Federal Ministry
of Transport and
Digital Infrastructure

EDR-DSSAD-03-05

EDR & DSSAD - Current understanding

IWG EDR/DSSAD – 3rd meeting
December 2019, Paris

Clear objectives and identification of differences

	EDR	DSSAD
Definition	… means a system with the sole purpose of recording and storing crash-related parameters and information shortly before, during and immediately after a crash [or in safety-critical events*].	…means a system with the sole purpose of recording and storing all significant interactions between the human driver and the automated driving function as well as its operation mode.
Purpose / objective	To conduct road safety analysis and assess the effectiveness of specific measures taken	To allow the attribution of liability, legal responsibility and conduct research
Scope	Step1: Vehicle categories according to R.E.3: M_1, N_1 Step 2: Vehicle categories according to R.E.3: M_2, M_3, N_2, N_3	Step1: Vehicle categories according to R.E.3: M_1, N_1 with automation level 3 or 4 and ALKS Step 2: Vehicle categories according to R.E.3: M_2, M_3, N_2, N_3 with automation level 3 or 4 and ALKS
Trigger/ events	Crashes (incl. soft objects collisions**) [and/or safety-critical events*]	Any change of conducting the driving task and/or triggered by EDR

* ”safety-critical events”:include high decelerations, which may lead to accident avoidance (e.g., by AEB system)

** “soft object collisions” include collisions e.g. with pedestrians or bicyclists

General requirements for **EDR** (all motor vehicles)

- EDR devices are made mandatory in some countries (e.g., US, China, ROK); others encouraged vehicle manufacturers to widespread EDR (e.g., Japan). Research projects (e.g., VERONICA) propagated the usefulness of EDRs and proposed the introduction of small changes which may lead to valuable results. The corresponding experiences made should be considered by the IWG when drafting new demands (e.g., triggering of soft object collisions).

- Recording time expected between -30s and +10s before/after event.

- Harmonized exchange formats and consistent time stamp are required for all data elements (e.g., current issue: data is gathered by different controllers partly using different time bases (UTC, GPS, others) and is stored divergent due to different priority levels).

General requirements for **DSSAD** (for ALKS)

- AD functions can only be activated if the DSSAD works accurately.
- DSSAD requirements can only be developed fully if functional requirements for the AD function (here ALKS) are available.
- DSSAD needs to be developed in a neutral way to allow other AD systems to be incorporated.
- DSSAD requires clear link to EDR data (e.g., via using the same time stamp)
- If the AD function is activated data will be monitored permanently (temporary storage), but only stored under specified conditions.

Current issues and way forward

- **There are still different views about the contents of the EDR and DSSAD, e.g. when is stored continuously and when discreetly?**

- **A principal, agreed understanding is required to define the contents and interactions of EDR and DSSAD:**
  - It is important to know when to monitor and when to store in the EDR and DSSAD. This leads possibly to a different information content. Furthermore, various combinations of driving situations (as well as later interactions of AD functions) are conceivable and need to be covered by the requirements.
  - It must be ensured that the most necessary data is available without interruption for all later use cases / evaluations.

- **With the help of Use Cases, the principles can be worked out and finally the triggers / events, as well as specific data elements and their formats (incl. sampling rates) can be determined.**

Abbreviations used in the following

Time point	Event Description
t_S	Vehicle ignition is turned “ON” (Start)
t_E	Vehicle ignition is turned “OFF” (End)
t_0	Crash (according to EDR triggers)
t_C	Safety-critical event (according to EDR triggers, e.g., high deceleration but no crash or soft collision)
t_{A_X}	Activation of AD function “X”
t_{D_X}	Deactivation of AD function “X”
t_{TD_X}	Transition demand is requested by AD function “X”
t_{DC_X}	Transition demand is responded to by driver according to the regulation and confirmed by AD function “X” (Transition demand ends, driver takes the driving task, AD function “X” is deactivated)
t_{S_MRM}	Minimum Risk Manouevre (MRM) starts
t_{E_MRM}	Minimum Risk Manouevre (MRM) ends
t_{OV_X}	Overriding of AD function “X”

