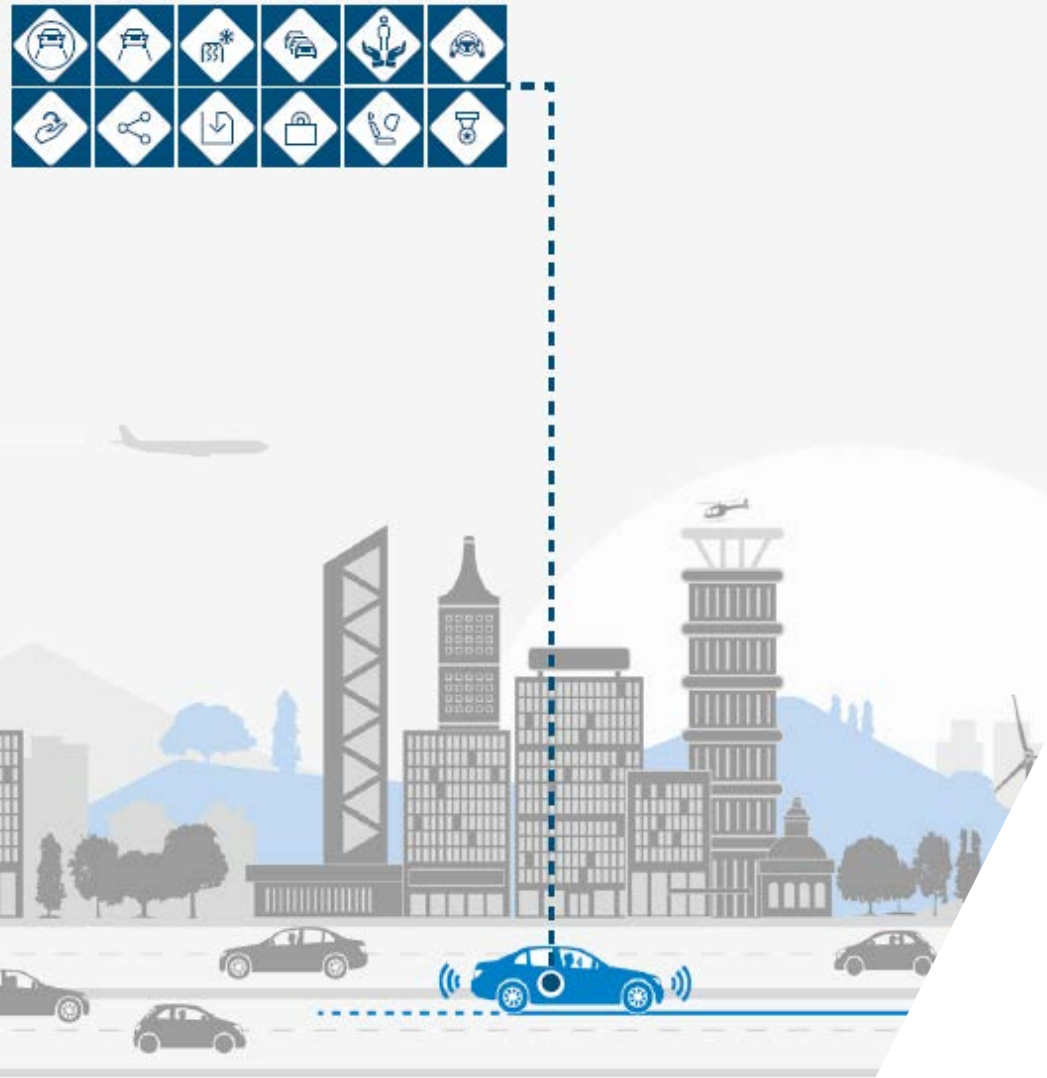

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SAFETY FIRST FOR AUTOMATED DRIVING

Globally published on 2nd of July 2019

FIRST PUBLICATION OF WHITE PAPER “SAFETY FIRST FOR AUTOMATED DRIVING” IS AVAILABLE.

