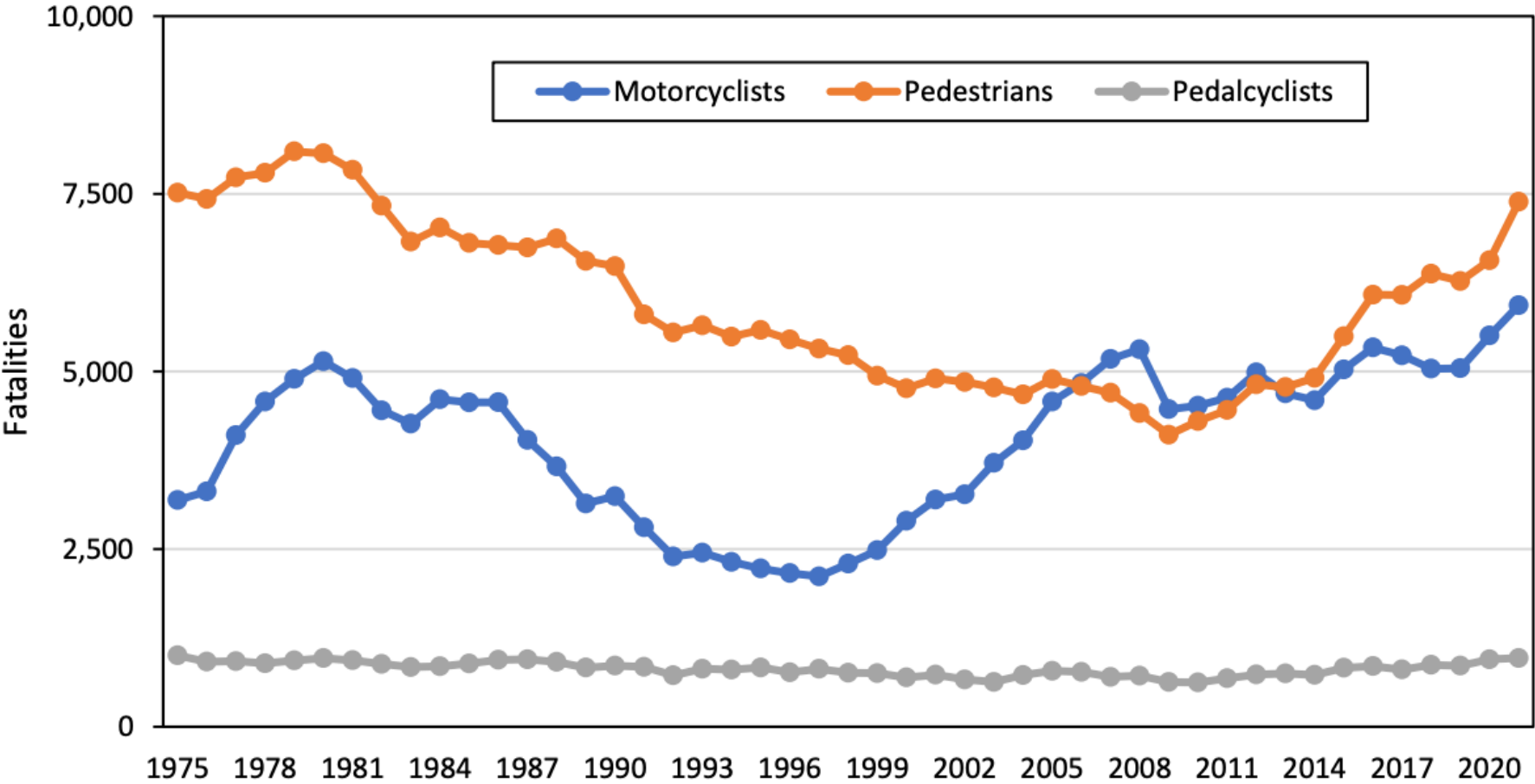# Deloitte.

