
                <olr:value>216</olr:value>
              </olr:bearing>
            </olr:lineProperties>
          </olr:last>
        - <olr:positiveOffset>
            <olr:value>0</olr:value>
          </olr:positiveOffset>
        + <olr:negativeOffset>
        </olr:optionLinearLocationReference>
      </olr:locationReference>
    </lrc:optionOpenLRLocationReferenceLink>
</lrc:method>
```

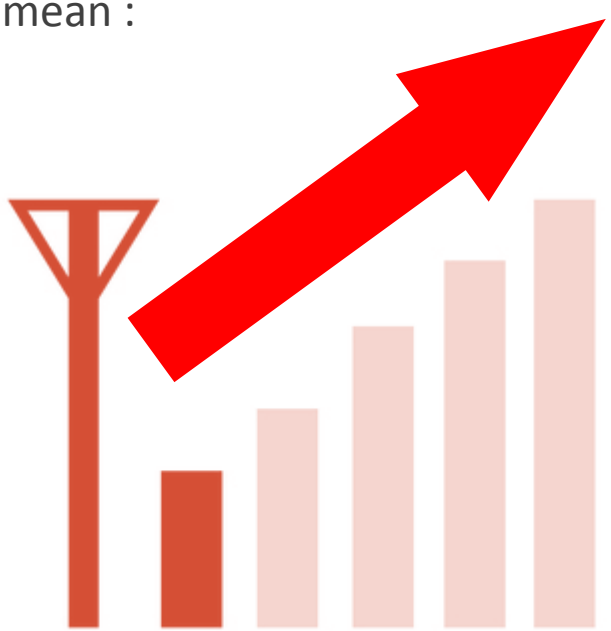
Is it WISE to use OLR only ?

In Paris during peak hours our services are updated up to every minute with over 250 TEC messages, and around 400 TFP live messages and traffic situations. Using OLR only would mean :

More CPU power

=

Increased hardware cost
OR bad performance



Bandwidth up 100-150 %

=

Increased data cost

Byte SIZE matters…

Comparing various LRMs for Traffic Event information

	TMC LRM	ETL LRM	OLR LRM
Max number of locations	65 536 per table	65 536 per table	Unlimited
Message size when used in TMC	2 bytes, with PLR 6 bytes	N/A	N/A
Size when used in TPEG	12 bytes, with PLR 16 bytes*	15 bytes*	TEC: 46 bytes* TFP: 226 bytes**

**subject to 50% compression rate*

*** equivalent of a message using TMC over 10 links*

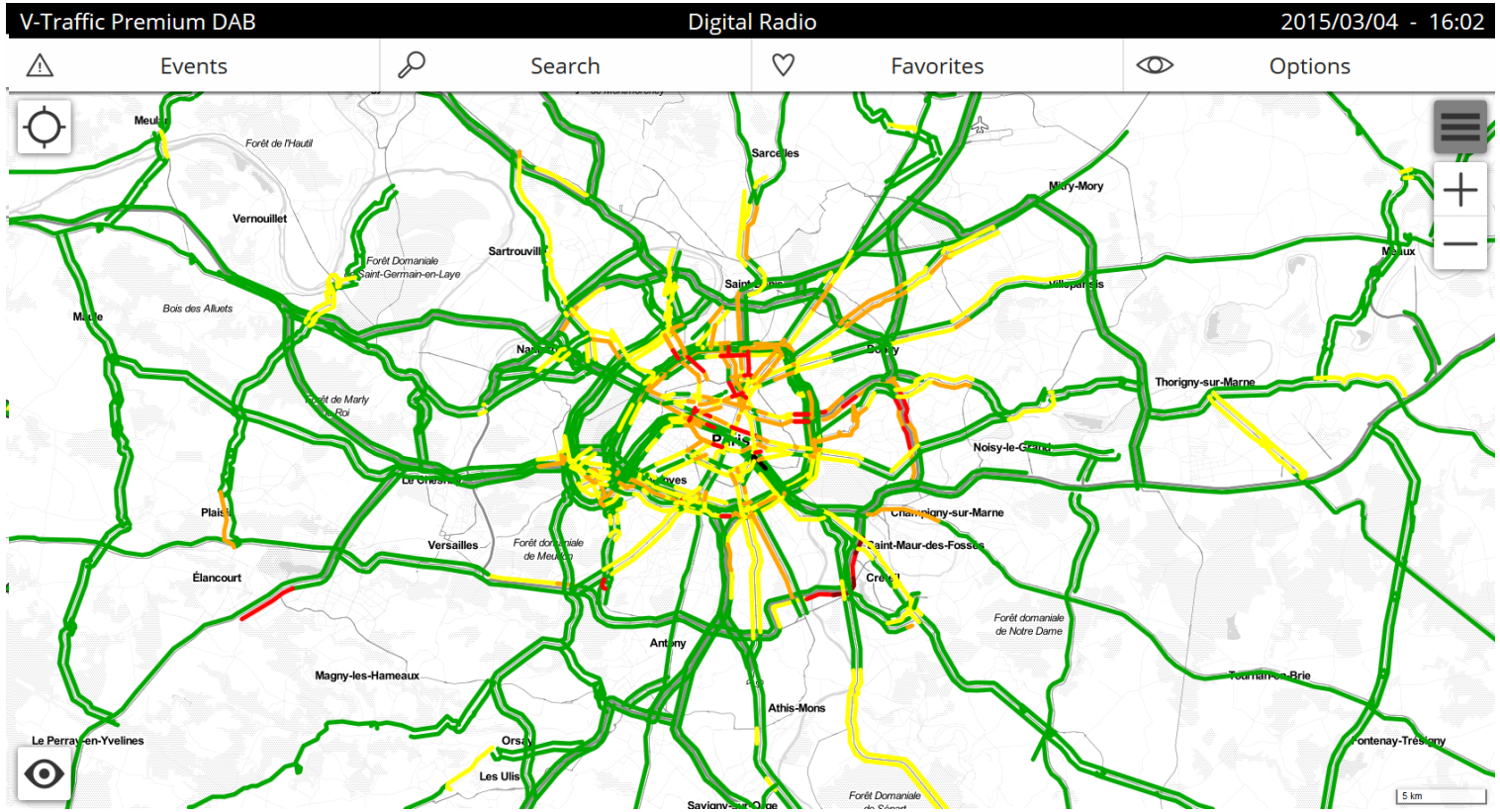
How about making TMC LR and OLR work together?