A worldwide team of 60 top safety specialist from 11 major companies wrote

157 pages

thinking safety from the top down – from risk balance to implementation

holistic approach to L3/4 systems

emphasizing the importance of safety by design and verification & validation

GLOBAL STANDARDIZATION AND SYNCHRONIZATION IS NEEDED TO COMPLEMENT REGIONAL AND TOPIC-SPECIFIC SAFETY INITIATIVES.

“SAFETY FIRST FOR AUTOMATED DRIVING” ACTS GLOBALLY AND COVERS ALL RELEVANT AREAS - FROM DESIGN TO VERIFICATION & VALIDATION OF L3/4 SYSTEM

INDEPENDENTLY DEVELOPED ECOSYSTEMS INCREASE THE COMPLEXITY TO HARMONIZE A UNIFIED LEGAL FRAMEWORK

ISO/PAS 21448 (SotiF)

Power Supply

Performance Compute

Tooling

Degradation

microphone

Camera

DNNs

Minimal Risk Maneuver

HD-maps

ISO 26262 (FuSa)

Radar

Ultrasonic

Ego-motion

Traffic Rules

ISO/SAE CD 21434 (Cyber Security)

User State Determination

Simulation

Lidar

GNSS

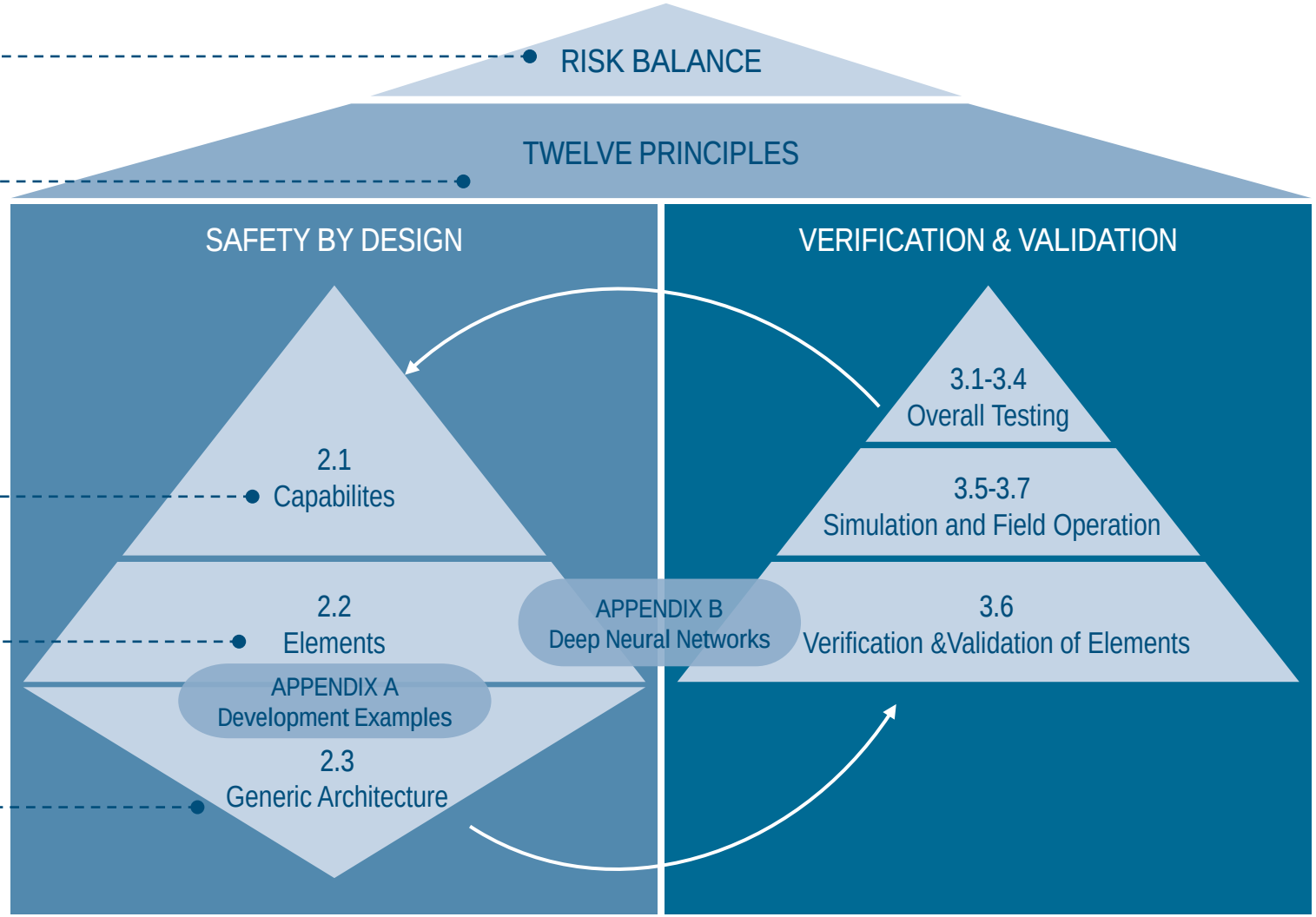
Different Ecosystems

A B C

STANDARDIZATION OF ECOSYSTEMS HAS THE POTENTIAL TO SPEED UP THE DEVELOPMENT AND DEFINITION OF A UNIFIED LEGAL FRAMEWORK

THINKING SAFETY FROM THE TOP DOWN – FROM RISK BALANCE TO IMPLEMENTATION

1. How safe must a Level 3/4 system be?
