



Management of Electronic Traffic Regulations (METR)

Overview and Standards Development Plans

06 NOVEMBER 2024

Bard de Vries, Lead Architect, NDW

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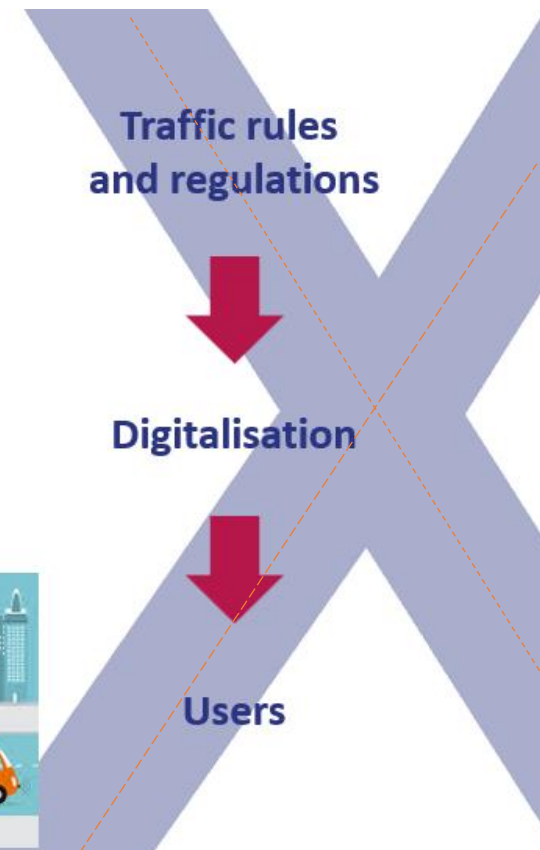
An aerial, high-angle photograph of a city street intersection, likely in New York City. The image is heavily blue-tinted. Tall, modern skyscrapers with glass facades line the streets. The street below shows traffic, including cars and a bus, and crosswalks. A semi-transparent dark rectangle is overlaid in the center, containing white text.

Bard de Vries
Lead Architect, NDW
Why Do We Need METR?

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To prepare for a future transport system where automated vehicles can manoeuvre safely on the roads we need:

- [illegible]



How trustworthy are current systems?

Database Errors



Possible Today



With METR

How trustworthy are recognition systems?

Sign recognition errors

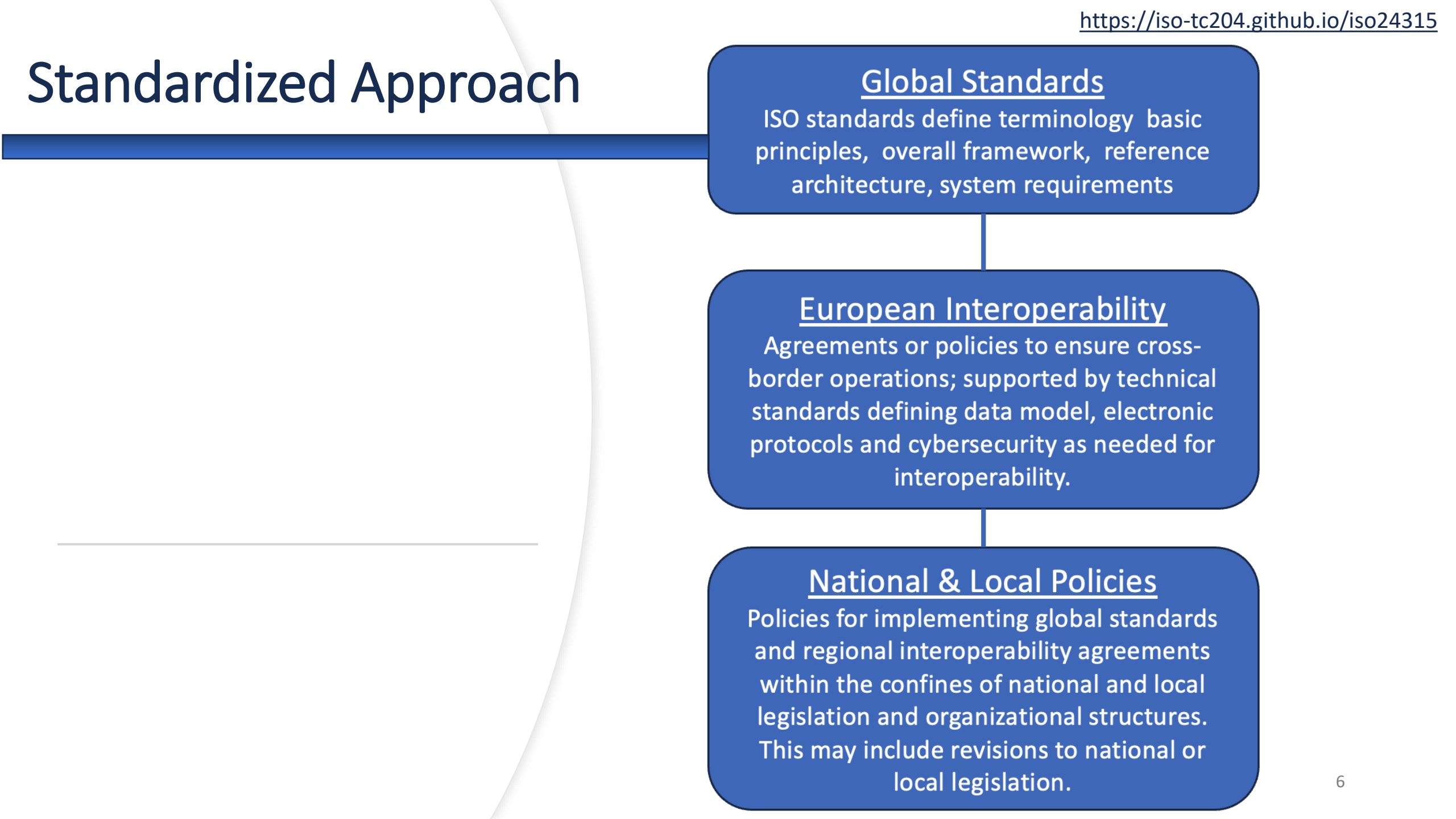


Possible Today



With METR

Standardized Approach



```
graph TD; A[Global Standards] --- B[European Interoperability]; B --- C[National & Local Policies];
```

Global Standards

ISO standards define terminology basic principles, overall framework, reference architecture, system requirements

European Interoperability

Agreements or policies to ensure cross-border operations; supported by technical standards defining data model, electronic protocols and cybersecurity as needed for interoperability.

National & Local Policies

Policies for implementing global standards and regional interoperability agreements within the confines of national and local legislation and organizational structures. This may include revisions to national or local legislation.

