PEGASUS Method for Assessment of Highly Automated Driving Function

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Supported by:

Federal Ministry
for Economic Affairs
and Energy

on the basis of a decision
by the German Bundestag

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Project for the **e**stablishment of **g**enerally **a**ccepted quality criteria, tools and methods as well as **s**cenarios and **s**ituations for the release of HAD functions.

42 Months Term	January 1st, 2016 – June 30th, 2019
17 German Partners	▪ OEM: Audi, BMW, Daimler, Opel, Volkswagen ▪ Tier 1: Bosch, Continental ▪ Test Lab: TÜV SÜD ▪ SMB: fka, iMAR, IPG, QTronic, TraceTronic, VIRES ▪ Scientific institutes: DLR, TU Darmstadt
12 Subcontracts	▪ i.a. IFR, ika, OFFIS
Project Volume	▪ approx. 34,5 Mio. EUR ▪ Subsidies: 16,3 Mio. EUR
Personnel Deployment	▪ approx. 1.791 man-month or 149 man-years

Resulting Starting Position – Automated Driving

Together with electric driving, automated driving is tomorrow's subject matter.

Basic functionality is technologically given

Has been demonstrated in various projects

High standards regarding quality and performance of the automated vehicle

➔ Measures that product needs to meet

Existing measures for testing and release are insufficient, too cost-intensive and too complex

➔ Consequently, the introduction of highly automated driving features today can only be achieved with great expenditure.

Major Questions of the Project

What level of performance is expected of an automated vehicle?
How can we verify that it achieves the desired performance consistently?

Scenario Analysis & Quality Measures

- What human capacity does the application require?
- What about technical capacity?
- Is it sufficiently accepted?
- Which criteria and measures can be deducted from it?

Implementation Process

- Which tools, methods and processes are necessary?

Testing

- How can complete-ness of relevant test runs be ensured?
- What do the criteria and measures for these test runs look like?
- What can be tested in labs or in simulation? What must be tested on proving grounds, what must be tested on the road?

Reflection of Results & Embedding

- Is the concept sustainable?
- How does the process of embedding work?

PEGASUS approach
to answer the question

How safe is safe enough and how can we verify that it achieves the desired performance consistently?

is:

Method for Assessment of Highly Automated Driving Function

PEGASUS Method for Assessment of Highly Automated Driving Function (HAD-F)

Argumentation	Evidence

Safety argumentation

Safety evidence

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Argumentation	Evidence

Goal:
Safety argument

Start:
Use-Case

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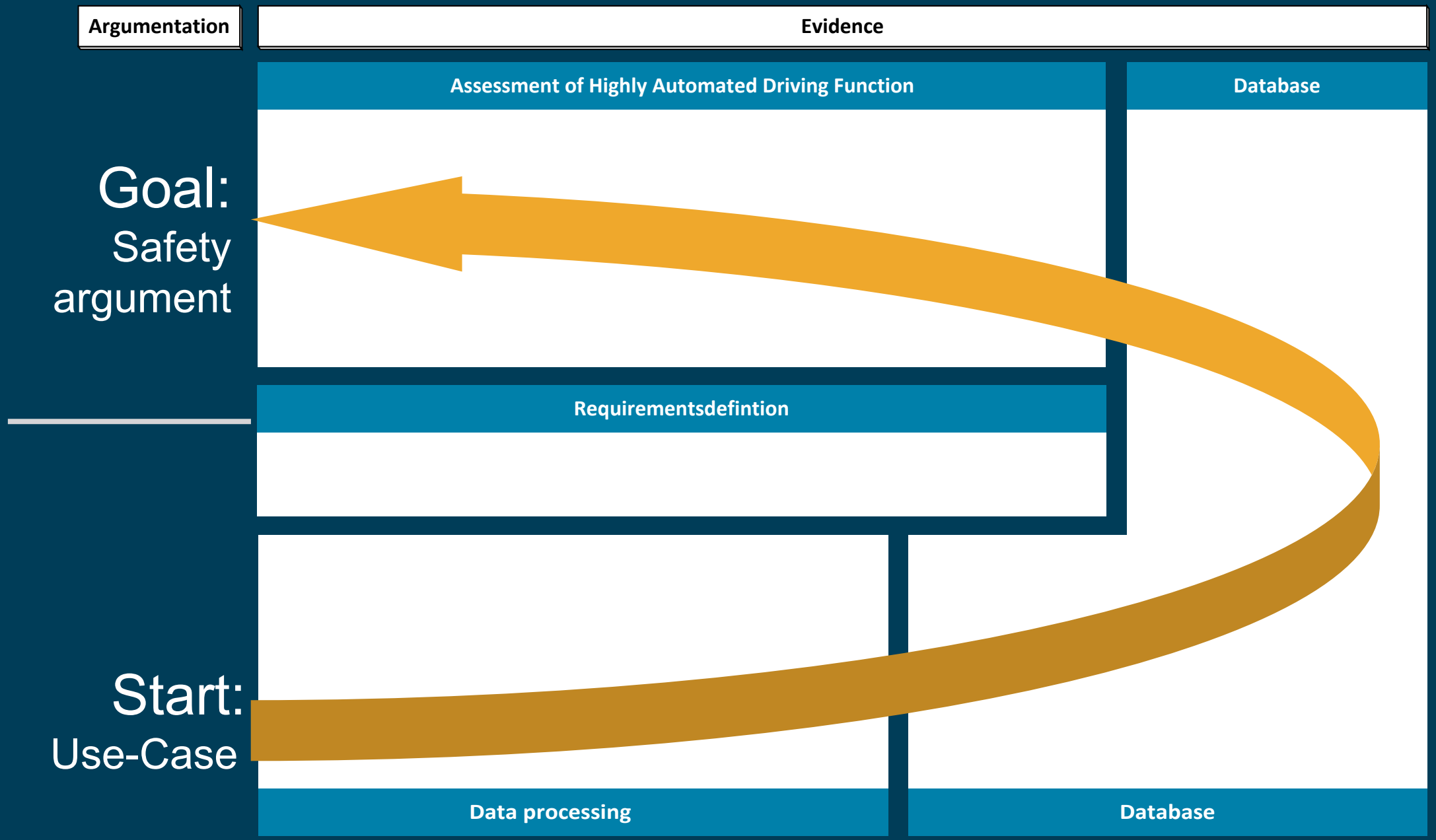