Connected Infrastructure & Vehicles

Paving the Way for a Safer, Smarter Future in Transportation

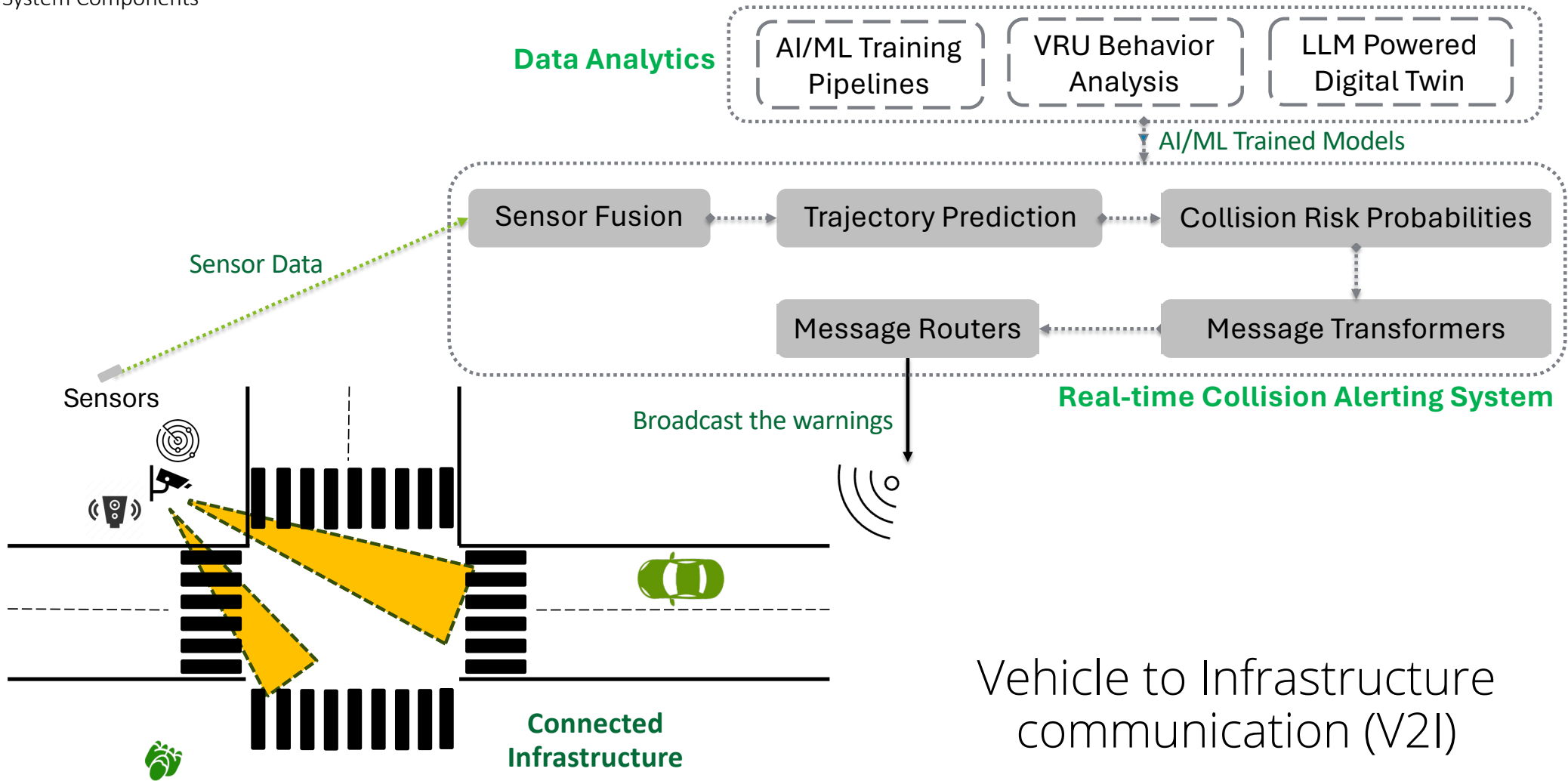# Transport Safety

Zero Road Fatalities is the only acceptable standard.

Source: FARS 1975-2020 Final File, 2021 ARF

VRU Safety System

System Components

Data Analytics

AI/ML Training Pipelines

VRU Behavior Analysis

LLM Powered Digital Twin

AI/ML Trained Models

Sensor Fusion → Trajectory Prediction → Collision Risk Probabilities

Message Routers ← Message Transformers

Sensor Data

Sensors

Broadcast the warnings

Real-time Collision Alerting System

Connected Infrastructure

Vehicle to Infrastructure communication (V2I)

Challenges

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Challenges

Confronting the intricacies of VRU safety requires an unwavering commitment to innovation and resilience, navigating through the demanding terrain to achieve effective solutions