NAPCORE:

Bringing the European dimension to the Standardized Approach

ISO TC204 WG19 –
mirrors CEN TC278
WG17 - Mobility
Integration

ITS Directive
2010/40/EU
(Amended by Directive 2023/2661)
CEN TC278 WG8
DATEXII + TN-ITS

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ISO TC204 WG19 - CEN TC278 WG17 - Mobility Integration



Urban Control Zone



Public-area robots



Parking



Vendor lock-in



Automated cars



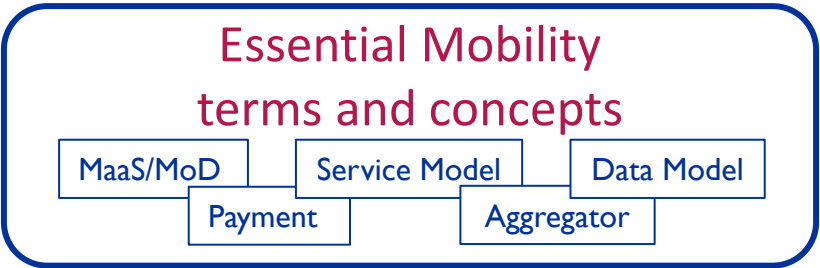
Location References



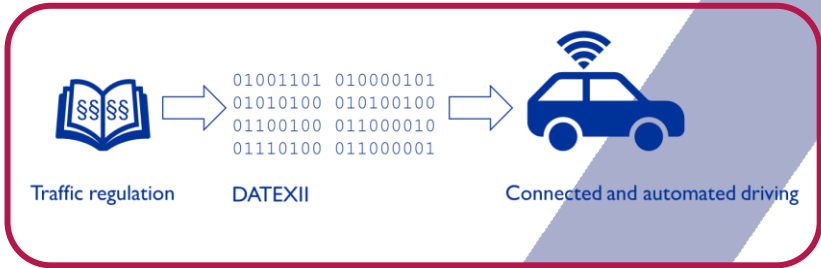
Support other WGs



Dissemination



Harmonization



Focal points for NAPCORE

- How to make METR work in a NAP centric data ecosystem (a.o. EMDS)
- Organise the European public stakeholder engagement and European governance on Regional European scope and stakeholder position.
- Participate in the global METR management team that controls scope purpose and development strategy of the global METR initiatives.
- Establish collaboration with stakeholder communities in Europe within the NAPCORE collaboration framework.
- Organise EU stakeholder requirement collection
- Set up central European requirement engineering team(s) that formulate EU positions, proposals and comments to be fed into formal CEN and ISO processes
- Adapt DATEX II and TN-ITS specifications to fulfil METR requirements
- Develop user guidance to support creation of national and local policies

An aerial, high-angle photograph of a city street intersection, likely in New York City. The image is heavily blue-tinted. Tall, modern skyscrapers with glass facades line the streets. The street below shows traffic lanes, crosswalks, and some vehicles. A semi-transparent dark rectangle is overlaid in the center, containing white text.

Ken Vaughn ITS Standards Expert, Trevilon Overview of METR

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Approach

Global Standards

ISO standards define terminology basic principles, overall framework, reference architecture, system requirements

Regional Interoperability

Agreements (formal or informal) to ensure cross-border operations; supported by technical standards defining data model, electronic protocols and cybersecurity as needed for interoperability.

National & Local Policies

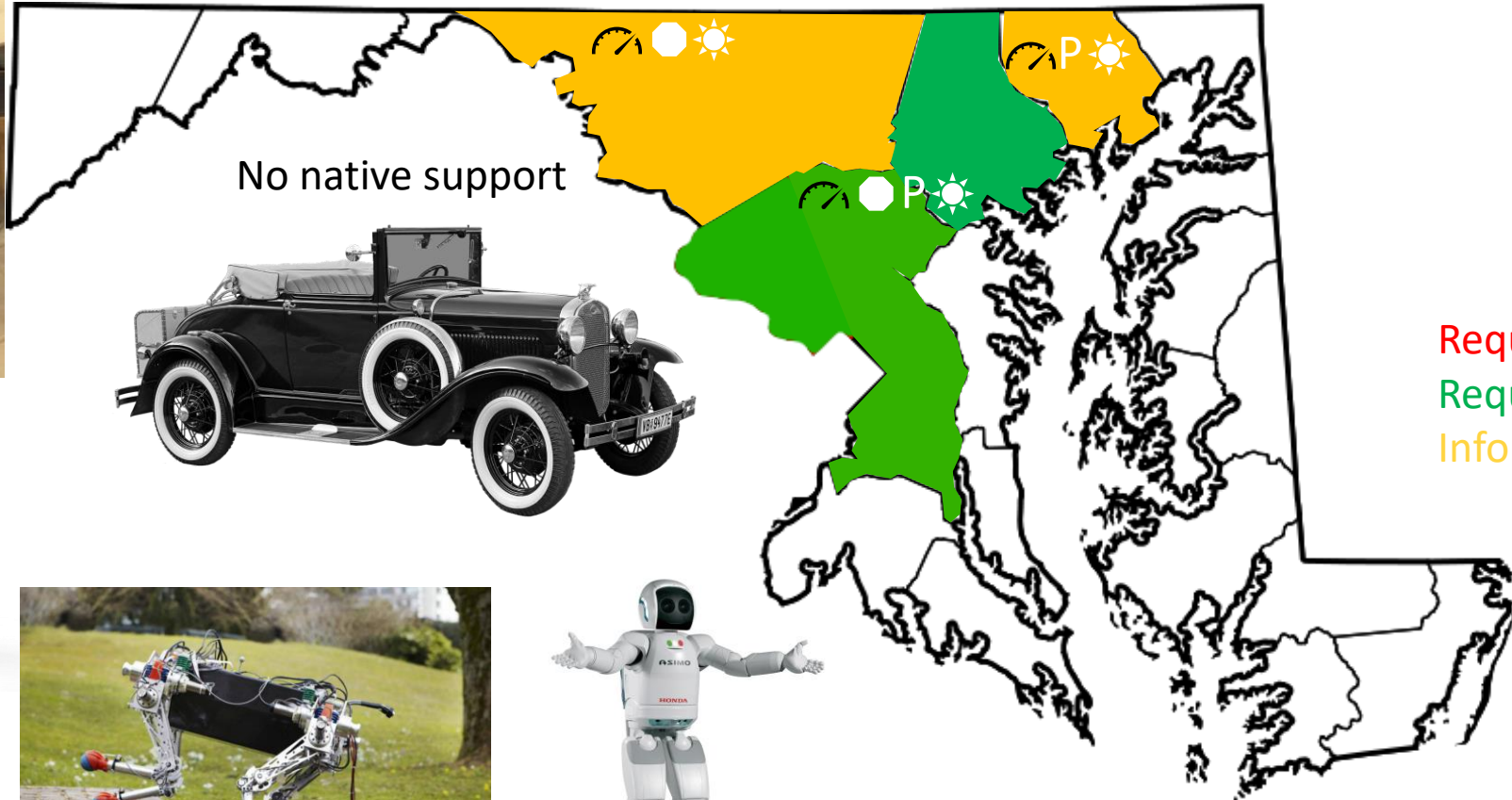
Policies for implementing global standards and regional interoperability agreements within the confines of national and local legislation and organizational structures. This may include revisions to national or local legislation.