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Argumentation

Evidence

Assessment of Highly Automated Driving Function

Database

Requirementsdefintion

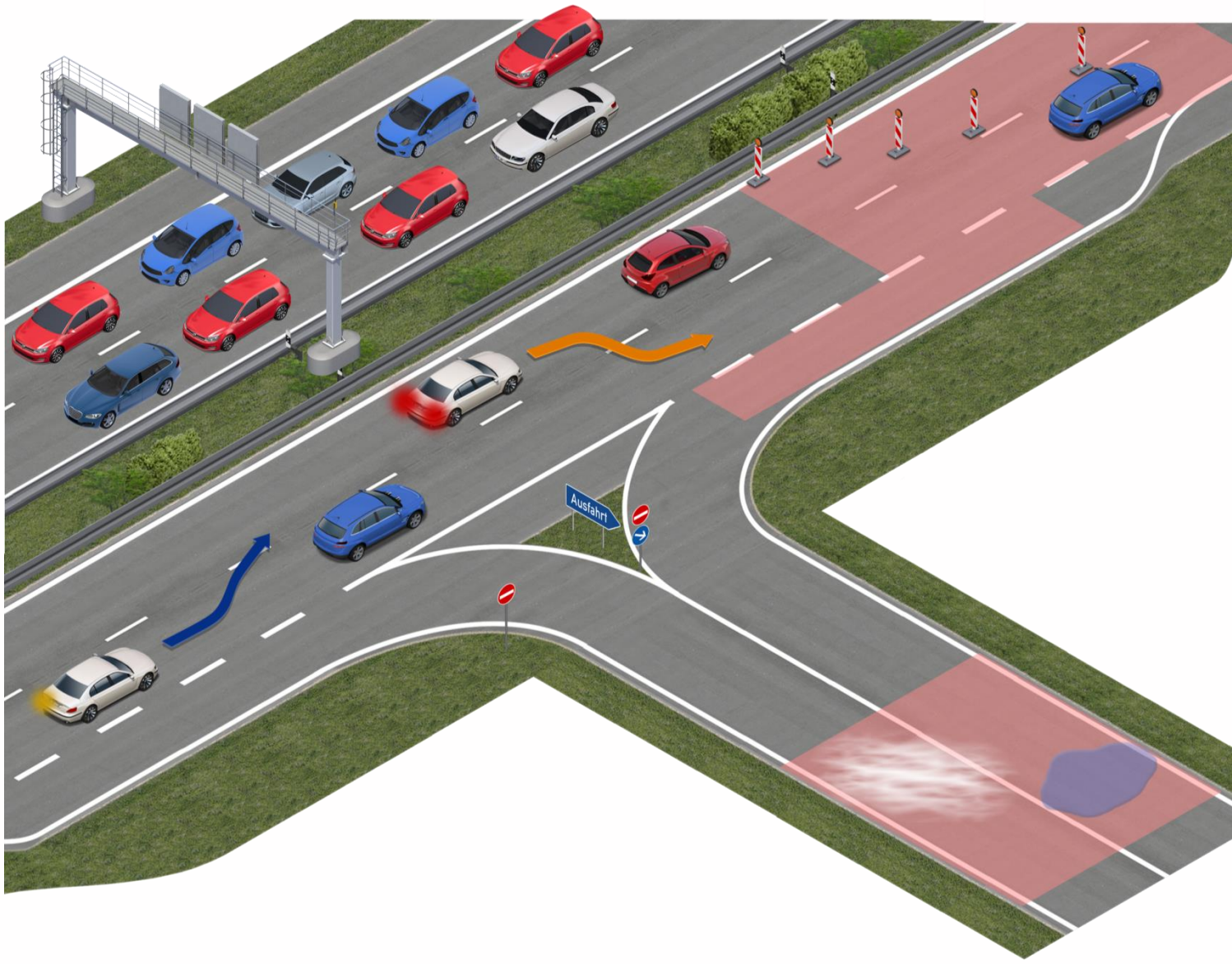
Use Case, Knowledge, Data

Data processing

Database

Use Case

- Safeguarding of Level 3 (Highly Automated Driving) function
- Based on an application-oriented example, highway chauffeur
  - Basic function:
    - ✓ Highways or highway-like roads incl. road markings
    - ✓ Speed 0 - 130 km/h
    - ✓ Automated following in stop & go traffic jams
    - ✓ Automated lane changing
    - ✓ Automated emergency braking and collision avoidance
    - ✗ Construction sites
    - ✗ Automated exiting off the highway
    - ✗ Extreme weather conditions