2. What aspects are necessary to achieve the safety goals?
3. What concepts are needed to cover all the above aspects?
4. Which building blocks are necessary to create the concepts?
5. How to design a generic architecture out of these building blocks?



HOW SAFE MUST A LEVEL 3/4 SYSTEM BE?

ACCIDENTS IN CHINESE CITIES

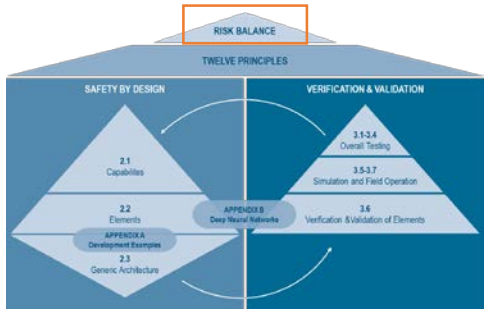
ACCIDENTS IN THE US

GLOBAL AVERAGE HUMAN DRIVING PERFORMANCE

ACCIDENTS ON GERMAN HIGHWAYS

ZERO AVOIDABLE ACCIDENTS

Based on recommendation of the German Ethics Commission in 06/2017 (BMVI):
Maximizing the evidence of a positive risk balance of automated driving solutions compared to THE AVERAGE HUMAN DRIVING PERFORMANCE.

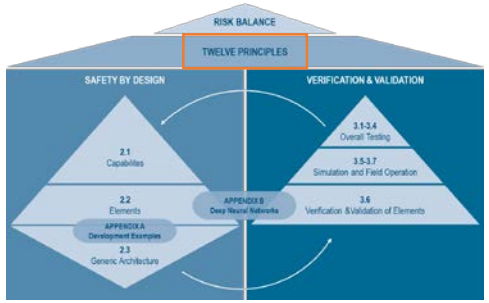


THE AVERAGE HUMAN DRIVING PERFORMANCE based on accidents statistics is differing

- between Europe, US and China
- and between road types e.g. highway or urban road
- weather, age of driver

WHAT ASPECTS ARE NECESSARY TO ACHIEVE THE SAFETY GOALS?

- Safe Operation
- Safety Layer
- Operational Design Domain
- Behavior in Traffic
- User Responsibility
- Vehicle Initiated Handover
- Vehicle-Operator Initiated Handover
- Interdependent Vehicle Operation & ADS
- Data Recording
- Security
- Passive Safety
- Safety Assesment