- Global Standards
 - Vocabulary
 - Operational concept
 - Define scenarios, user needs, etc.
 - Reference architecture
 - Requirements
- Region-specific interfaces and regulations to aid interoperability
 - e.g., DATEX-II, NAPCORE, ITS Directive
- National and local tailoring
 - Adapting to national regulatory framework
 - Assigning responsibilities to specific agencies
- Implementation Guide
 - Identifying global, regional, national, and local aspects

Complicating Factors: Rules

- **Jurisdictions often have multiple rule makers, such as:**
 - Legislative bodies (e.g., highway code)
 - Traffic engineering department (e.g., static signs and pavement markings)
 - Temporary rule makers (e.g., those declaring road closures, temporary speed limits)
- **Jurisdictions vary in size**
 - National highway code
 - Mom and pop store with one accessible parking space
- **Large number of rules**
 - Highway code
 - Regulations
 - Warnings and guidance
- **Legal interpretations (e.g., what is the legal meaning of “stop”)**
- **Rules can emerge, change, or be overridden with little notice**

Complicating Factors: Deployment



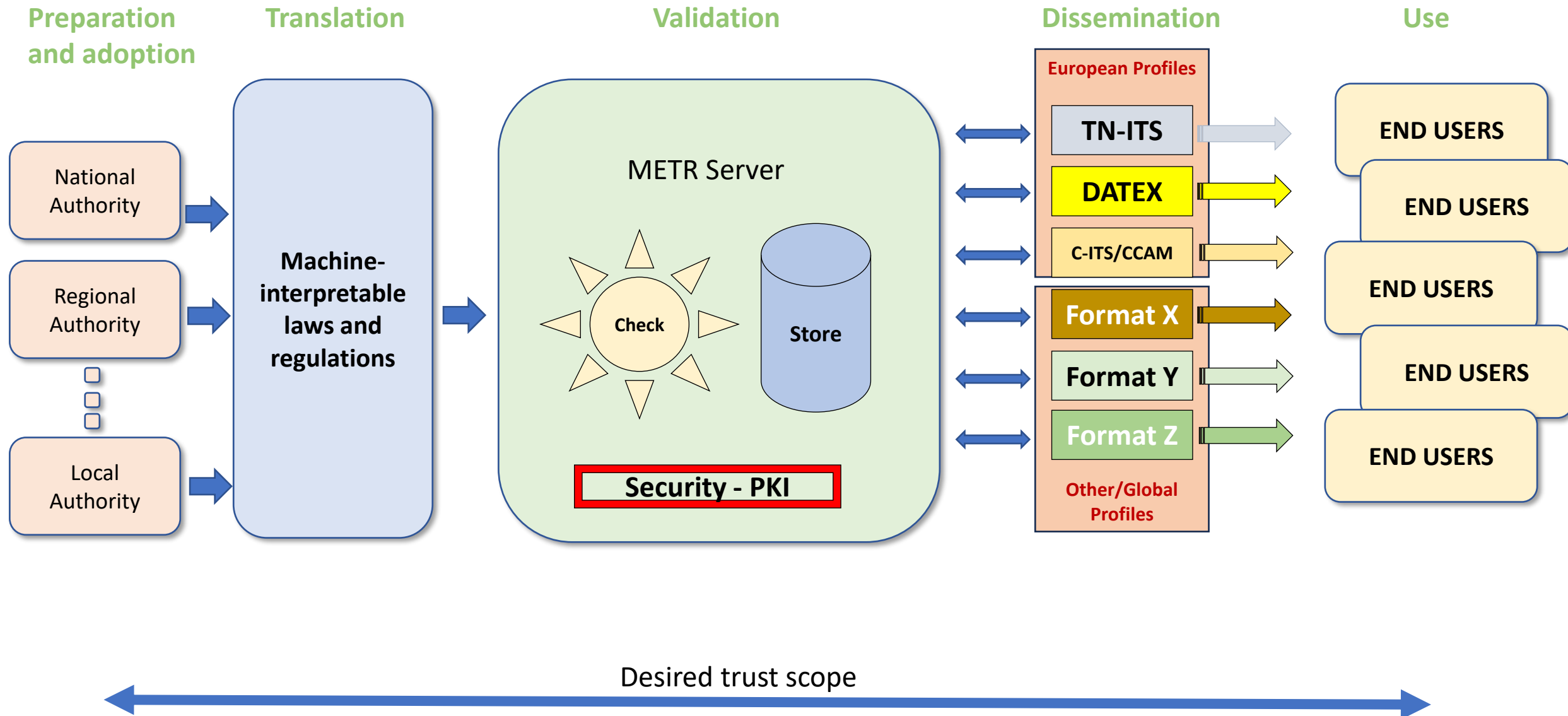
Required to operate
Required to use feature
Information supported as provided



Complicating Factors: Technology

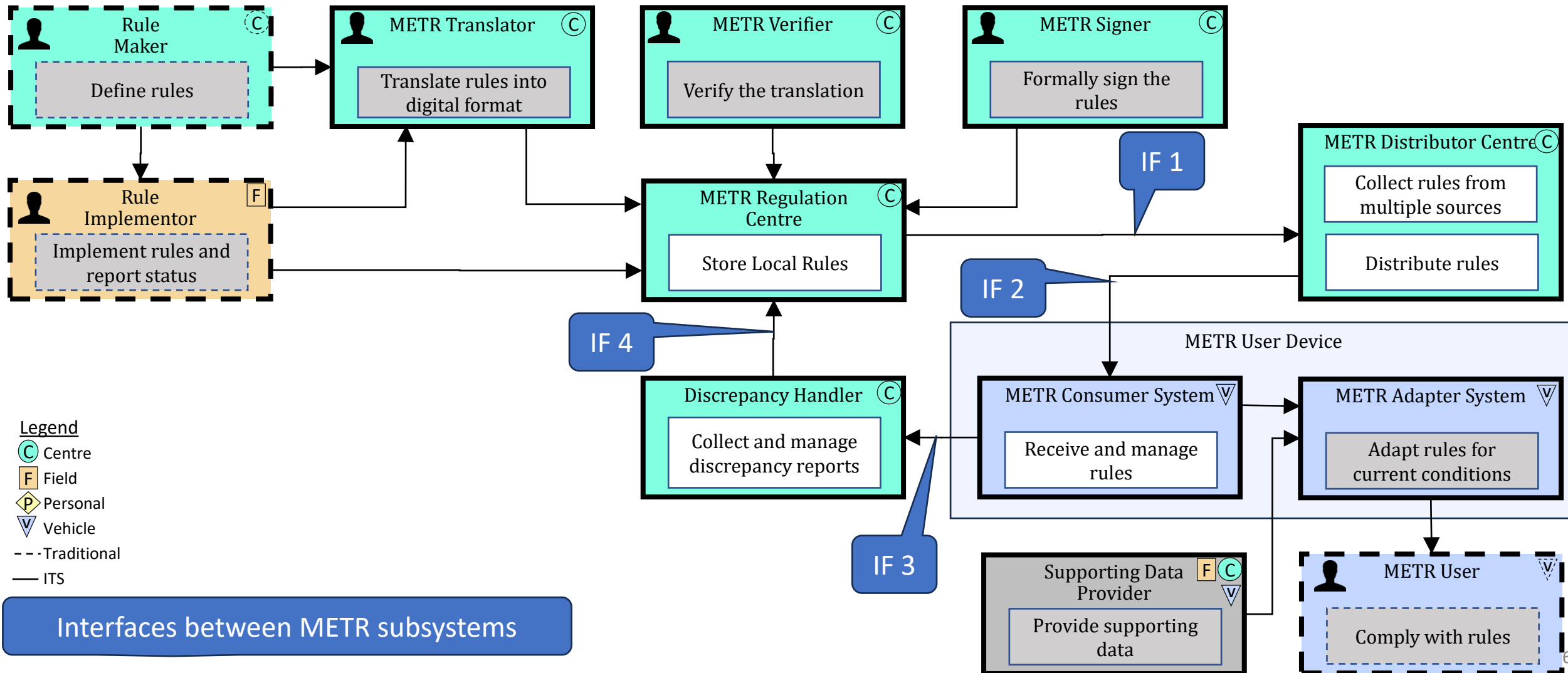
- **Trustworthiness requires non-repudiation for each participating system (including vehicle)**
- **Electronic signatures must be periodically updated to remain secure**
- **Rules have to be accurately positioned on different electronic maps**
- **Distribution to mobile users rely upon imperfect and limited communication links**
- **Distribution systems will need to repackage rules**
 - Regulation system signs each rule; can be traced from end user back to regulator
 - Regulation system signs its rule set (i.e., confirms set includes all rules within jurisdiction)
 - Distribution system repackages and signs rule sets (i.e., confirms set includes all rules within constraints requested by consumer)
- **Many standards already exist, e.g., in Europe we must coordinate with:**
 - DATEX II,
 - TN-ITS,
 - TPEG2,
 - etc.