source: VW

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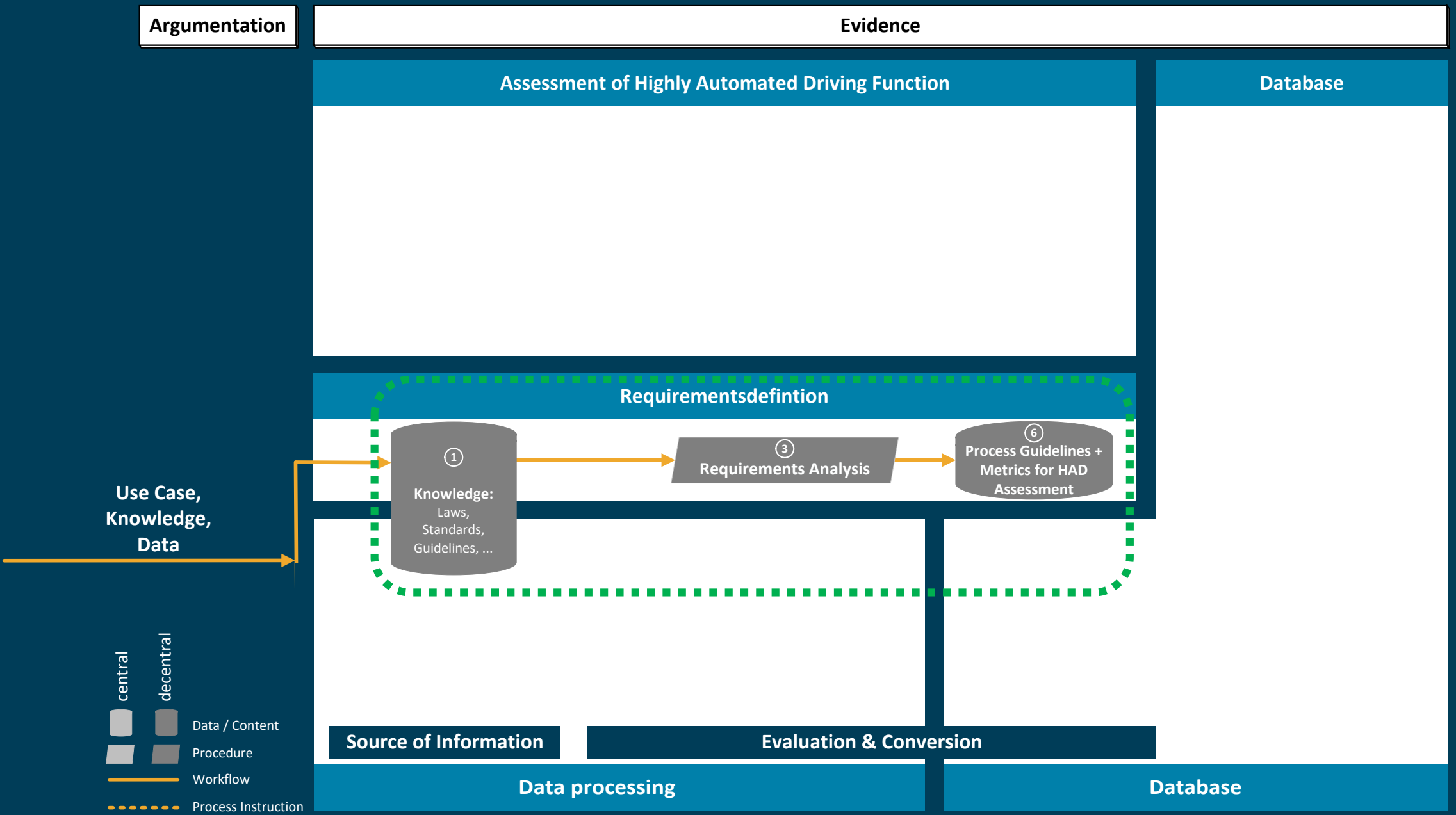
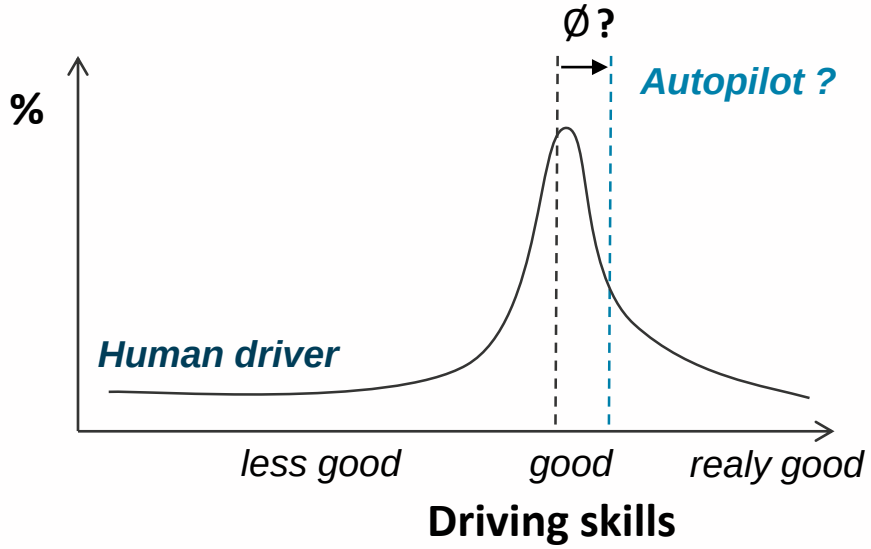


Social acceptance

How good is good enough?

- Which functional performance does a highly automated druving function need to reach a social acceptance?



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Argumentation

Evidence

Assessment of Highly Automated Driving Function

Database

Requirementsdefintion

① **Knowledge:** Laws, Standards, Guidelines, ...