Use Cases

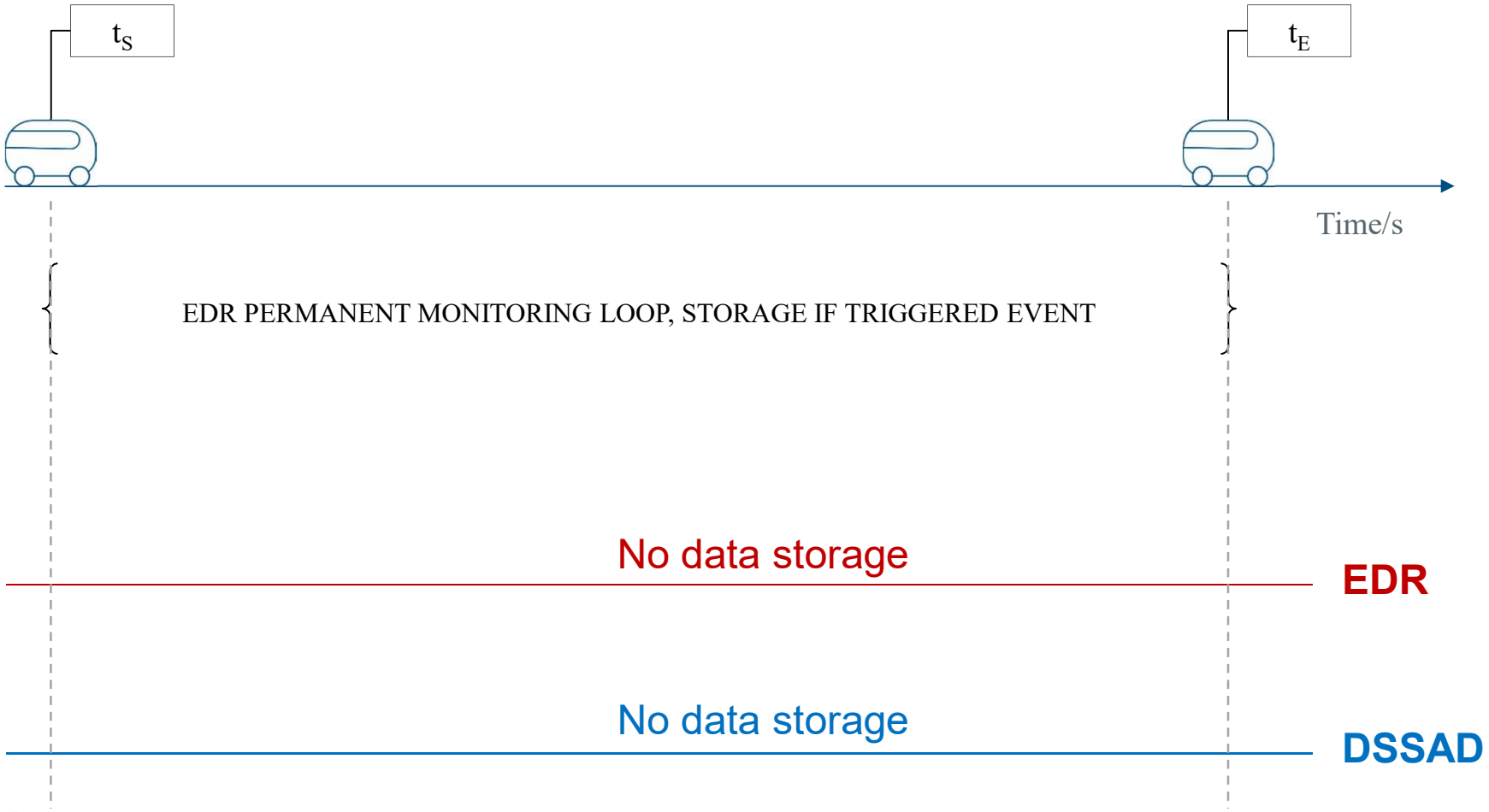
UC 1 – Conventional driving:

- 1a Normal driving
- 1b Crash / Soft collision [/ Safety-critical event]

UC 2 – Driving using AD function (here: **AF1 – ALKS**):

- 2a Normal Driving
- 2b Normal Driving with Transition Demand
- 2c Overriding
- 2d Minimum Risk Manoeuvre
- 2e Crash
- 2f Soft collision [or Safety-critical event]

UC 1a – Normal driving (conventional)



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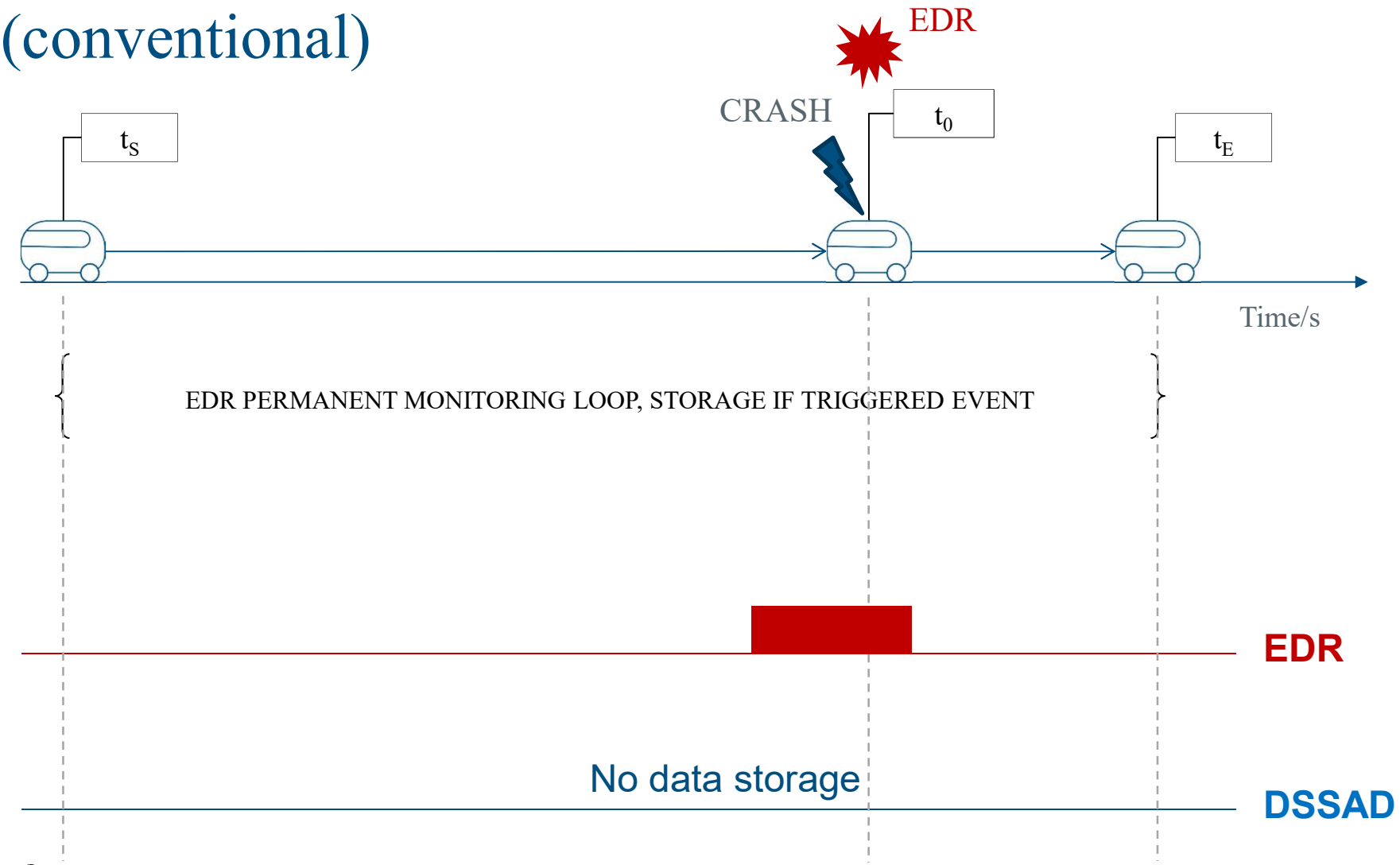
UC 1b – Crash / Soft collision [/ Safety-critical Event] (conventional)