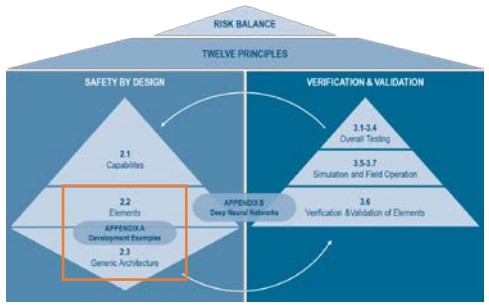


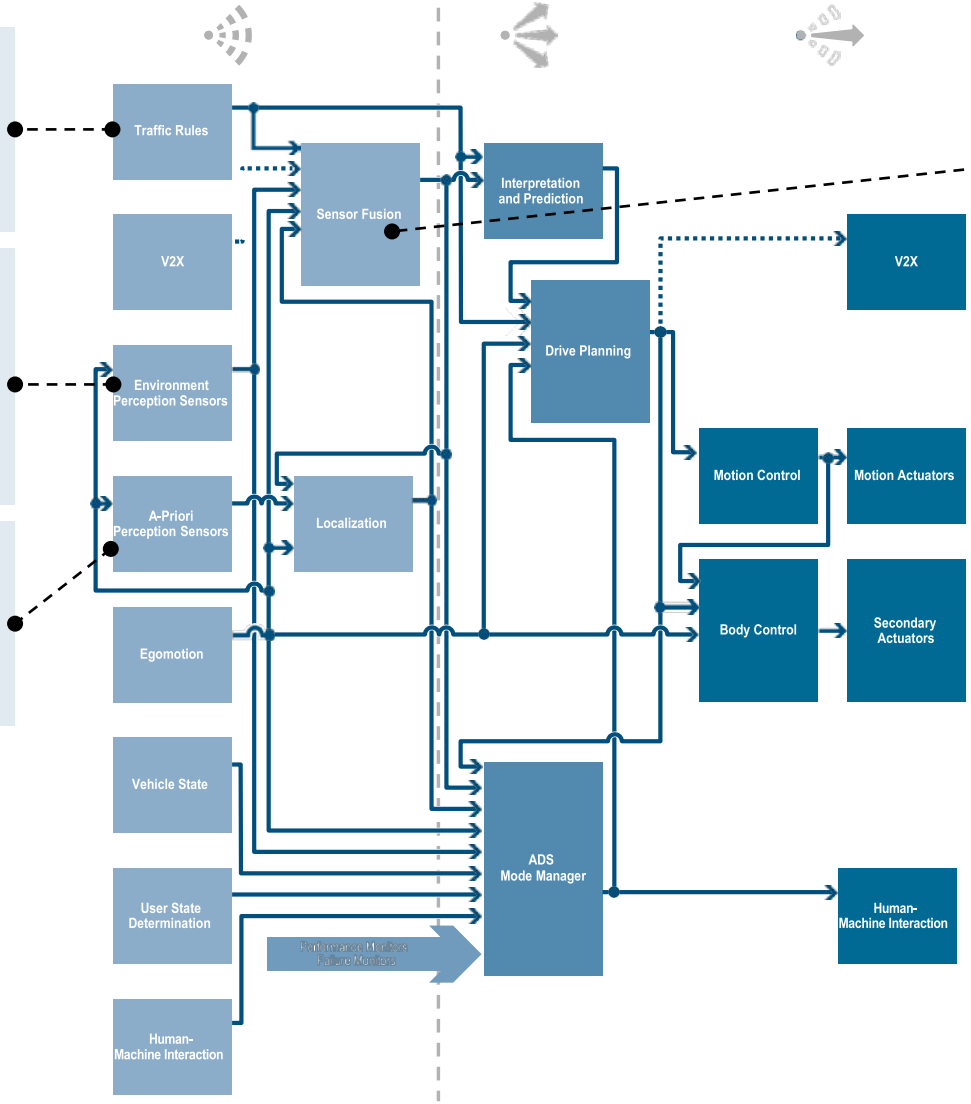
WHICH BUILDING BLOCKS ARE NECESSARY TO CREATE CONCEPTS AND HOW TO DESIGN A GENERIC ARCHITECTURE OUT OF THEM?

Traffic Rules: Worldwide and locally different traffic rules need to be taken into account.

Environment Perception Sensors: Different physical principles.

HD maps have to offer reliable map attributes.





Sensor Fusion: Combination of at least three sensor technologies (e.g. camera, lidar, radar).