1
Ultra-Low Latency

- Ensuring collision alerts reach vehicles swiftly, sensor perception must deliver **within 100 milliseconds**, in all-weather conditions.
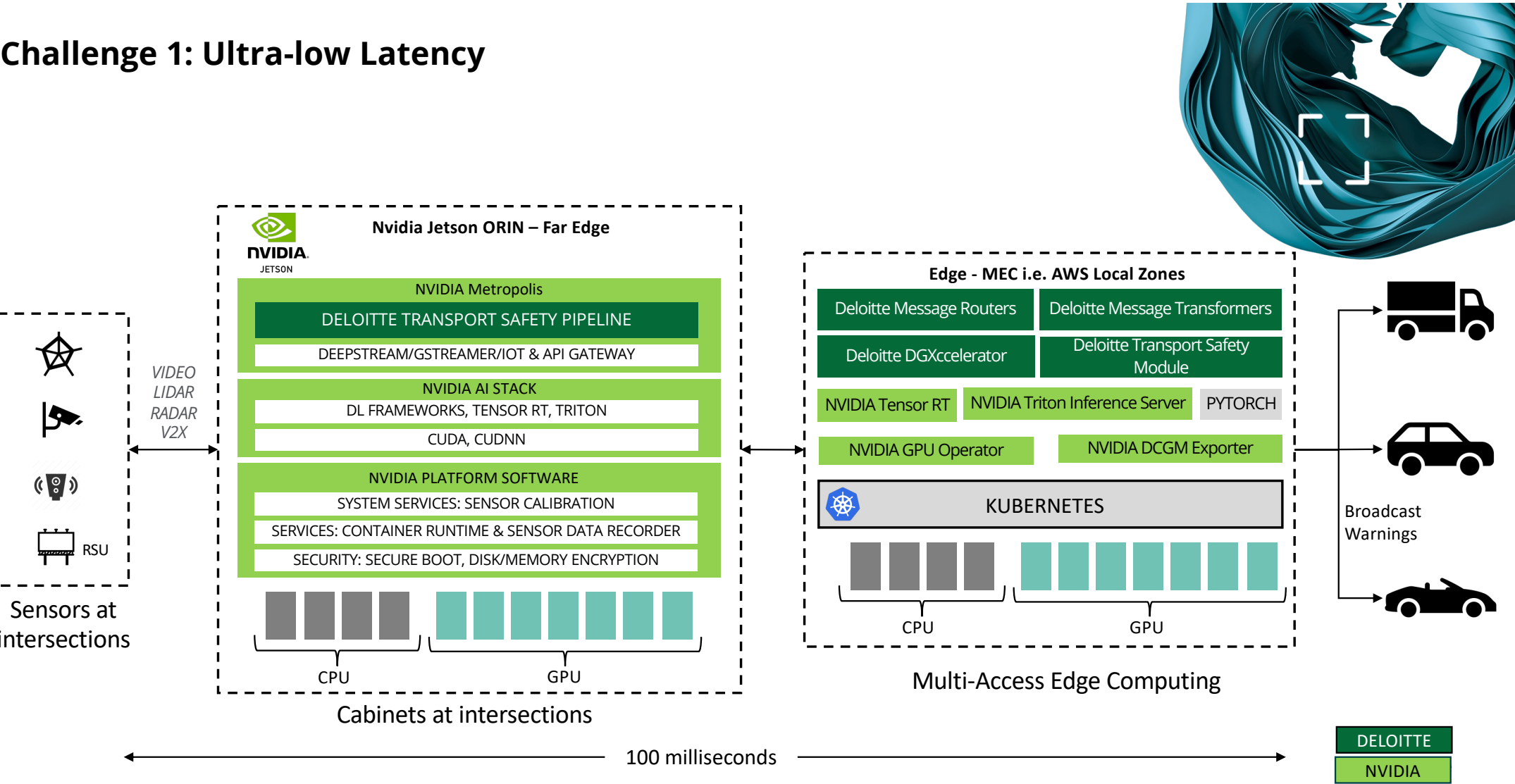
2
DNN training & VRU behavior analysis

- Scarcity of data from roadside sensors that **capture various traffic conflict scenarios**