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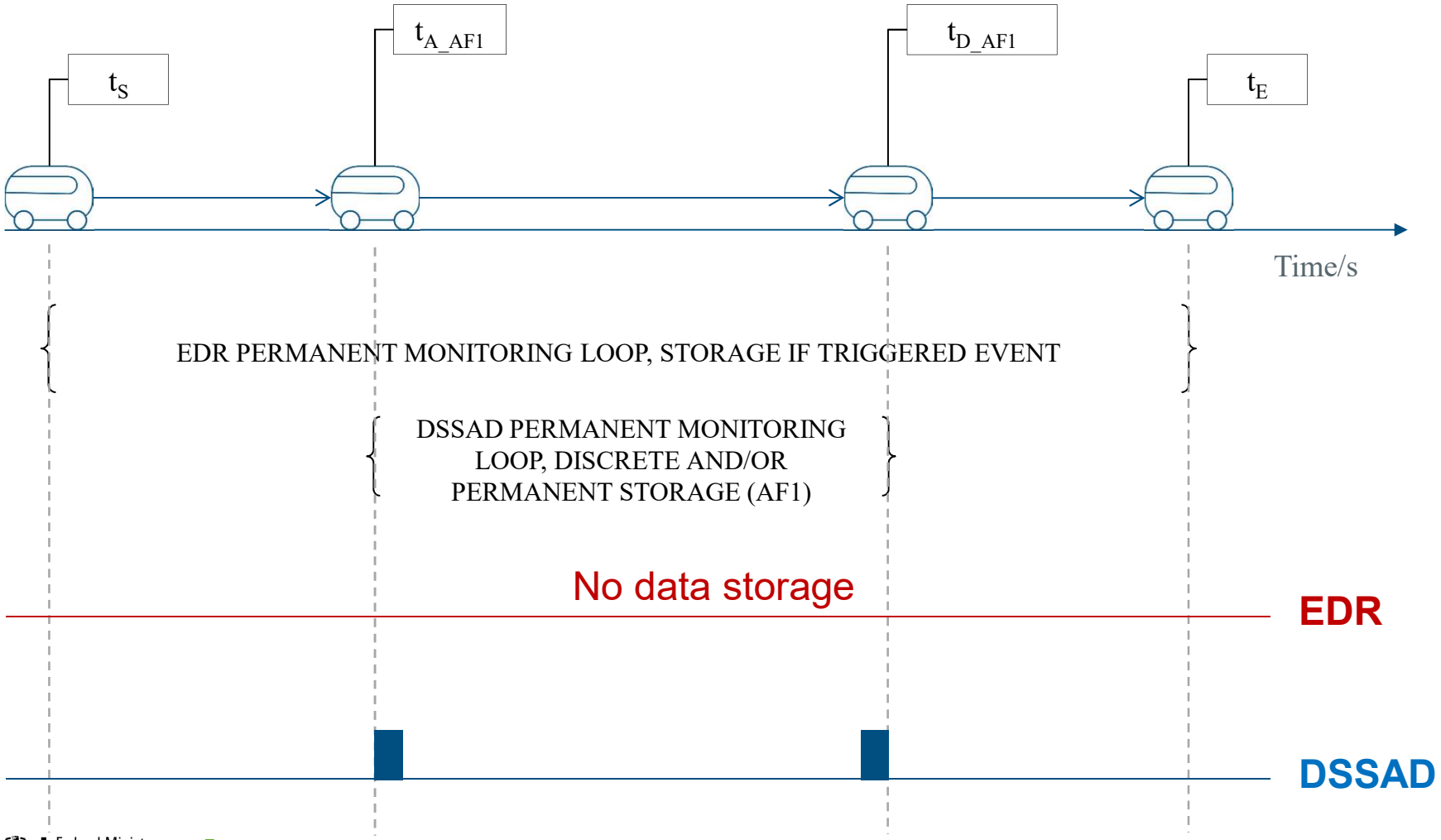
UC 2a – Normal driving (with automated function)