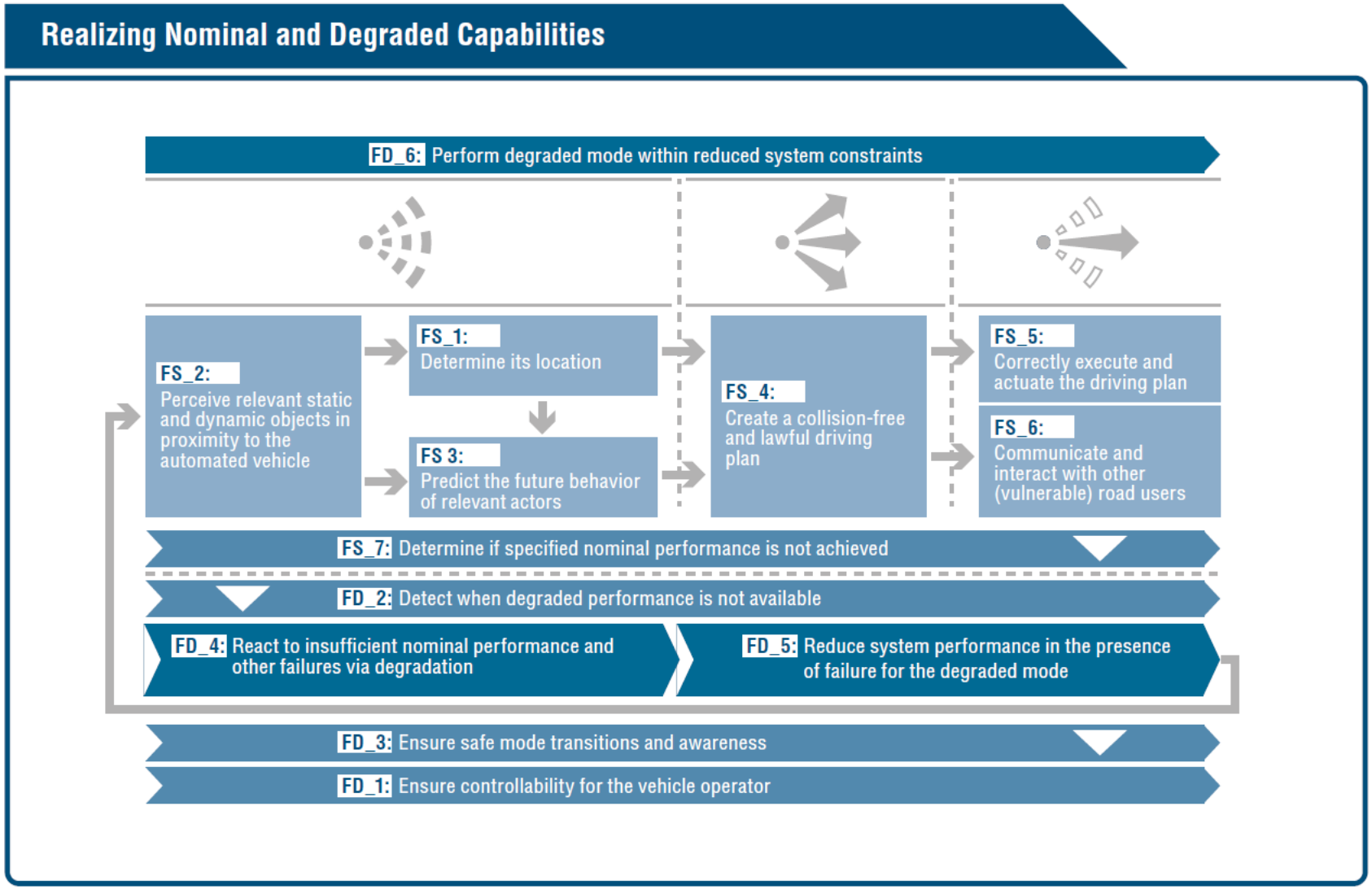
Safety measures for supervised offline trained DNNs.

Integrated circuits need to fulfill Functional Safety requirements.

Complement Verification & Validation approaches by field monitoring.

Implementation of redundant safety channel.