③ **Requirements Analysis**

⑥ **Process Guidelines + Metrics for HAD Assessment**

Use Case, Knowledge, Data

② **Daten:**
Test Drive
Simulation
Simulator
FOT/NDS
Accident

Source of Information

central
decentral

Data / Content
Procedure
Workflow
Process Instruction

Data processing

Database

Input data

NDS / FOT

Simulation

Simulator

Real world

crash

GIDAS

GERMAN IN-DEPTH ACCIDENT STUDY

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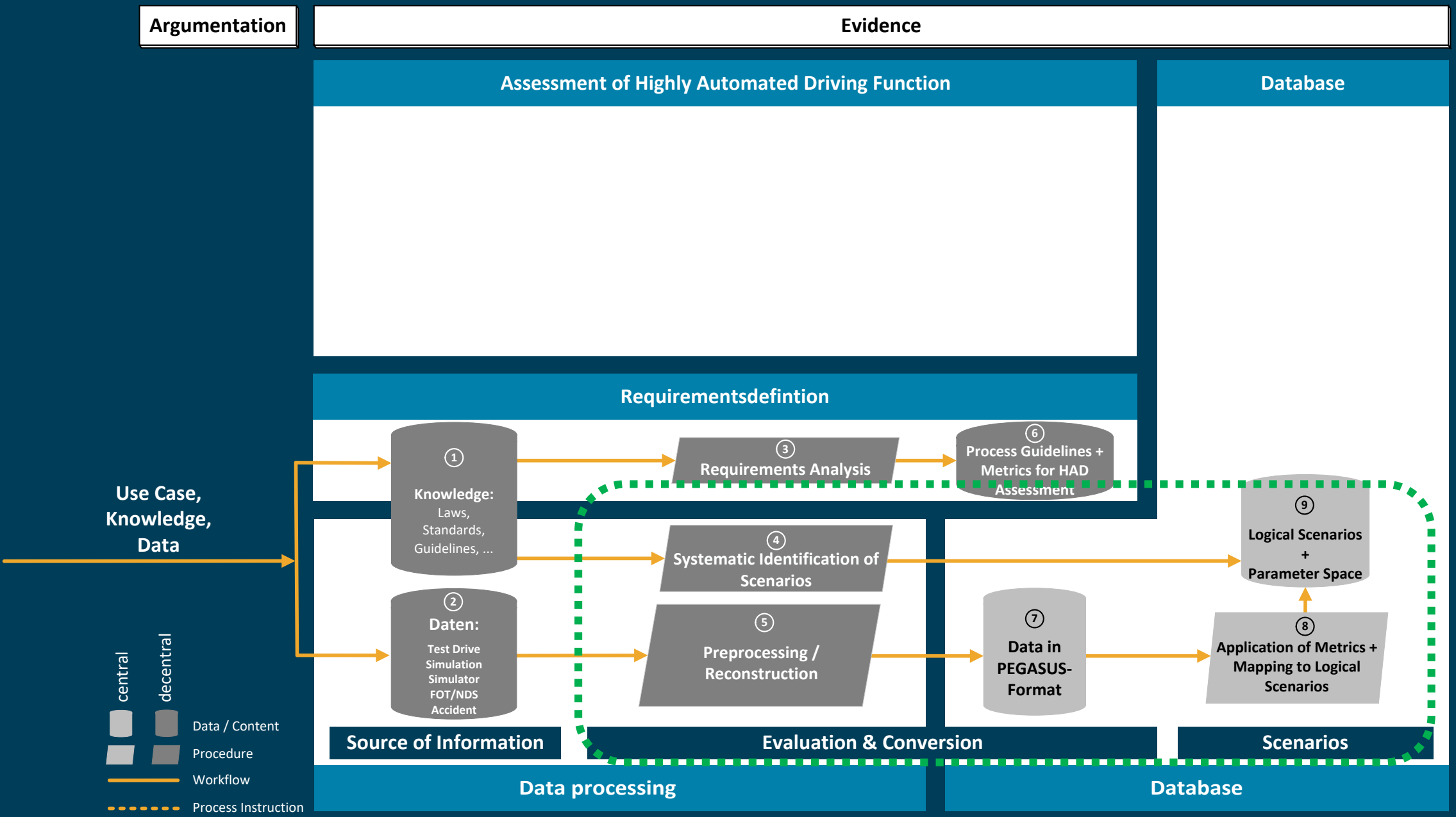

Scenarios and possibilities for description

Layer model

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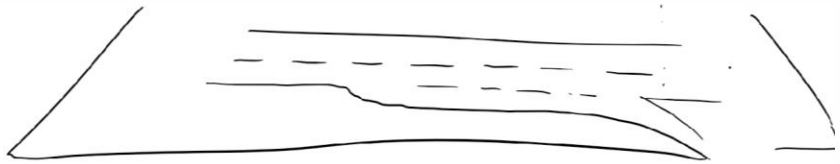