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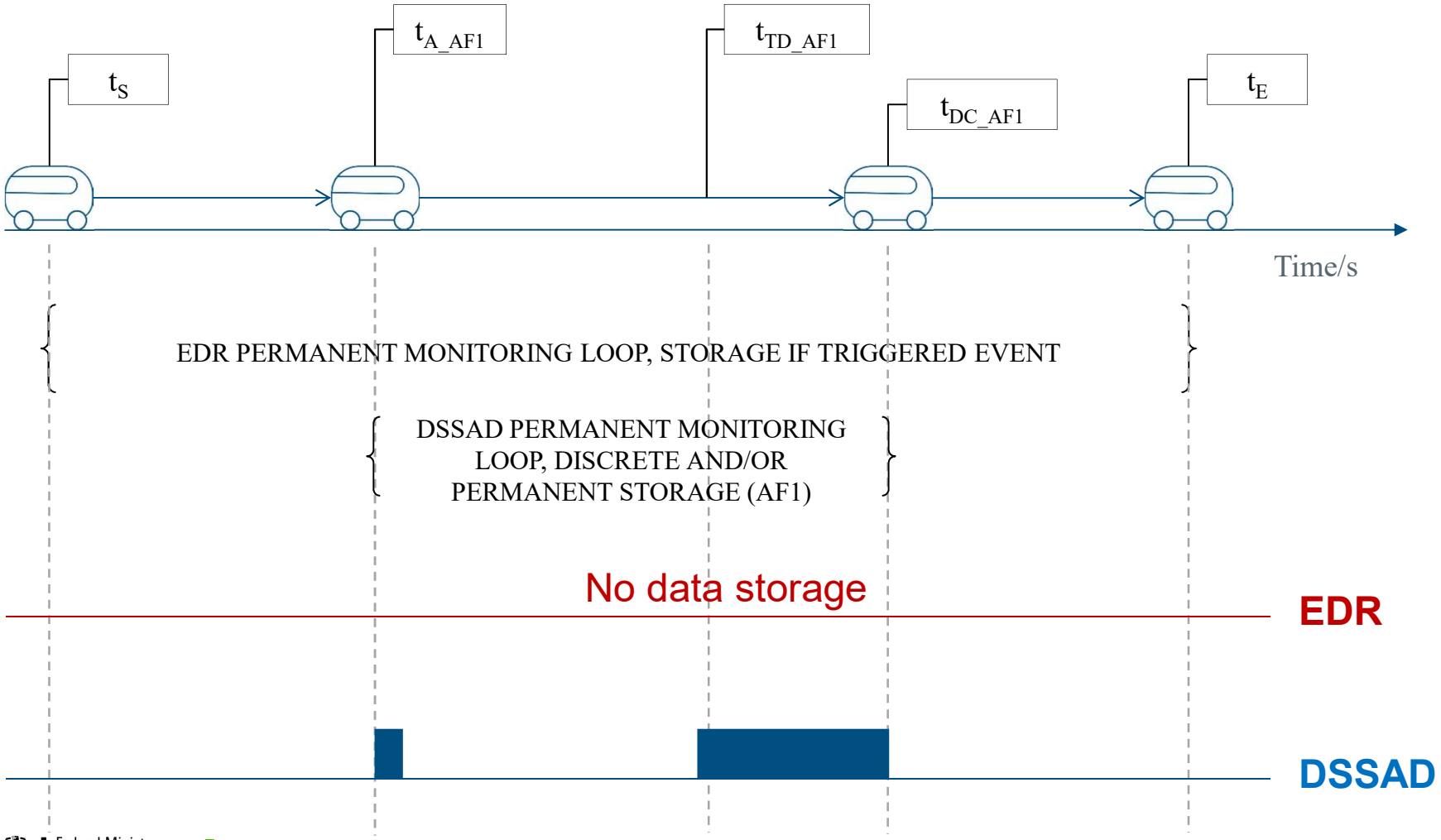
UC 2b – Normal driving with Transition Demand (TD)