METR main processes – Trust scope and Cybersecurity



METR simplified architecture

<https://iso-tc204.github.io/iso24315>



Status: Fall 2024

- Part 1: Vocabulary – Proposed DTS ballot
- Part 2: Operational Concept (ConOps) – Proposed DTR ballot
- Part 3: System of System Requirements (SoSR) – Proposed DTS ballot
- Part 4: Regulation System Requirements (RSR) – Working draft
- Part 5: Distribution System Requirements (DSR) – Working draft
- Part 6: Consumer System Requirements (CSR) – Working draft
- Part 7: Discrepancy Handling System Requirements (DHSR) – Working draft
- Part 8: METR Data Requirements (MDR) – Working draft
- (NEW) Part 9: METR Maps (*formal name TBD*)
- (NEW) Part 10: METR Cybersecurity (*formal name TBD*)
- ITS — Station unit requirements — Working draft

Kjersti Leiren Boag
Senior ITS Advisor, NPRA
Mapping METR into Reality

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The Norwegian METR project 2022-28



An efficient, sustainable and safe transport system

PRIMARY OBJECTIVES



Easier travel and increased competitiveness for businesses



Contributing to fulfilling Norway's climate and environmental goals



Vision Zero for fatalities and serious injuries in traffic



Efficient use of new technology



Value for money

PERFORMANCE INDICATORS

- 1.1 Improve road accessibility
- 1.2 Maintain a high level of perceived customer satisfaction

2.1 Reduce carbon emissions

3.1 Reduce fatalities and serious injuries

4.1 Increase digitalisation

5.1 Reduce internal costs

5.2 Streamline transport costs

Strategic direction: Digital first



The digital road of the future



Fully digitized value chain for roads



Digital value-added services for customers



Traffic Safety

Prioritised actions



Predictable road accessibility



Sustainability

The Norwegian METR project 2022-28

<https://iso-tc204.github.io/iso24315>



Main goal:

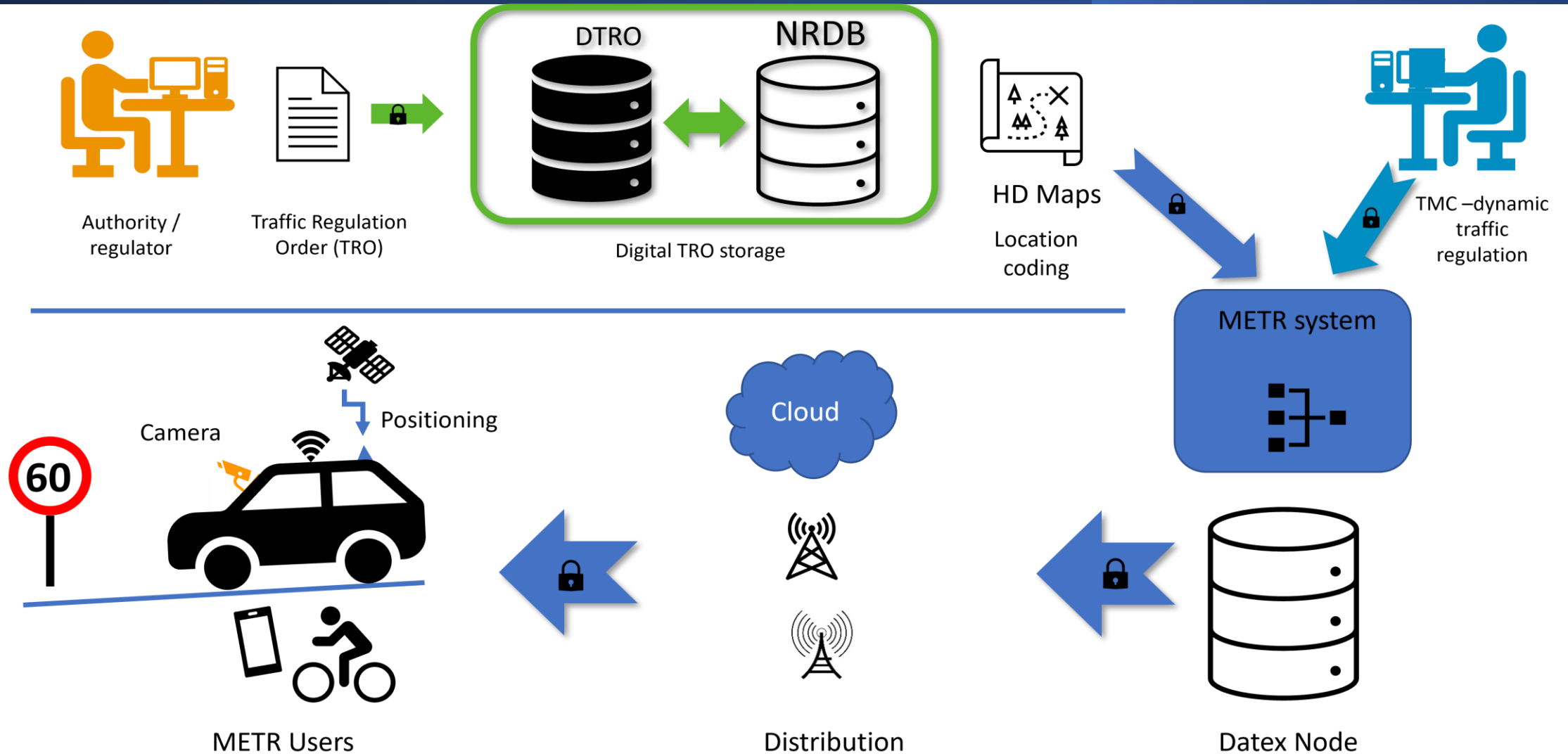
- Description and implementation plan for a METR concept covering the public road network in Norway, harmonised with EC regulations and international standardisation.