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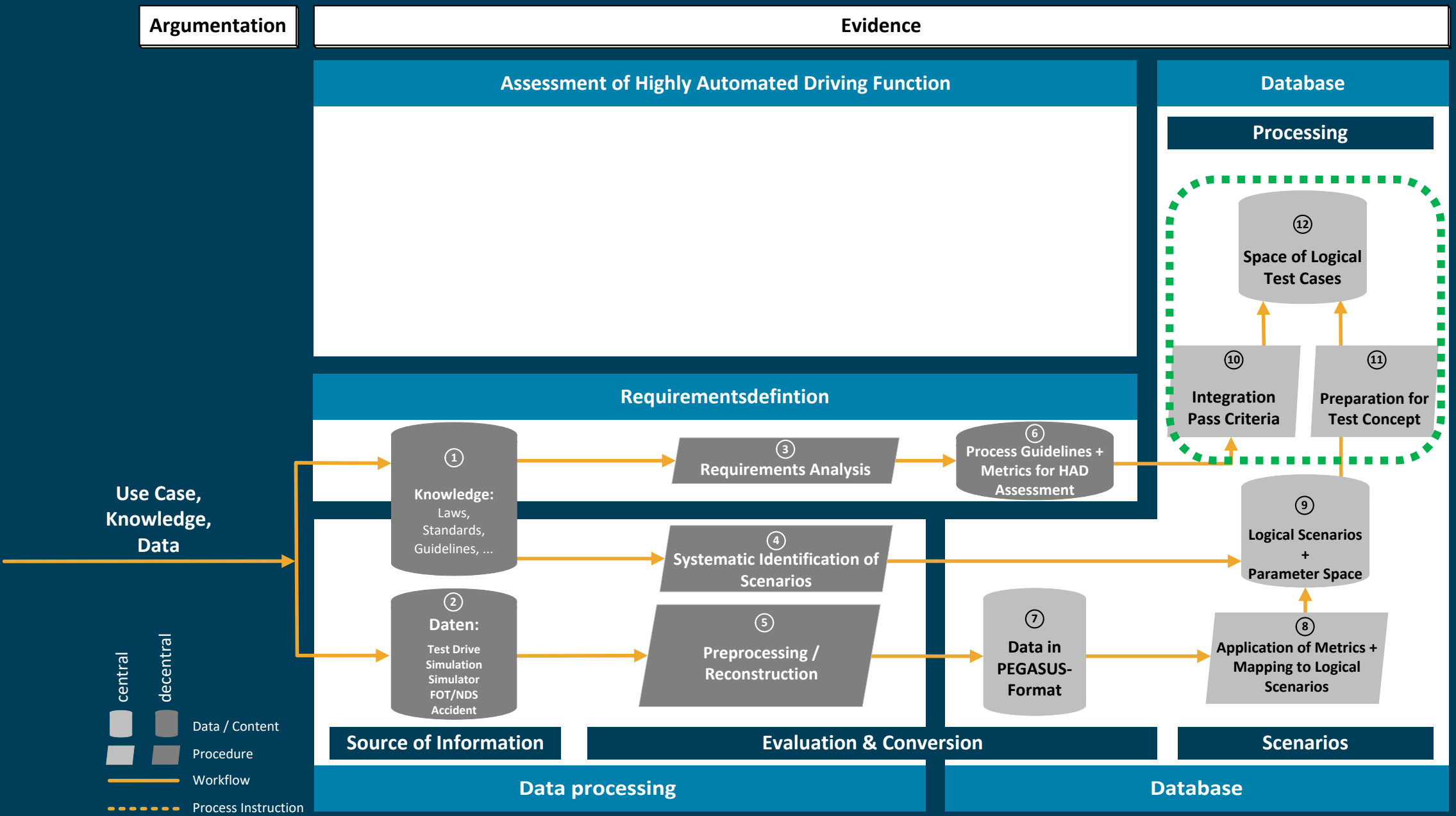