3
Coverage & Costs

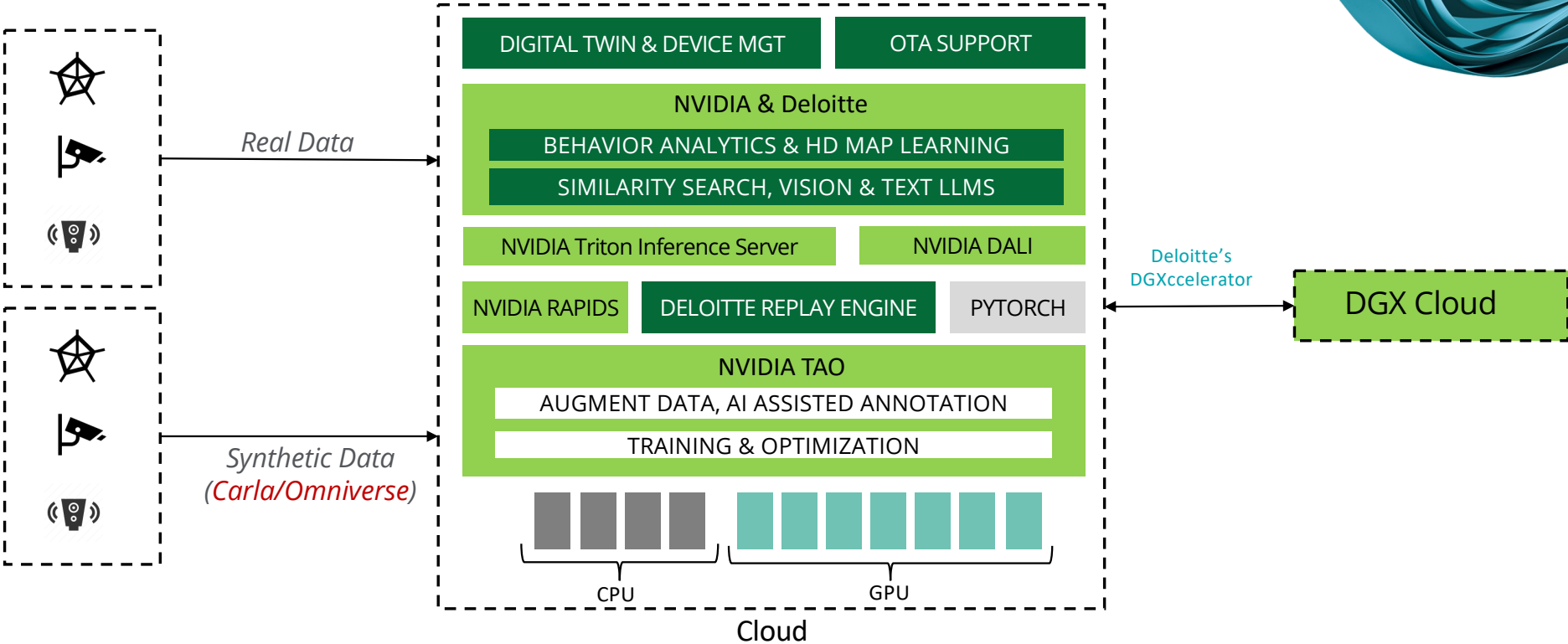- Deliver Collision Risk warnings to **all kinds of connected vehicles** (v2x as well as non-v2x) for maximum coverage

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Challenge 1: Ultra-low Latency

Nvidia Jetson ORIN – Far Edge

NVIDIA Metropolis

DELOITTE TRANSPORT SAFETY PIPELINE

DEEPSTREAM/GSTREAMER/IOT & API GATEWAY

NVIDIA AI STACK

DL FRAMEWORKS, TENSOR RT, TRITON

CUDA, CUDNN

NVIDIA PLATFORM SOFTWARE

SYSTEM SERVICES: SENSOR CALIBRATION

SERVICES: CONTAINER RUNTIME & SENSOR DATA RECORDER

SECURITY: SECURE BOOT, DISK/MEMORY ENCRYPTION

CPU

GPU

Cabinets at intersections

VIDEO
LIDAR
RADAR
V2X

RSU

Sensors at intersections

Edge - MEC i.e. AWS Local Zones

Deloitte Message Routers

Deloitte Message Transformers

Deloitte DGXccelerator

Deloitte Transport Safety Module

NVIDIA Tensor RT

NVIDIA Triton Inference Server

PYTORCH

NVIDIA GPU Operator

NVIDIA DCGM Exporter

KUBERNETES

CPU

GPU

Multi-Access Edge Computing

Broadcast Warnings

← 100 milliseconds →

DELOITTE

NVIDIA

Challenge 2: AI Model Training & VRU Behavior Analysis

Leveraged Carla/Omniverse to strategically deploy pertinent sensors on intersection poles, thereby generating synthetic data from diverse vantage points and create various incident scenarios.