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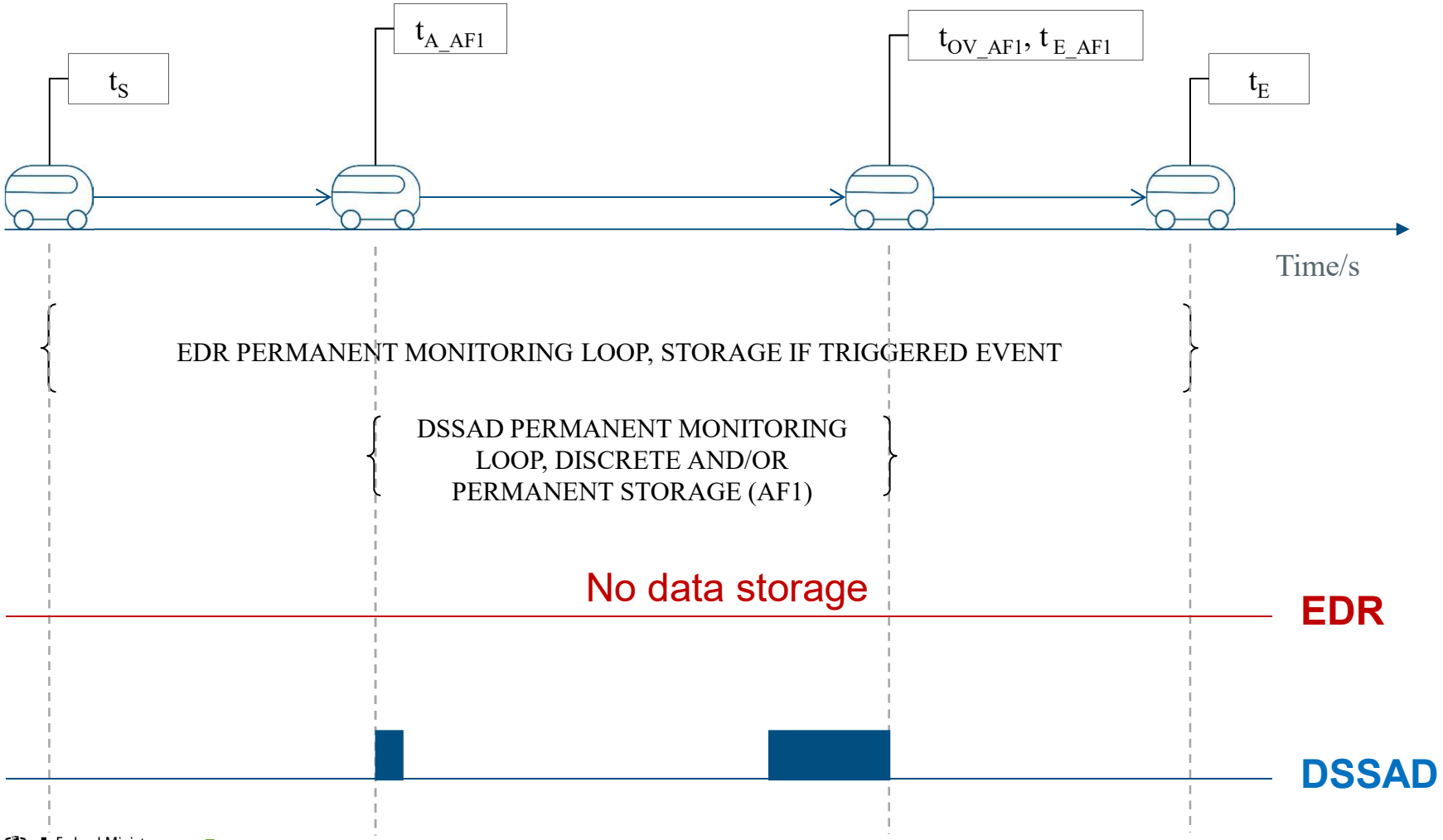
UC 2c – Overriding (OV)



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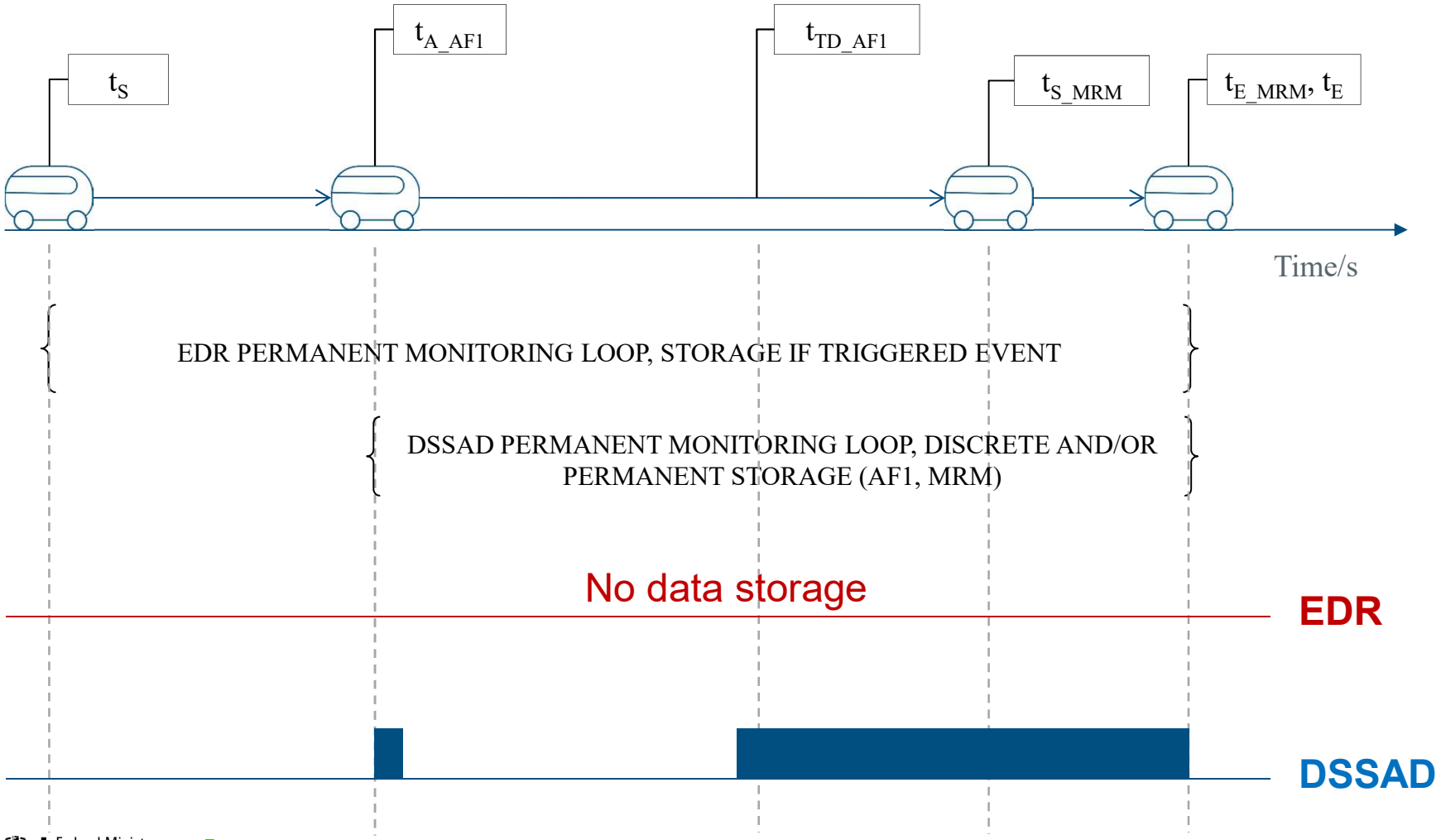
UC 2d – Minimum Risk Manoeuvre (MRM)