Focus areas 2023-25:

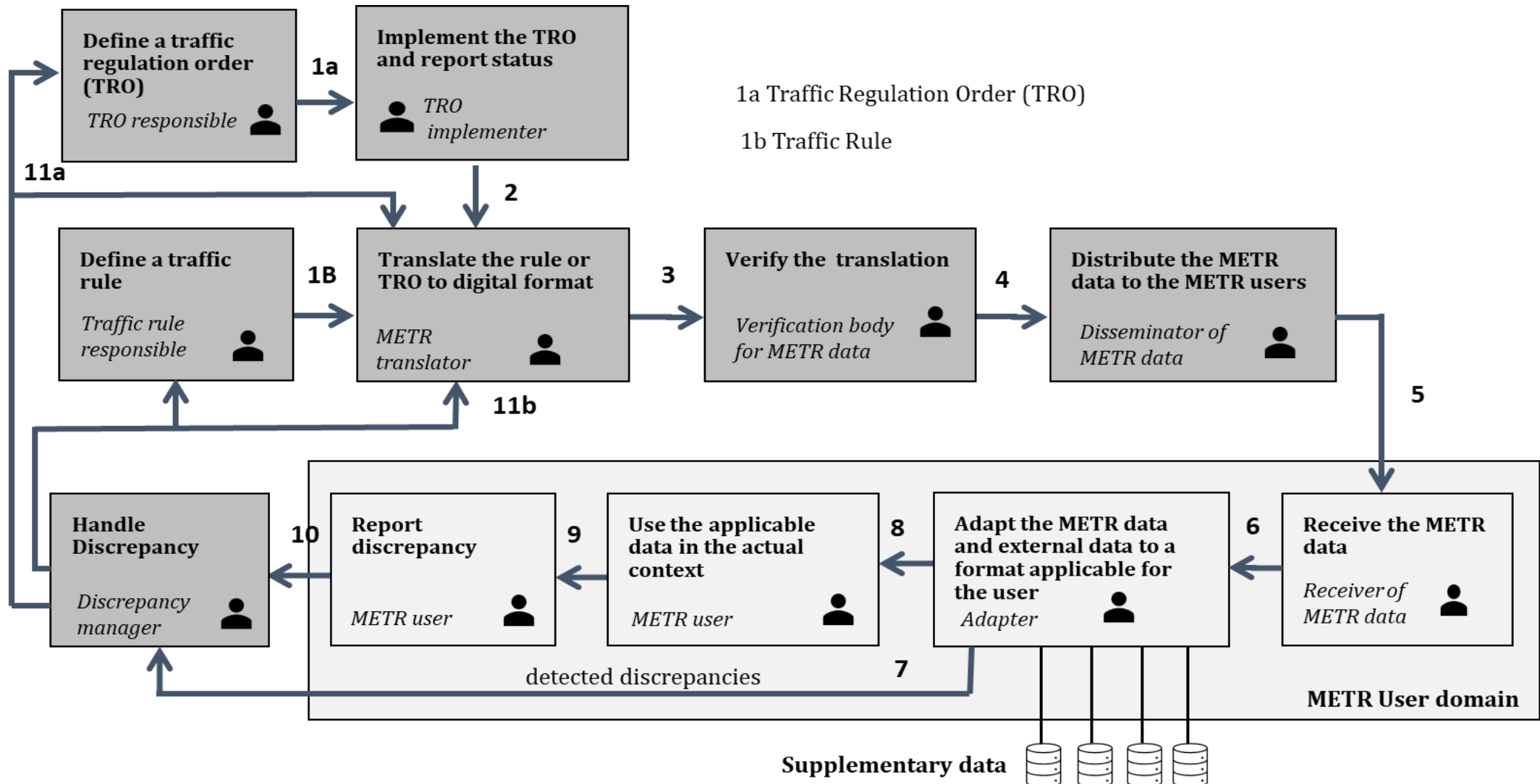
- Traffic Regulation Orders => from analogue to digital
 - *dialogue with municipalities, counties and cities has started*
- Dynamic Traffic Regulations
 - *TMCs, Datex II, integration of PKI (Pilot)*
- ISO / CEN Standardisation & international harmonisation
 - *official Norwegian METR standard based on ISO 24315 Part 1-3*