SAFETY BY DESIGN
NOMINAL AND DEGRADED FUNCTION



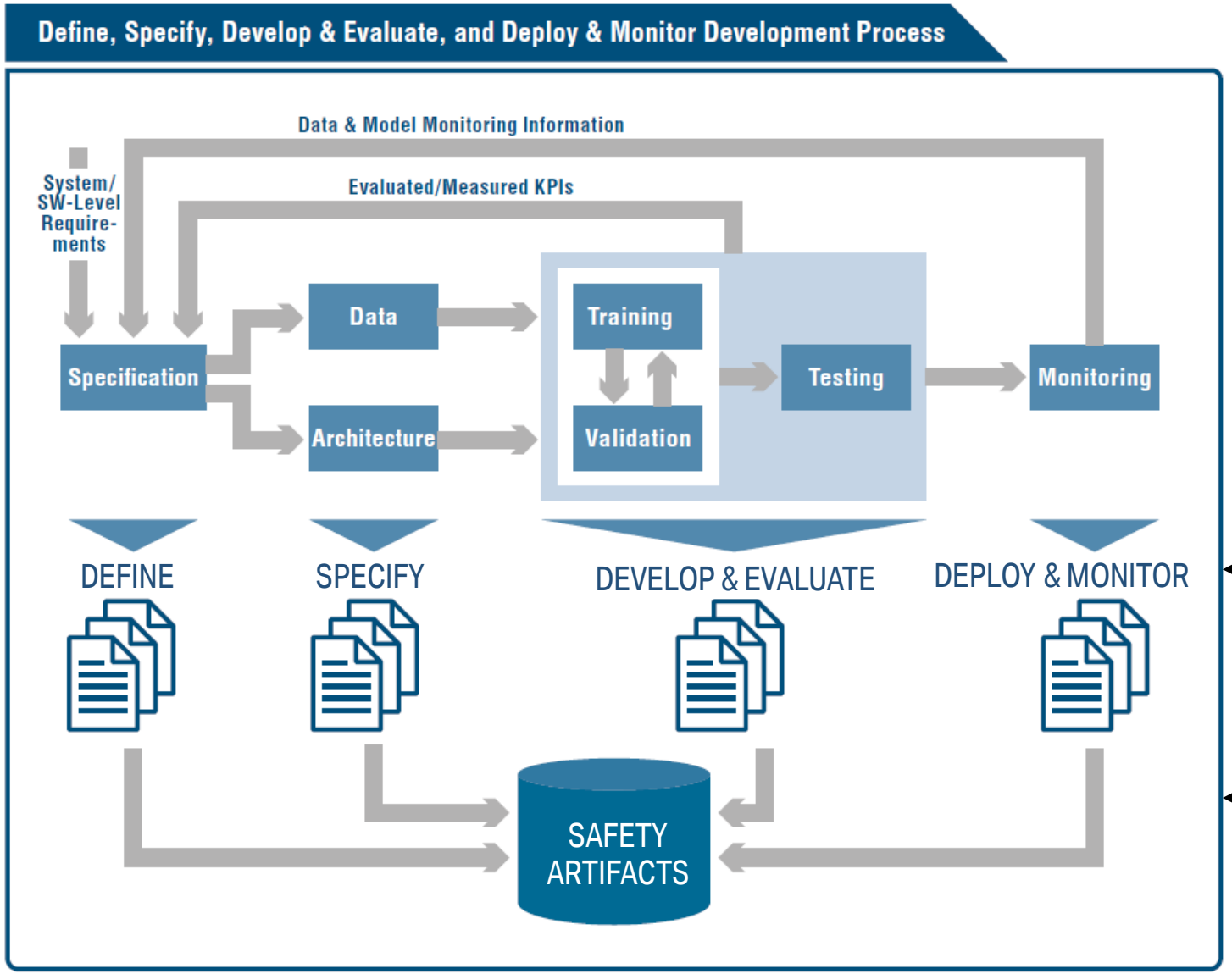
Fail Safe (FS):

After failure the risk is small or covered by *Fail Degraded*

Fail Degraded (FD):

Provide safe system for specific time until Minimal Risk Condition (MRC) is reached

DEEP NEURAL NETWORKS:
CRUCIAL TECHNOLOGY FOR AUTOMATED DRIVING.