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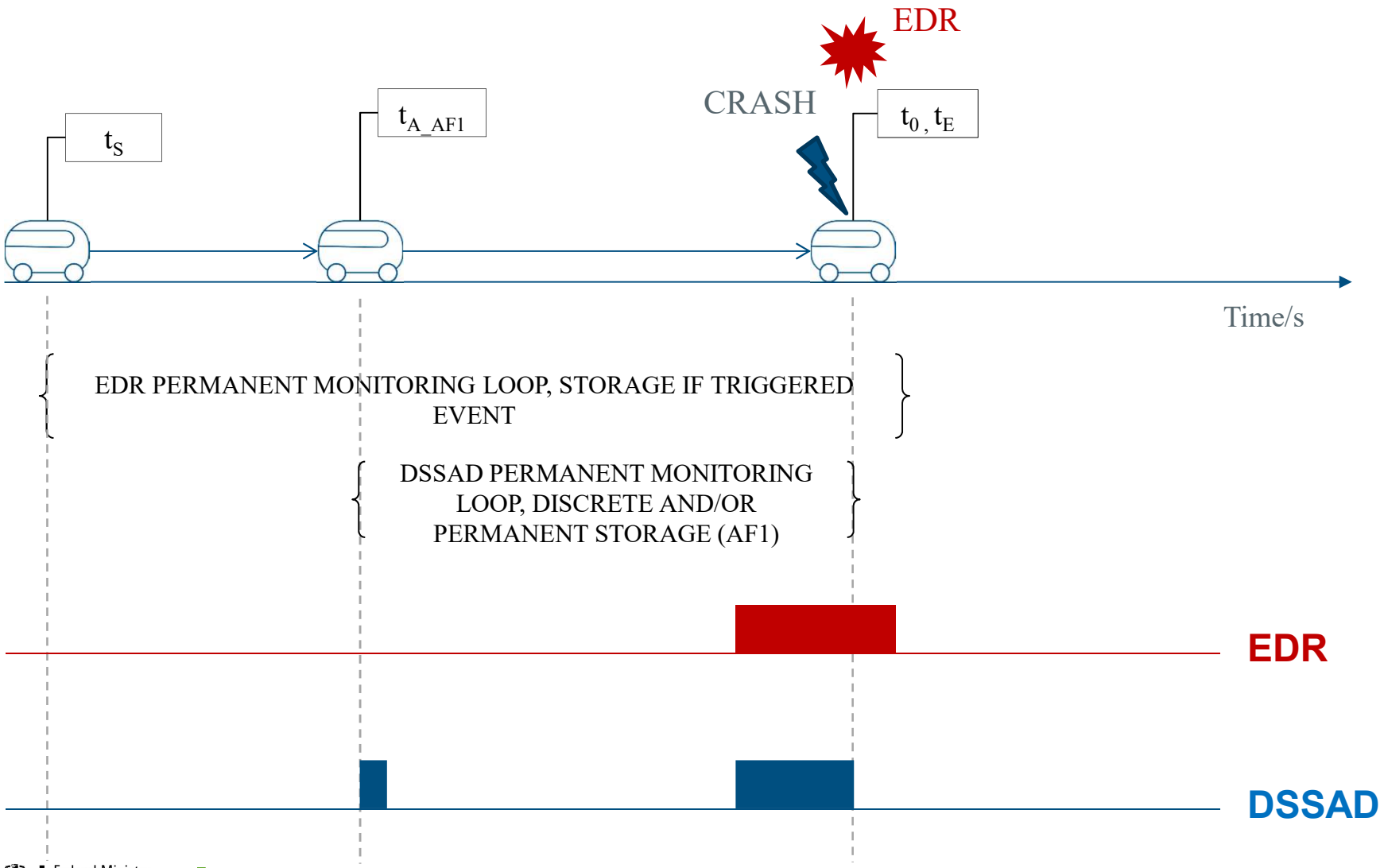
UC 2e – Crash (with automated function)



