



## Work Item F0031 Virtual Lane Closure

December 5th, 2022

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05 Dez. 2022

WI F0031 Virtual Lane Closure – 4<sup>th</sup> Regular Meeting



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## Agenda

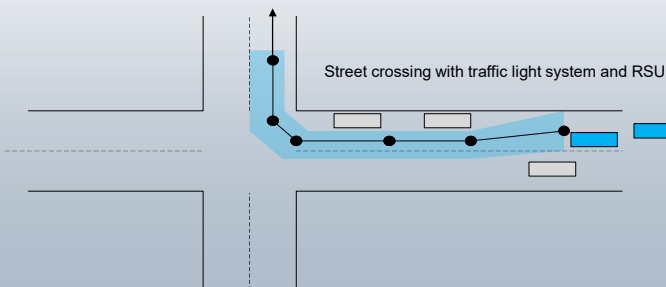
1. Results
2. Example use case
3. Encoding concept
4. Encoding rules
5. Encoding ASN1
6. Delimitation to IVIM
7. Results
8. Preview on Profiles
9. Further process
10. Discussion



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## Example Use Case

- Blocked lane on a red traffic light
- Emergency services vehicles (ESV) approach from the right
- ESV or RSU send DENM with RelevaceArea before reaching the blockade
- RelevaceArea encodes the are that is intended for the ESV
- DENM receivers have time to clear the path before ESV arrive



## Encoding concept

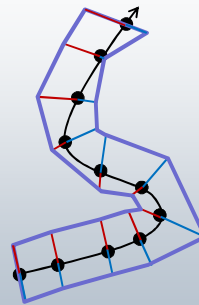
Accepted proposal: Trace of points with variable offsets to the left and right

RelevanceArea

RelevancePoint

borderOffsetToLeft

borderOffsetToRight



Proposed by Jasja Tijink in a C2C regular telco

## Proposed encoding rules

### General rules

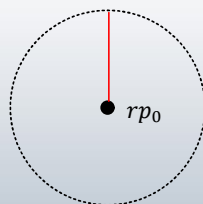
- One DENM for one event e.g. rescue and recovery in process
- Up to 16 separated areas can be encoded in one DENM
- One coherent area can be encoded in as one sequence of relevancePoint[s]
- If one relevancePoint only has borderOffsetToLeft encoded, the second offset borderOffsetToRight has the same length as borderOffsetToLeft

Results of a DLR Workshop: Lukas Merk,  
Sten Ruppe and Maik Bargmann

## Proposed encoding rules (2/3)

### Circle

- If the area consist of only one relevance point the encoded area is a circle
  - In this case the optional border offset should not be used



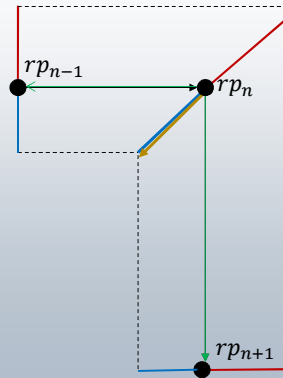
Results of a DLR Workshop: Lukas Merk,  
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## Proposed encoding rules (3/3)

### Multiple point area

- If the area consist of more than one relevance point the encoding is based on orthogonal vectors as shown

1. Create for each relevance point<sub>n</sub> ( $rp_n$ ) vector  $v_{n-}$  and  $v_{n+}$  from  $rp_n$  to  $rp_{n-1}$  and from  $rp_n$  to  $rp_{n+1}$
2. Calculate  $\hat{v}_n$  the normalized vectors of  $v_n$
3. Calculate  $\hat{v}_o$  as the normalized sum of the vectors  $\hat{v}_{n-}$  and  $\hat{v}_{n+}$
4. The border offset vectors follow the direction of  $\hat{v}_o$
5. Connect the endings of the border offsets of  $rp_n$  for each side to the endings of  $rp_{n-1}$  and  $rp_{n+1}$  to create the area



Results of a DLR Workshop: Lukas Merk, Sten Ruppe and Maik Bargmann

## Encoding ASN1 (new in alacarte container)

```

IMPORTS DeltaReferencePosition, DeltaTimeHundredthOfSecond, DeltaTimeMilliSecondPosNeg, DeltaTimeSecond, InformationQuality
FROM ITS-Container (itu-t (0) identified-organization (4) etsi (0) itsDomain (5) ... (102894) cdd (2) version3 (3) );

RelevanceAreas ::= SEQUENCE (SIZE(1..16)) OF RelevanceArea

RelevanceArea ::= SEQUENCE {
    relevancePoint SEQUENCE (SIZE(1..23)) OF RelevancePoint,
    informationQuality InformationQuality OPTIONAL
}

RelevancePoint ::= SEQUENCE {
    eventPosition DeltaReferencePosition, -- point in between left and right delimitation of RelevanceArea
    borderOffsetToLeft Width, -- left border of the RelevanceArea, if borderOffsetToRight is missing, also borderOffsetToRight
    borderOffsetToRight Width OPTIONAL, -- right border of the RelevanceArea
    timeOfRelevance DeltaTimeHundredthOfSecond OPTIONAL,

    areaState AreaState,
    ...
}

AreaState ::= ENUMERATED {
    freeToUse (0),
    physicallyBlocked (1),
    reservedForUse (2)
}

-- @unit: 0.1 metre
Width ::= INTEGER {
    tenCentimeterToTheRight(-1),
    tenCentimeterToTheLeft(1)
} (-255..256)
    
```

Sequence of RelevanceArea

Information quality constant within one coherent area

If only one border offset is encoded, both offsets are the same

Timestamp from which on the area between this and the next RelevancePoint has a relevant AreaState

## DENM vs. IVIM

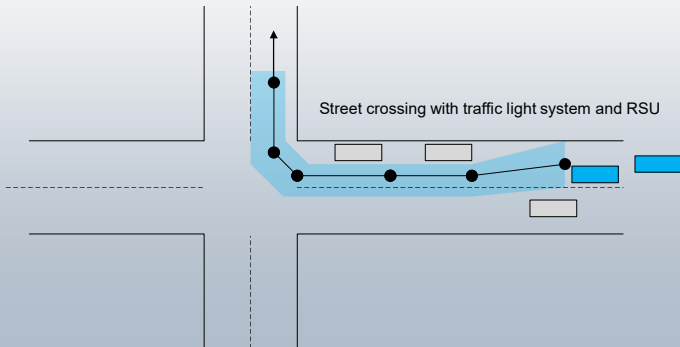
- DENM is for warnings, IVIM gives instructions
- Permanently and semi-permanently blocked lanes and other areas, that would normally be blocked with street signs belong in the IVIM
- RelevanceAreas represent a warning for areas that are occupied or will be occupied in the near future
- Before drivers had to approximate the intend of an emergency vehicle, by the speed and direction of its path
- Now RelevanceAreas can transmit the intend of an emergency vehicle in detail
- How to handle that intend is still up to the receiver

## Results

- Draft of closing report is done
- Encoding scheme is finalized
- Delimitation to IVI message
- Next steps towards ETSI

## Profile timeOfRelevance (example Use Case)

- Set time of relevance as time when area between two *rp* has to be cleared in case of AreaState (2) reservedForUse
- Area stays active until updated in new DENM



## Further process

- Finish C2C report end of 2022 (reviewers welcome)
- Use C2C report as basis for ETSI standardization (2023)
- Create prototype implementations
  - DLR will start using it in projects in 2023
- Discuss profiling in C2C

## Discussion

- ASN1 Naming
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Thank you!