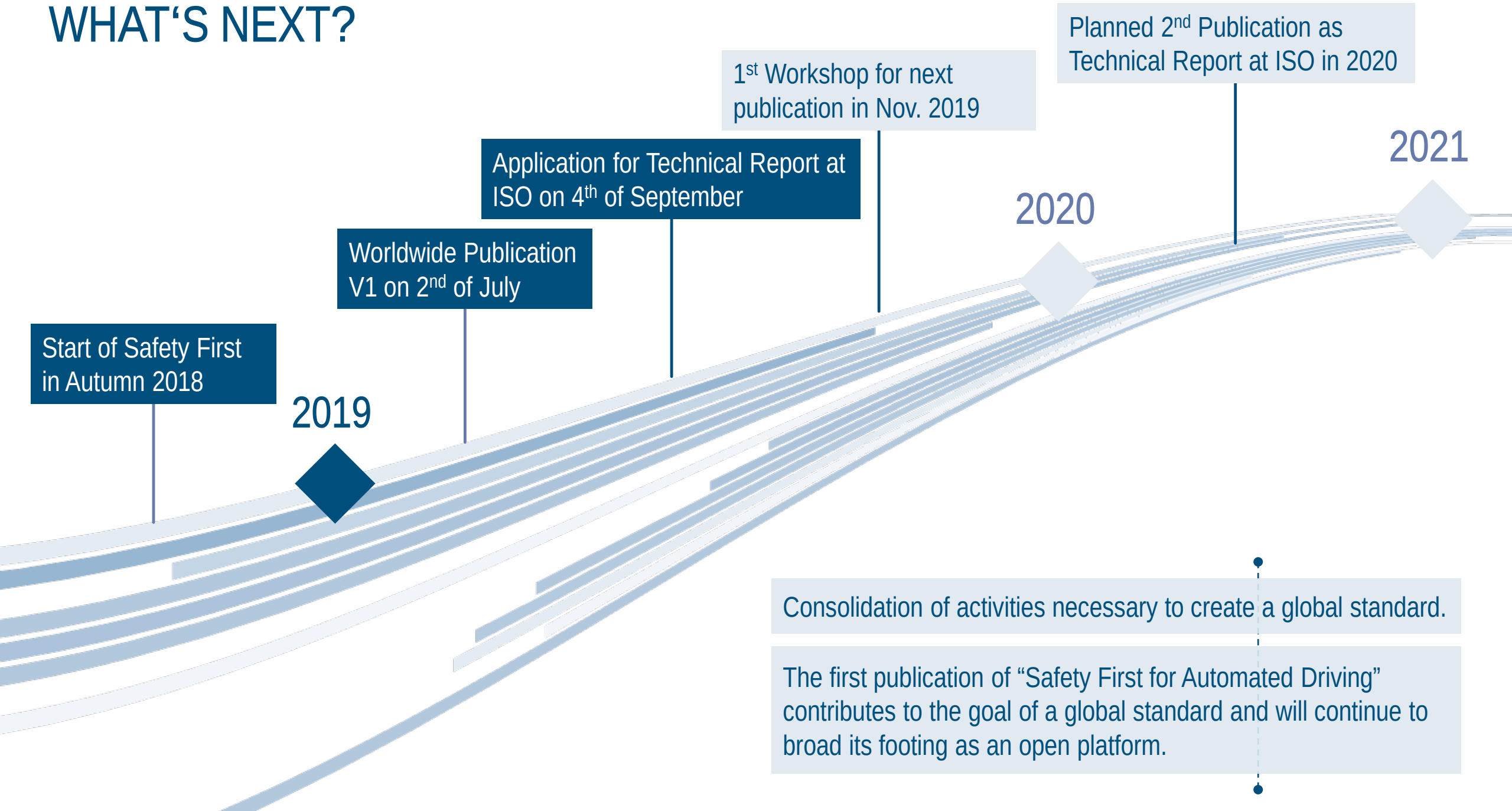
Modular-based system architecture recommends that machine learning algorithms are treated as a software component.