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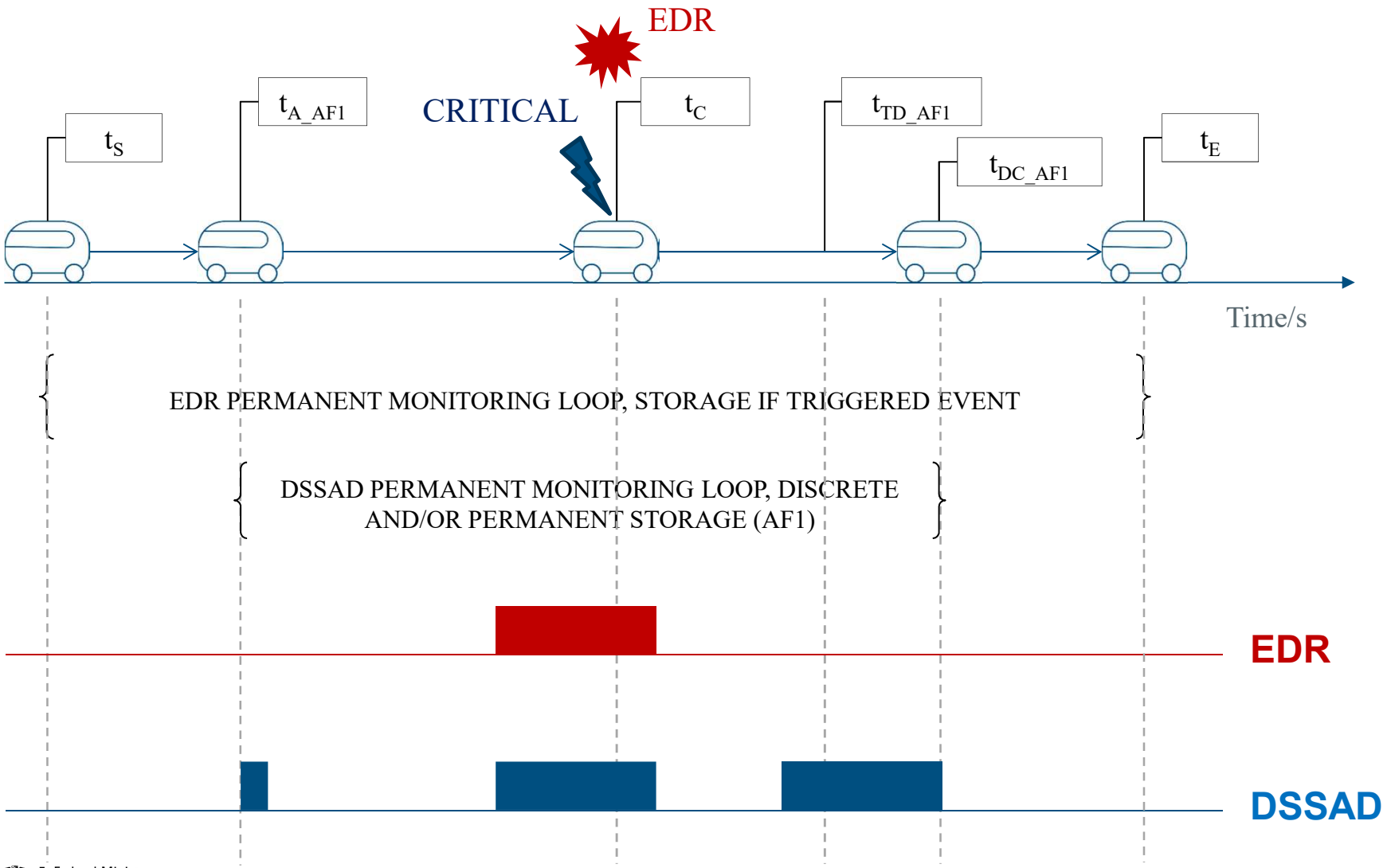
UC 2f – Soft collision [/ Safety-critical Event]



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Discussion / Conclusions

- Triggers for an **EDR** are clearly linked to crashes and soft collisions [and safety-critical events].

- **DSSAD** shall provide data to clarify the entity (physical driver or automated system) in control of the driving task. Thus it shall record event-based data/information when in automated mode, but it shall not allow creating a driving profile.

  - Depending on the “event” in automated mode, a different parameter set could be stored in the **DSSAD**.

- In case of a collision during automated mode, **DSSAD** and **EDR** data is needed.

- **EDR** and **DSSAD** data has to withstand severe crashes and therefore require tests on vehicle and on component level.