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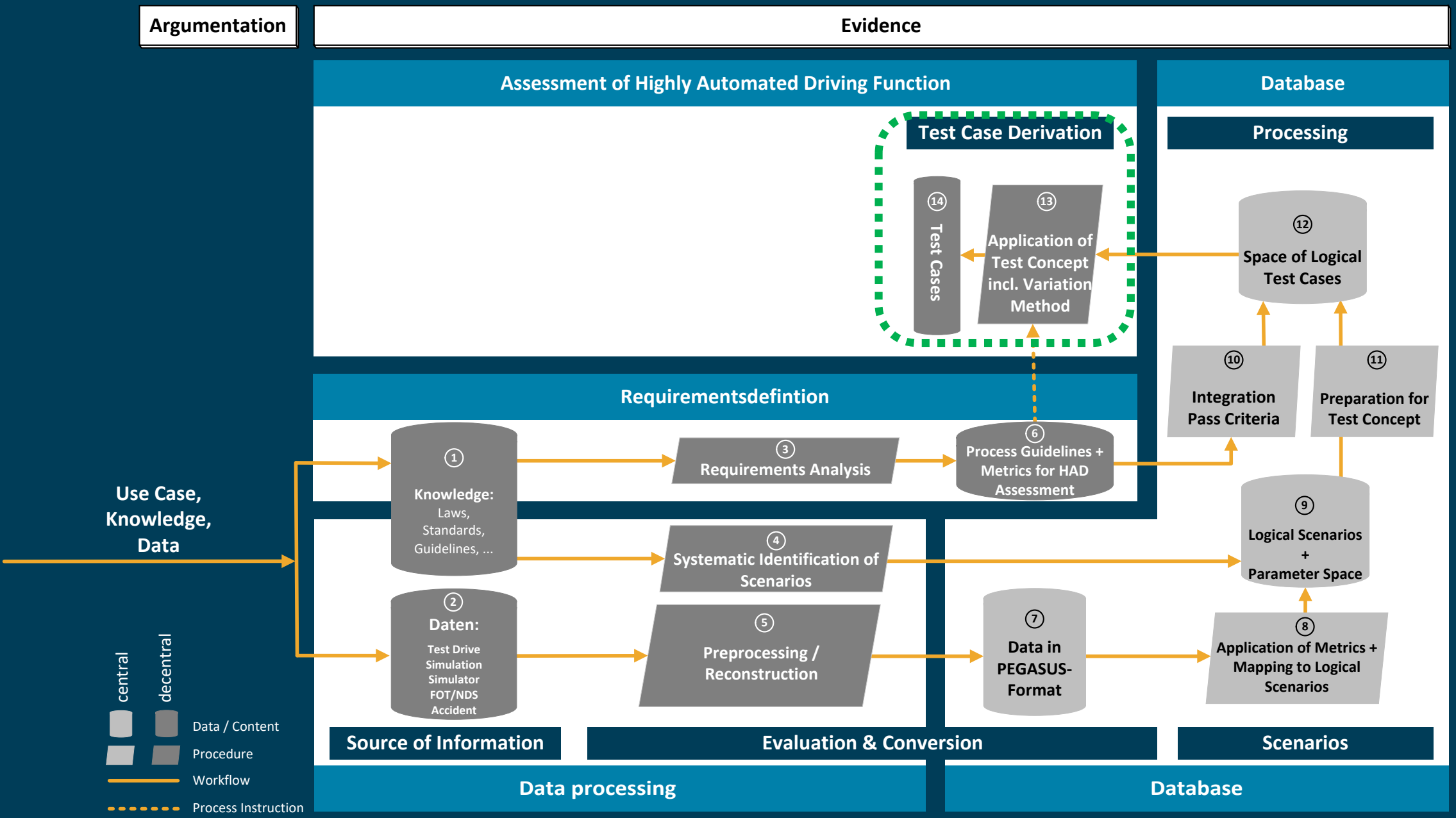
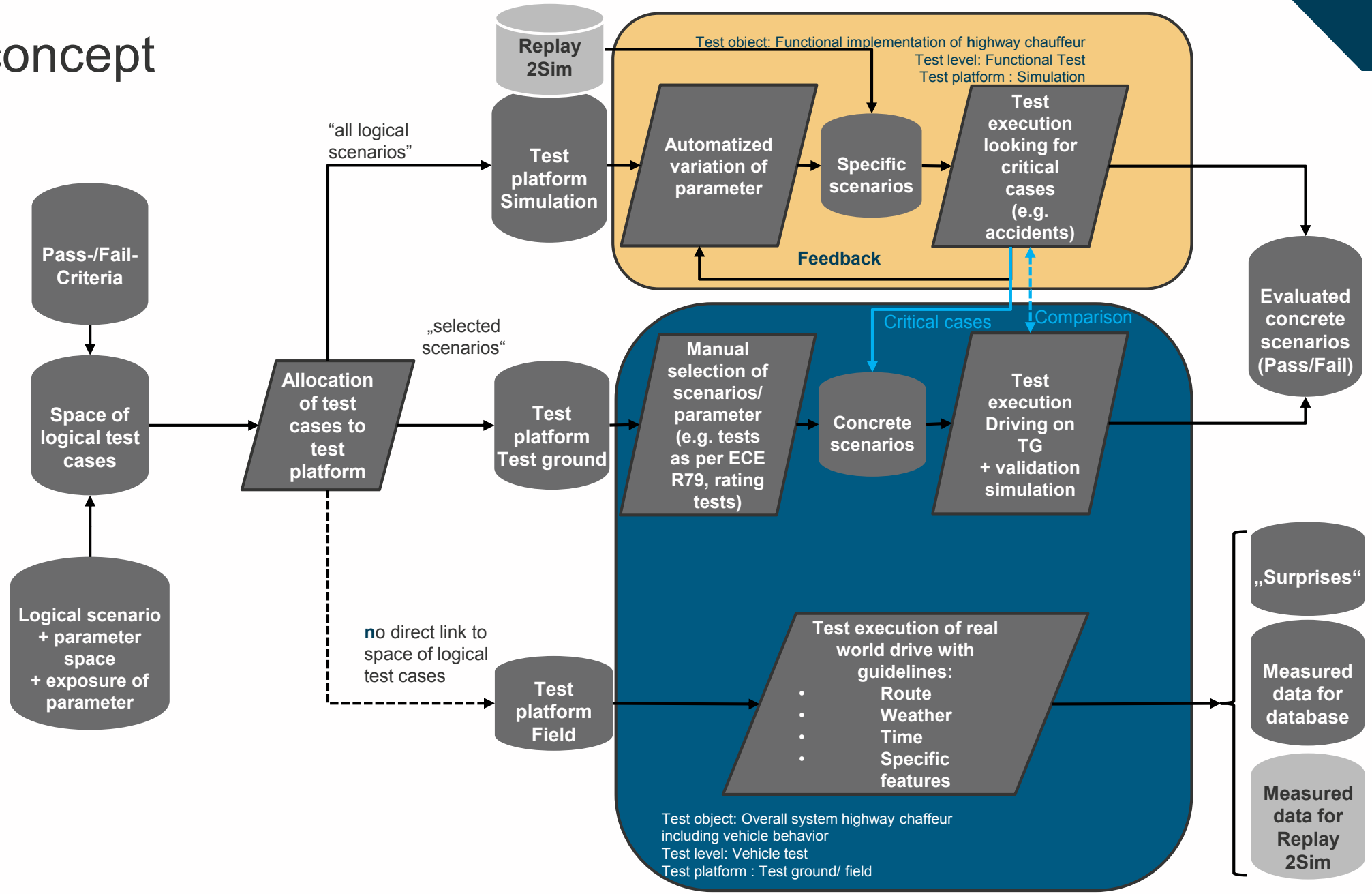