Development steps of deep neuronal networks

Each step should provide safety artifacts to support the safety case.

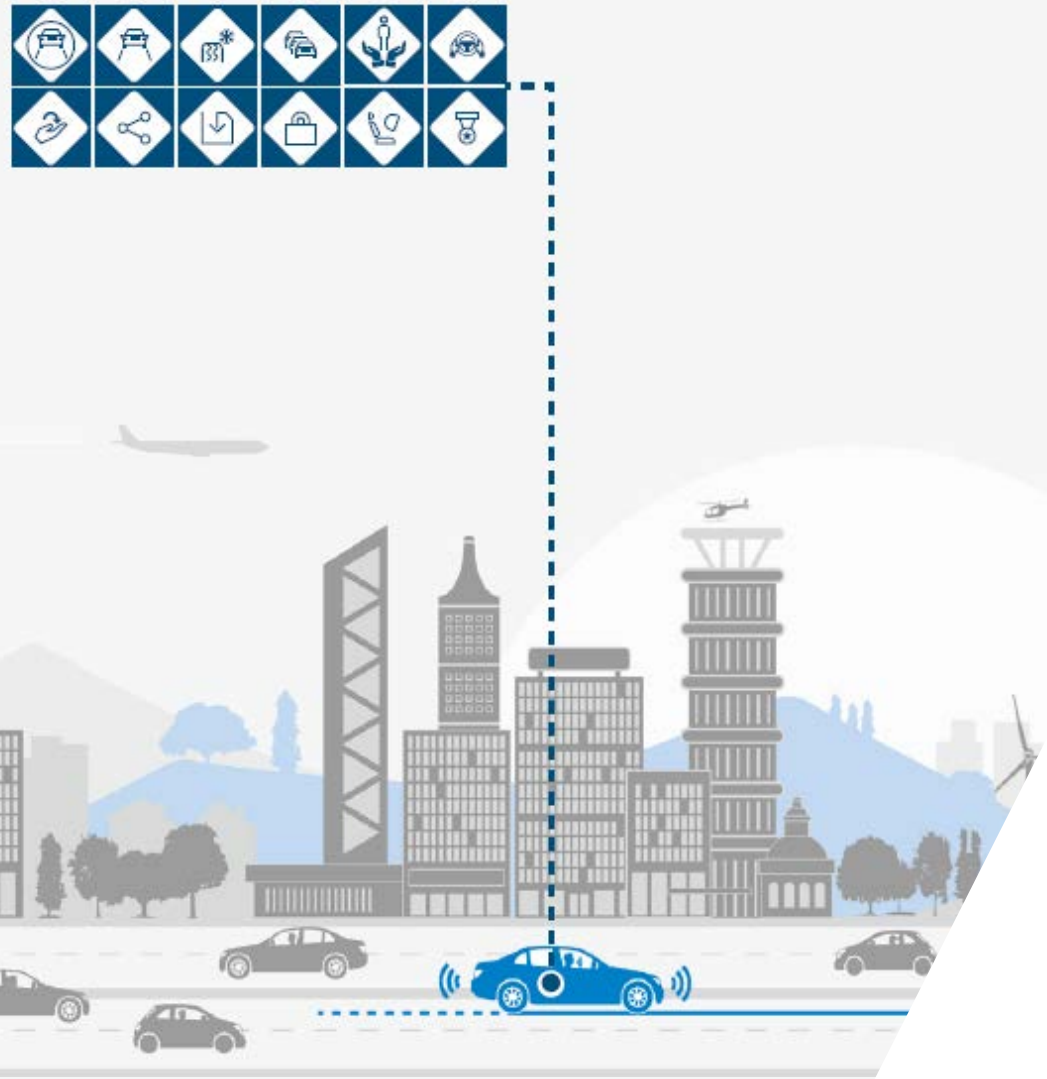
*Machine Learning

WHAT‘S NEXT?



Consolidation of activities necessary to create a global standard.

The first publication of “Safety First for Automated Driving” contributes to the goal of a global standard and will continue to broad its footing as an open platform.



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THANKS TO ALL PARTNERS FOR YOUR CONTRIBUTION!

...TO BE CONTINUED.