Categories of data elements with examples - **EDR**

General

- Vehicle identification number
- Safety system equipment
- …

Dynamics

- Vehicle accelerations / speed
- Braking status
- Engine throttle
- Steering input
- Roll angle
- Tyre pressure
- Multi-collision detection
- …

Trigger / Events

- Trigger
- Overview of stored events
- …

Environment

- Ambient temperature
- Head lamp status
- Front wiper status
- …

Occupants

- Occupant size classification
- Seat track position
- Driver drowsiness
- Driver distraction
- …

Safety systems

- Safety belt status
- Airbag / pretensioner deployment times
- Pedestrian protection pressure sensor
- AEB system activation level
- Lane keeping system activation level
- E-Call
- …

Check

- Last data retrieval
- Malfunctions
- Complete file recorded / sent
- On-board power supply
- …

Time / location

- [UTC] time stamp
- [GPS] coordinates

Categories of data elements with examples - **DSSAD**

General

- Vehicle identification number
- AD function equipment
- …

AD function [ALKS]

- Operation mode
- TD
- MRM
- EM
- OV
- Reasons for automatic mode changes
- (Confirmed) Interactions with driver
- …

Environment

- Ambient temperature
- Front wiper status
- Brightness / illumination
- …

Trigger / Events

- EDR activation
- Overview of AD events
- …

Dynamics

- Vehicle speed
- Braking status
- Steering input
- …

Check

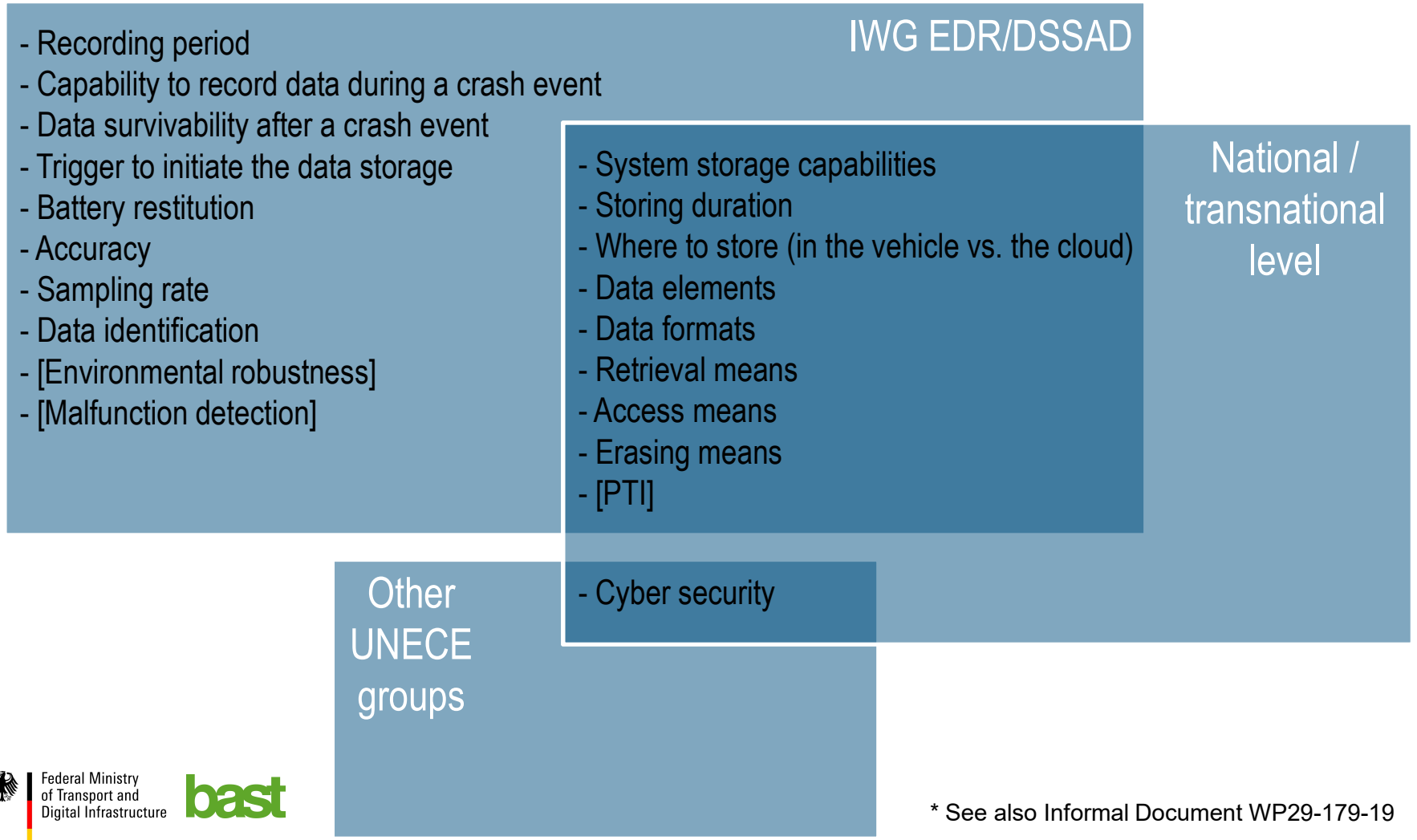
- Last data retrieval
- Malfunctions
- Complete file recorded / sent
- Communication with EDR
- …

Time / location

- [UTC] time stamp
- [GPS] coordinates

Other Items* under Discussion

– IWG EDR/DSSAD is a technical group aiming for technology neutrality!



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* See also Informal Document WP29-179-19

Thank you for your kind attention!