Test concept



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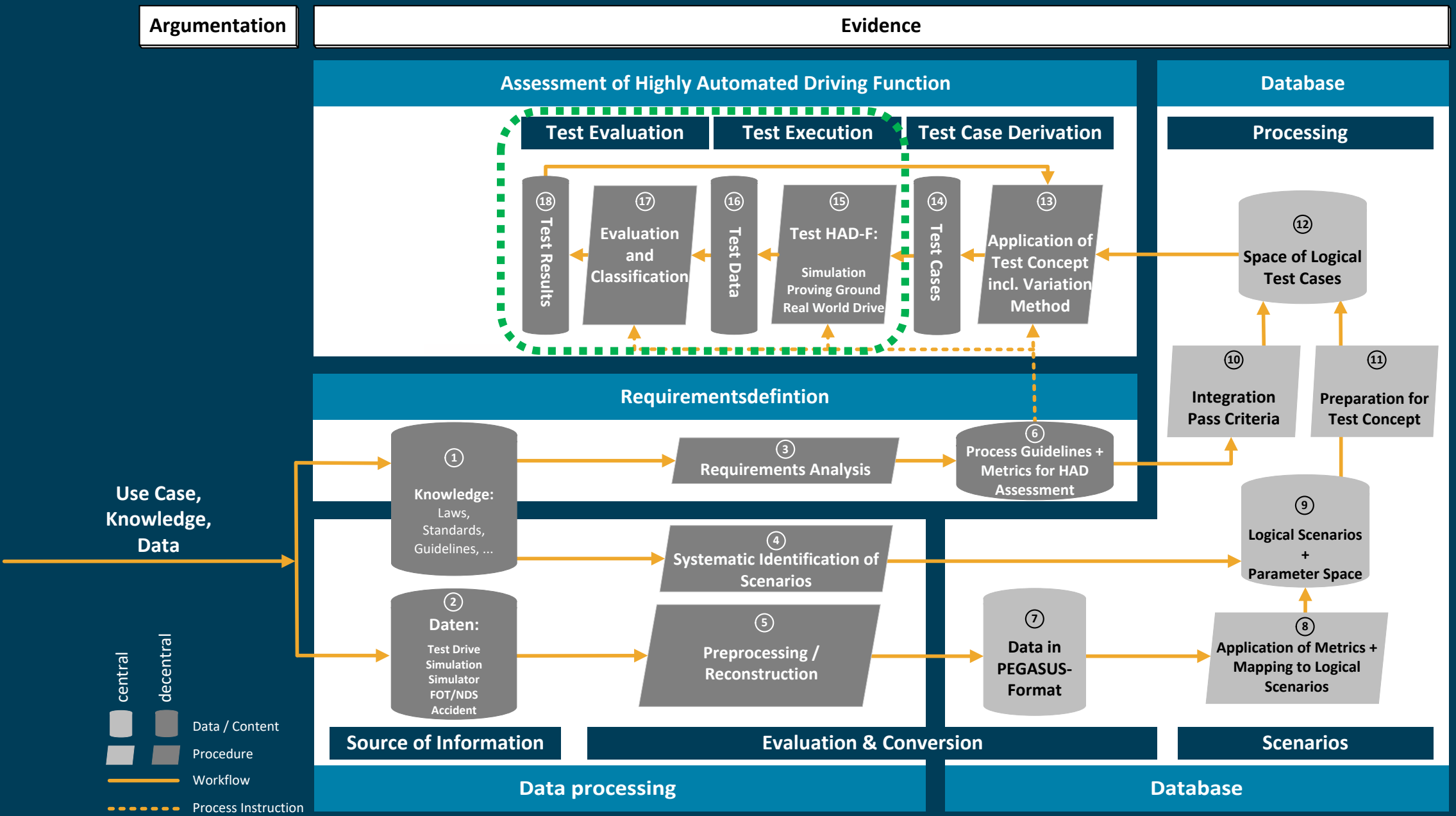
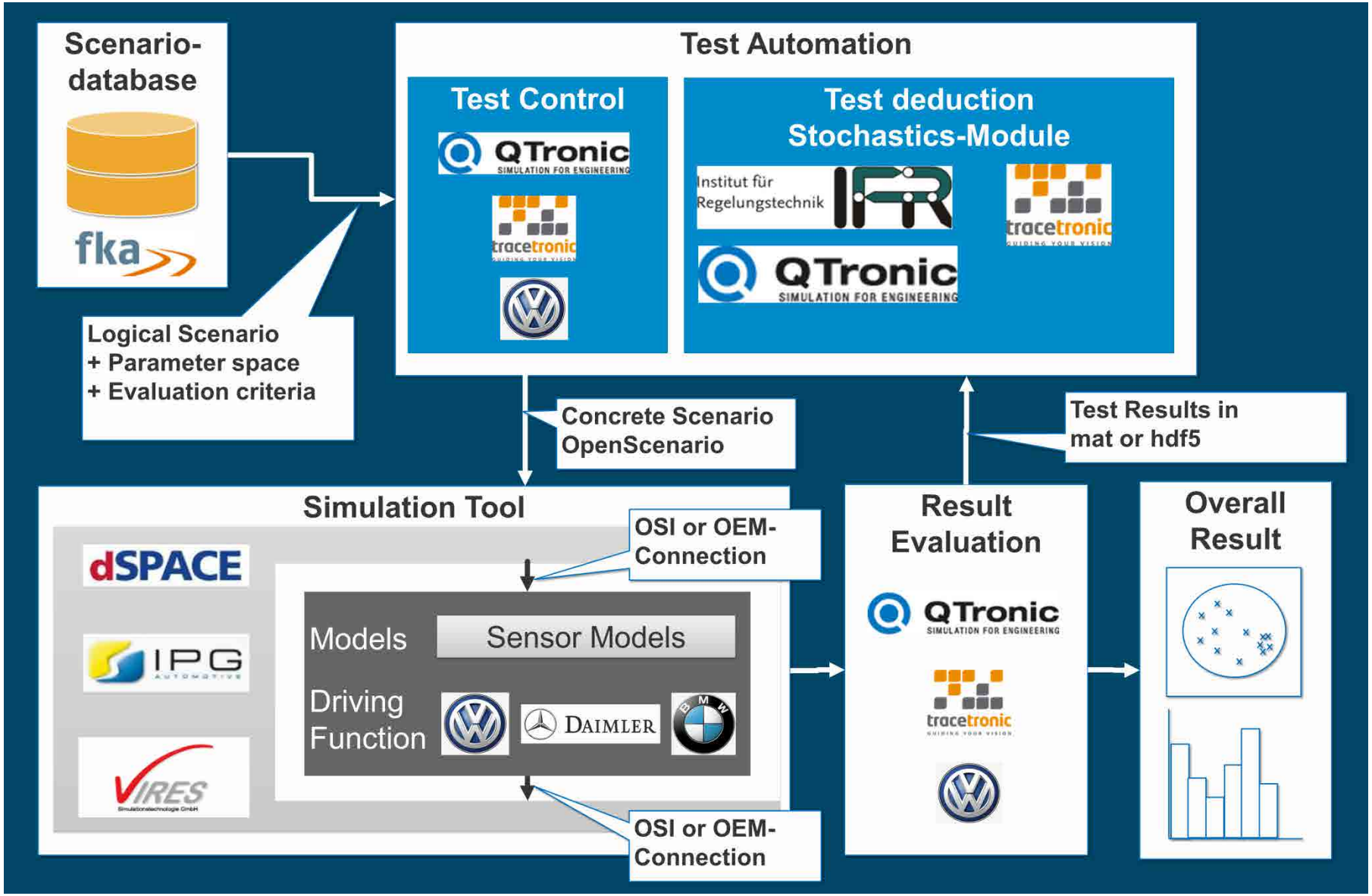