V-Traffic TPEG services make use of TMC and OLR LRMs in parallel

#1: Using TMC LR where available

#2: Relying on OLR for events and flow data outside the TMC LR

NOTE: As the TMC tables improve, the amount of OLR locations decreases, making the combination of methods more efficient over time.



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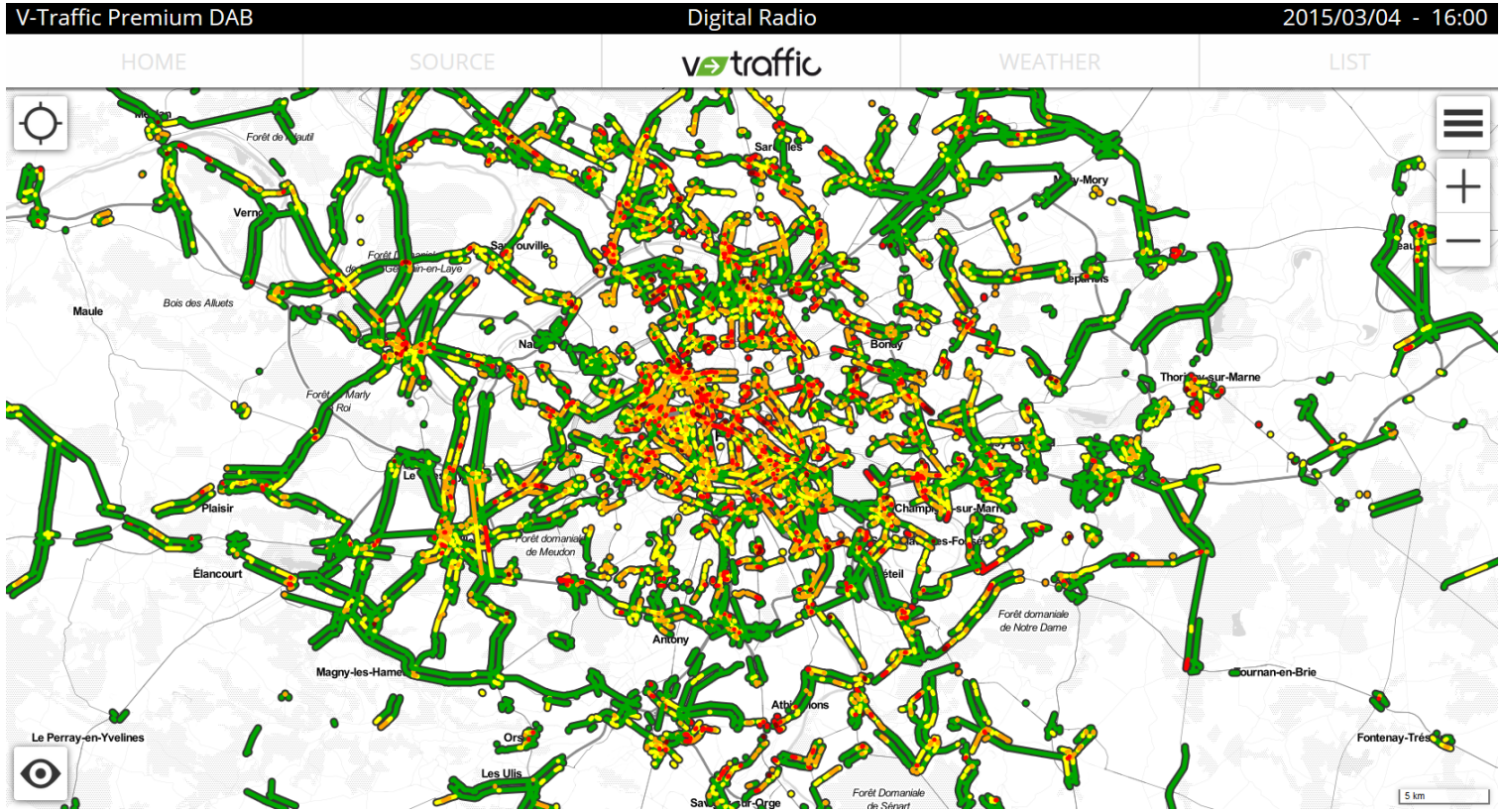

Conclusion

TPEG specifications allow different LRMs for each message

V-Traffic service use a combination of LR methods to get the best of all worlds :

① **TMC with offsets** - compact, robust and proven. Does the job where available

② **ETL** (Extended TMC Location) for slip road (exits, entries) etc

③ **OLR** for traffic situations located outside the TMC table

This hybrid strategy preserves the unique features of the TMC LRM:

Suitable for all types of receiver capabilities and price ranges

Minimum bandwidth consumption for Traffic events and Traffic flow information

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