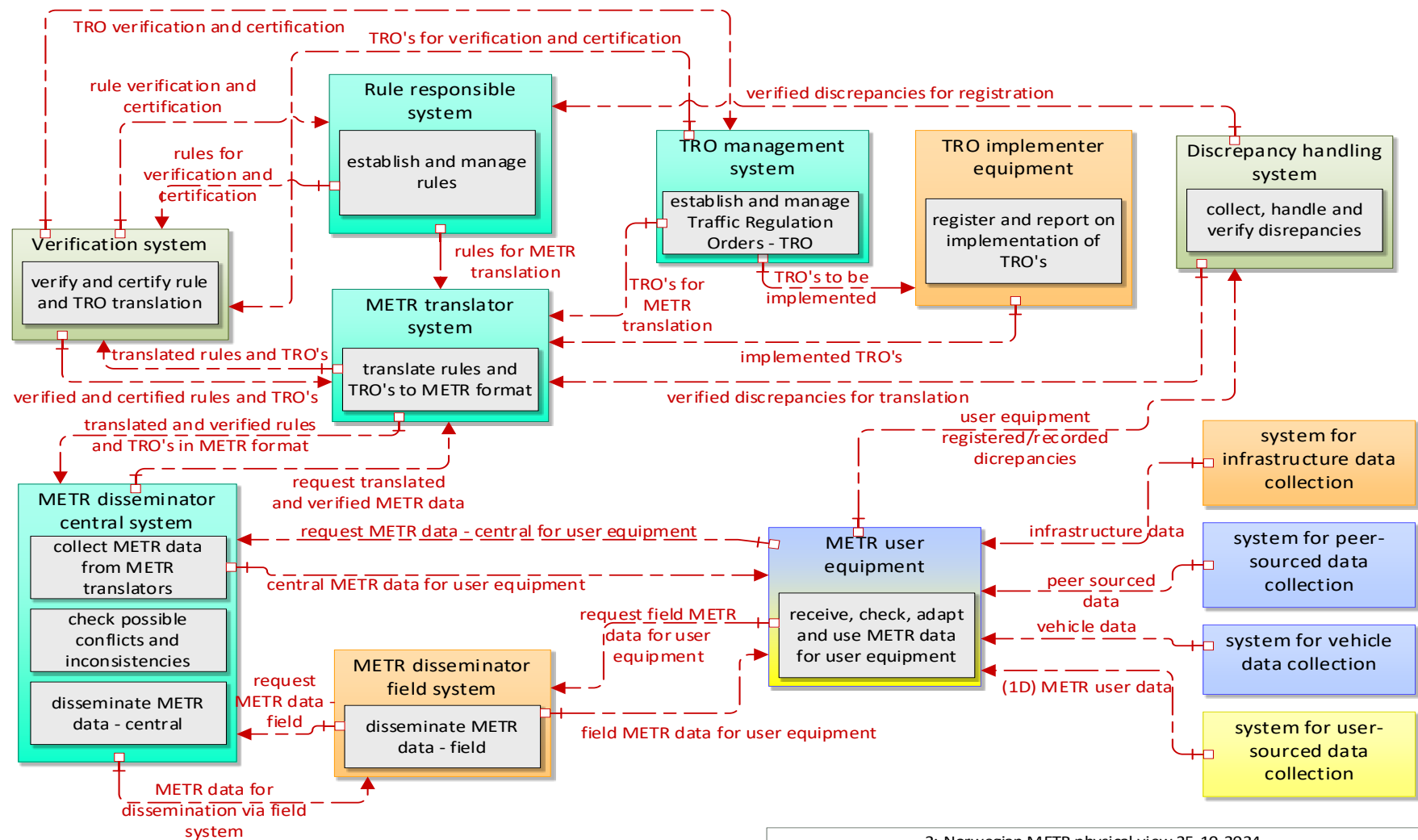
Traffic Regulations



High-level processes in the Norwegian METR concept

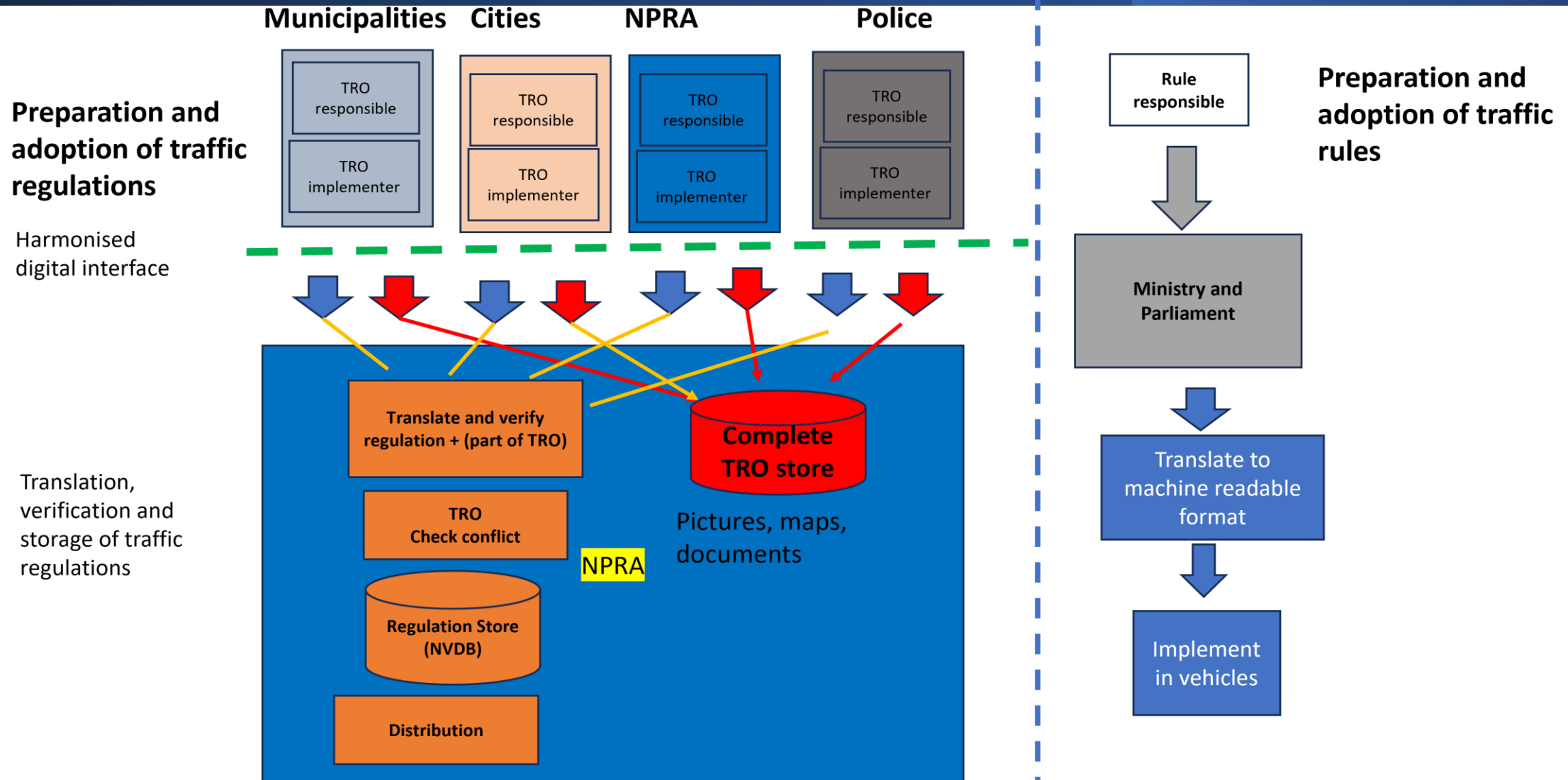


The Norwegian METR System of Systems



Preliminary analysis of roles and responsibilities + systems

<https://iso-tc204.github.io/iso24315>

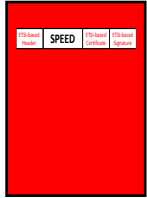


Knut Evensen
ITS Standards Expert, NPRA
Additional Thoughts on Cybersecurity

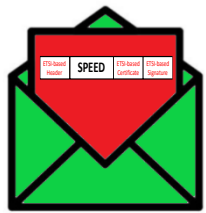
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How cybersecurity and PKI is used in the simplified METR example

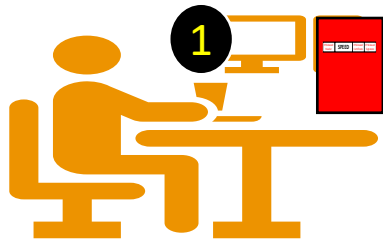
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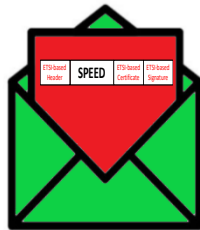
A digitally signed Traffic Regulation Order (TRO) can be compared to a physical document that has a stamp from the authority and a signature from the person with the rights to sign.



The secure transfer of a TRO can be compared to a physical envelope that has a wax seal and is sent via registered mail.