Example: Software in the Loop



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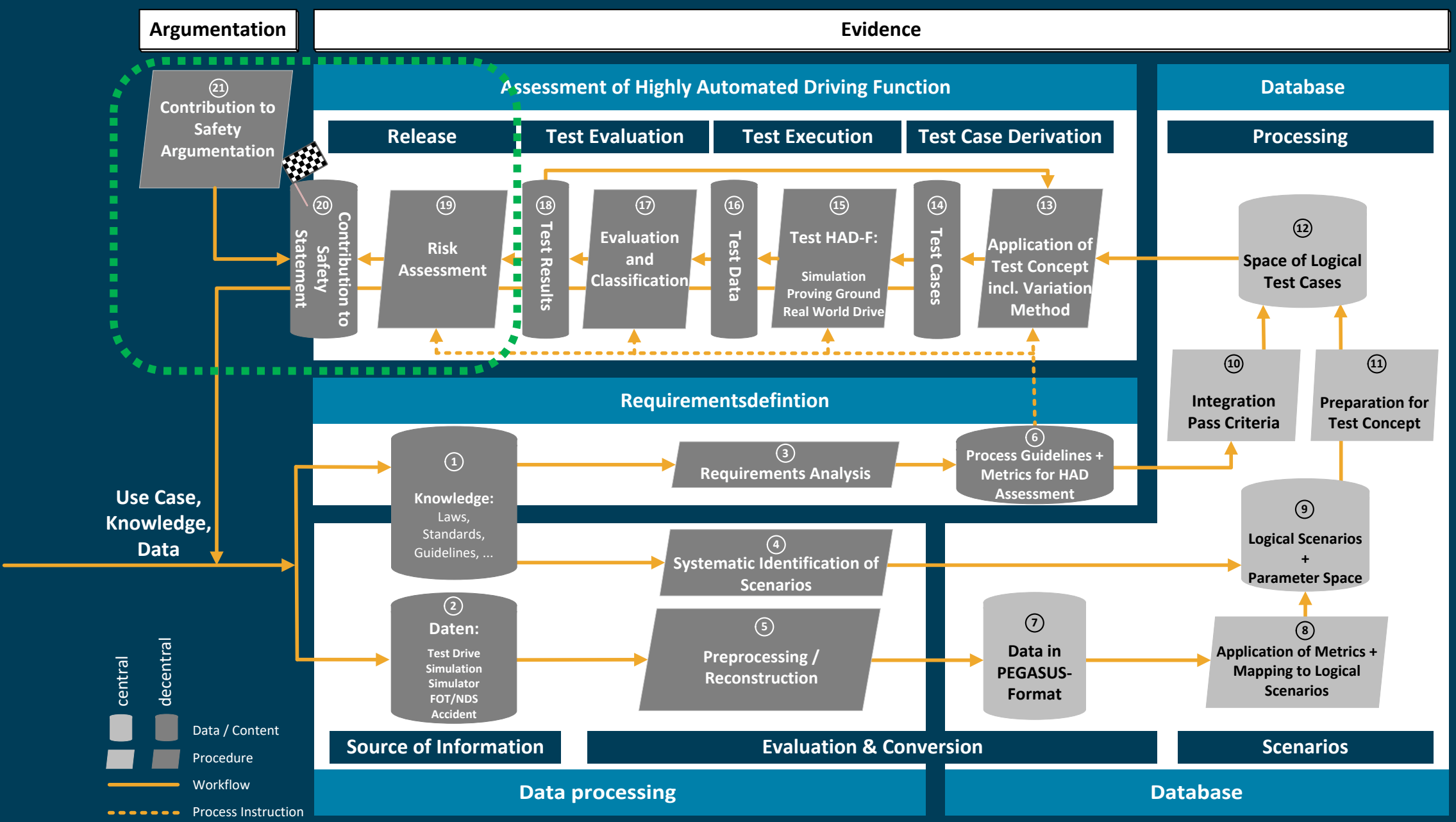

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