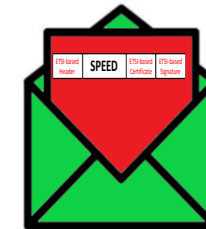
TMC with GIS computer and personal card for METR credentials



METR message in TLS 1.3 security



METR Central system (ITS Station)

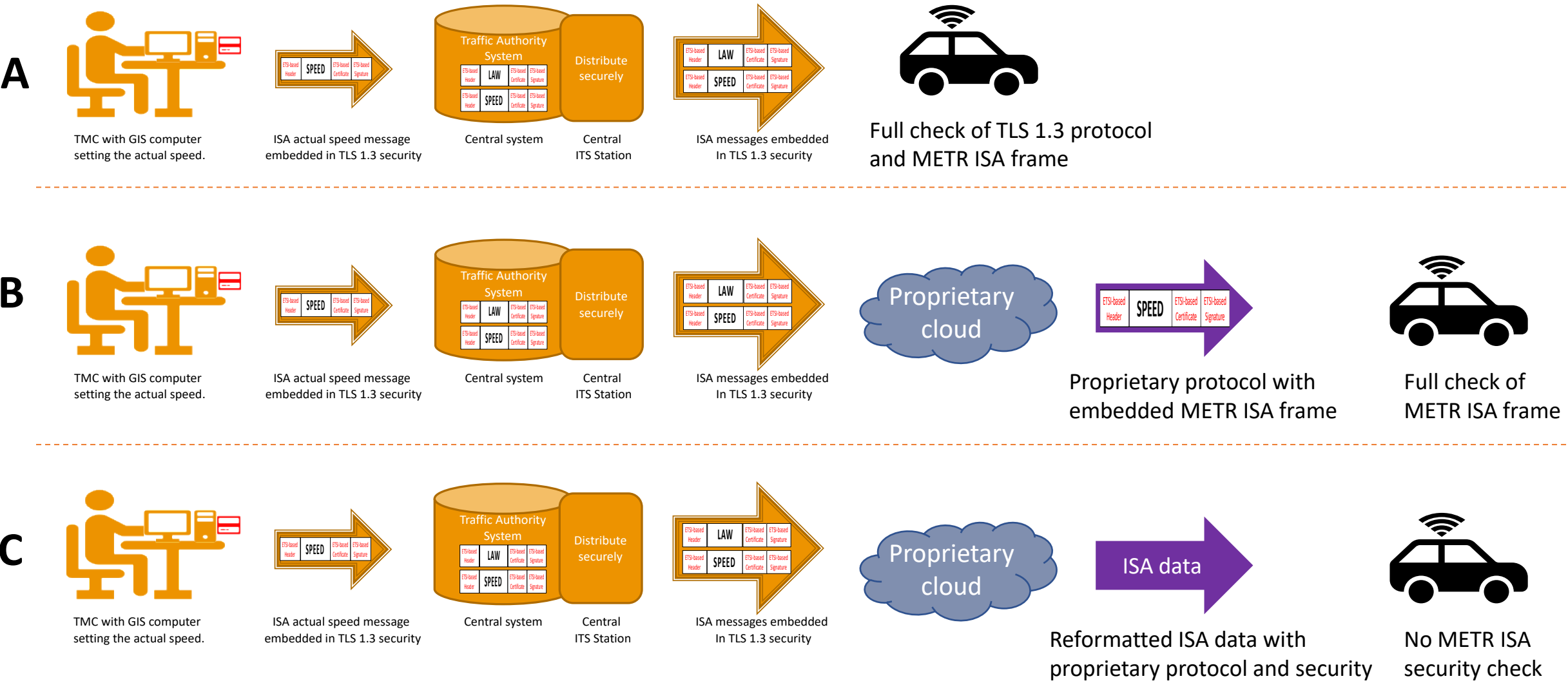


METR message in TLS 1.3 security

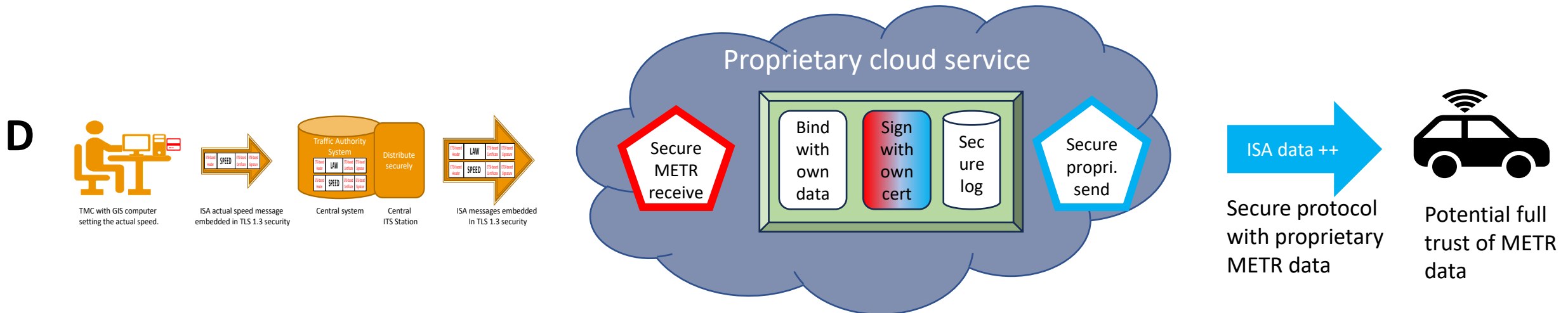


END USER ITS Station

Different deployment models offer varying levels of trust



How to trust a proprietary domain

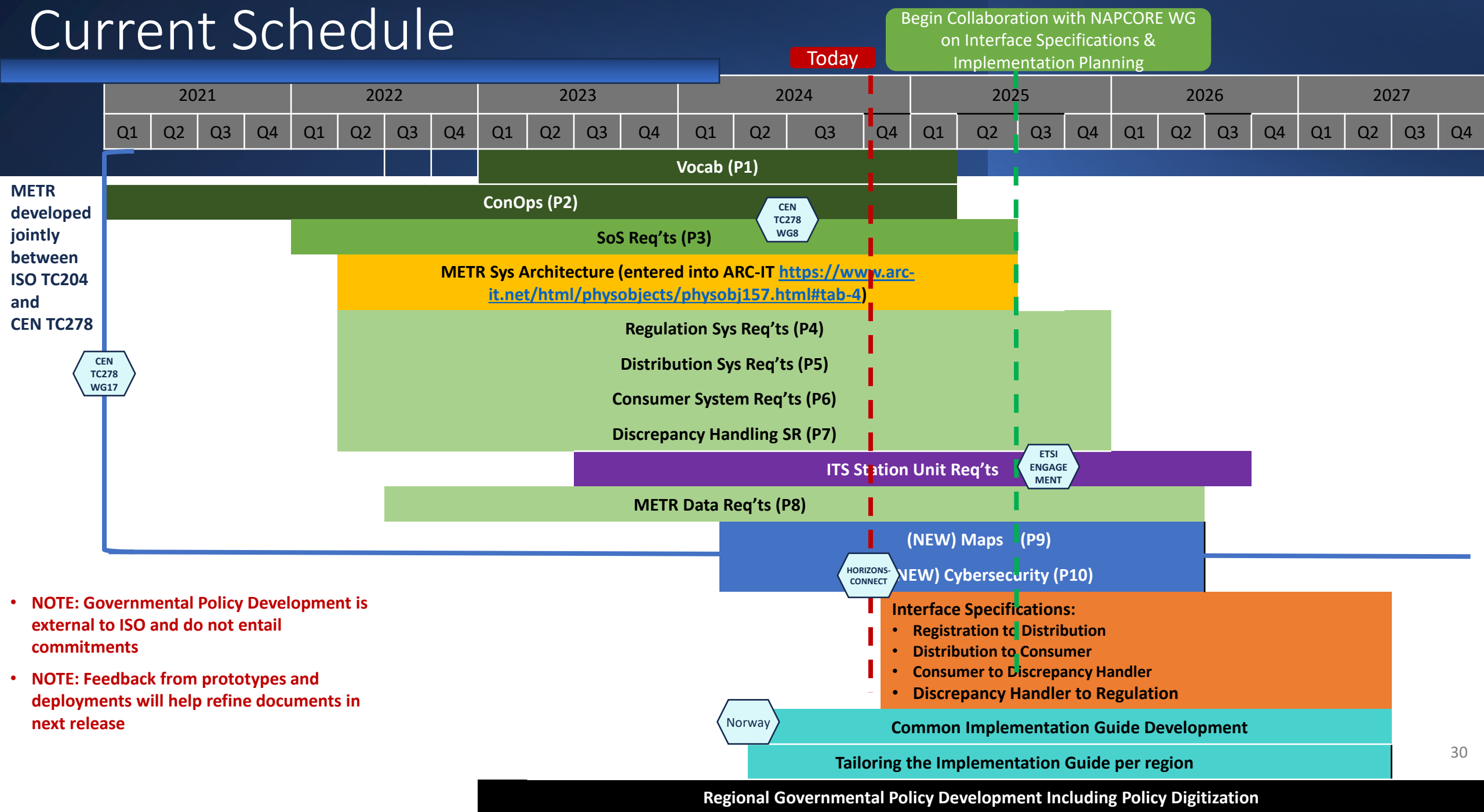


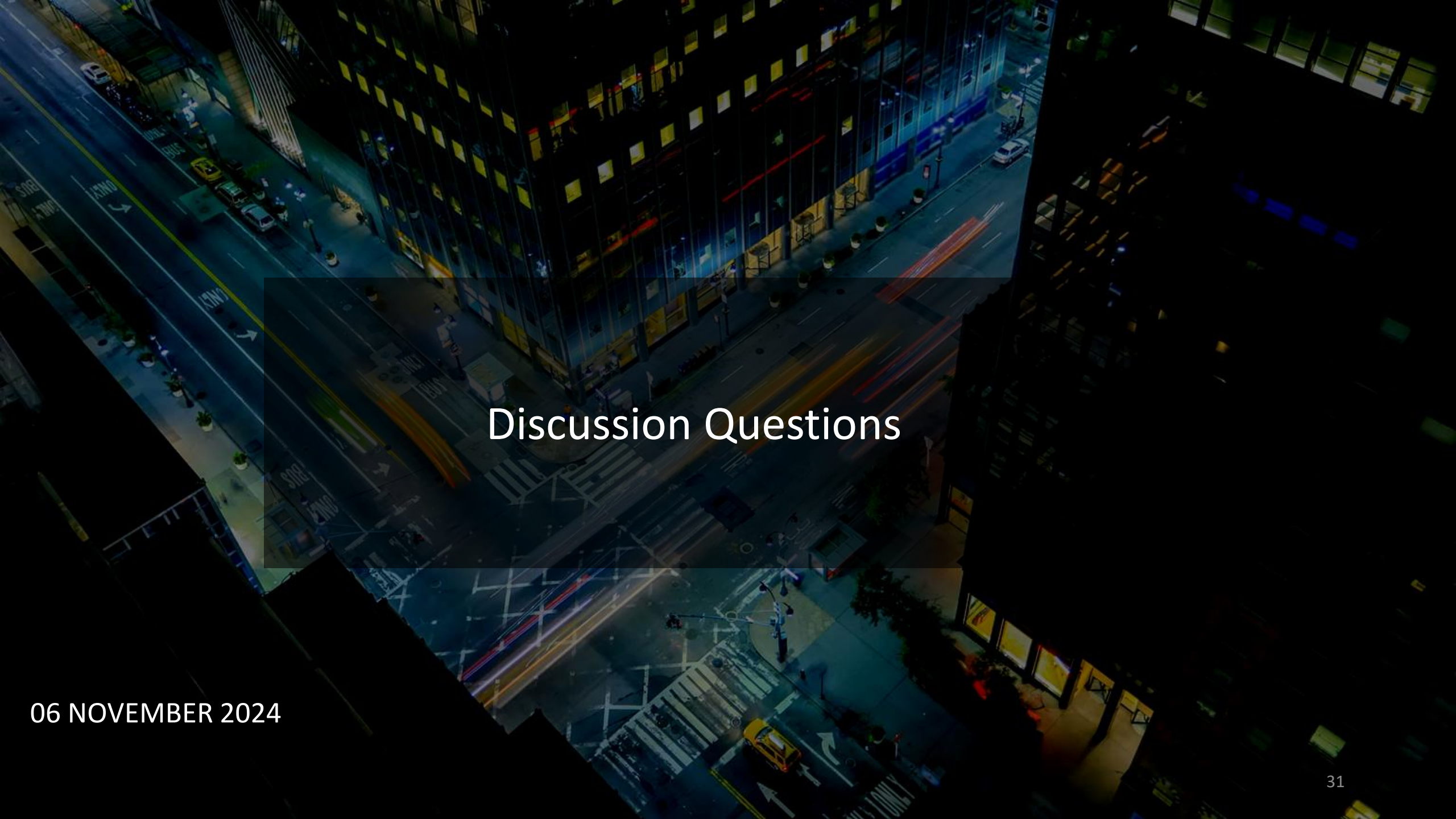
- The prerequisite for full trust is to follow a complete set of **policies** incl verification, certification, management, governance, etc. Examples:
 - The cloud system must be certified secure, i.e. all critical processes happen in a secure environment
 - The PKI must be trusted by all involved actors
 - All critical processes must be logged and signed, so that a critical data frame received by a car can be unraveled and traced back to its secure origin (forensics)
 - Non-repudiation for all exposed access points, including proprietary interfaces
- 90% can be re-used from C-ITS Security/Certificate policy (CCMS)

Ken Vaughn
ITS Standards Expert, Trevilon
Schedule & Next Steps

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Current Schedule



An aerial, high-angle photograph of a city street intersection at night. The scene is illuminated by streetlights and the lights of buildings. Long, colorful light trails from cars are visible on the roads, indicating motion. A semi-transparent dark rectangular box is centered over the intersection, containing the text "Discussion Questions".

Discussion Questions

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Questions for Audience

- What questions do you have about METR?
- Do you believe METR can improve traffic operations? What other use cases are there not mentioned yet?
- What challenges do you foresee with deploying METR? (e.g., data entry, maintenance, etc.)
- What should the METR standards developers keep in mind as they complete the METR ISO standards and begin work on the Interface Specifications?
- When could you envision METR being fully functional in your organization or at other locations?
- Are there specific ways to accelerate METR implementation safely and effectively?
- Would you like to become more engaged in completing METR standards? In demonstrating an implementation of some or all of METR?

Thank you from the METR Team!

Questions?

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