Real Data

Synthetic Data
(Carla/Omniverse)

DIGITAL TWIN & DEVICE MGT

OTA SUPPORT

NVIDIA & Deloitte

BEHAVIOR ANALYTICS & HD MAP LEARNING

SIMILARITY SEARCH, VISION & TEXT LLMS

NVIDIA Triton Inference Server

NVIDIA DALI

NVIDIA RAPIDS

DELOITTE REPLAY ENGINE

PYTORCH

NVIDIA TAO

AUGMENT DATA, AI ASSISTED ANNOTATION

TRAINING & OPTIMIZATION

CPU

GPU

Cloud

Deloitte's DGXccelerator

DGX Cloud
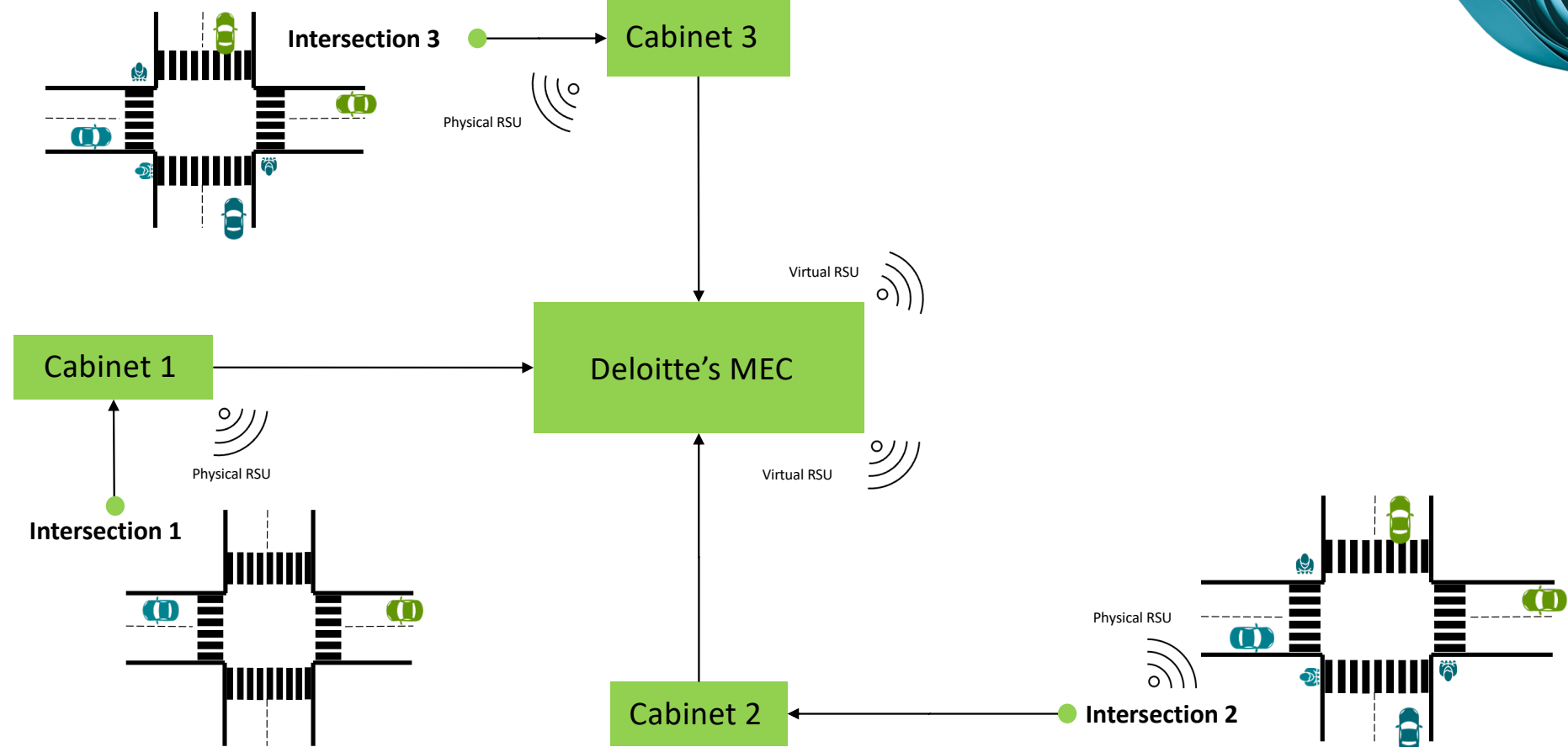
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Gaining insights into road user behavior and applying these insights consistently across similar road geometries across states is a fundamentally crucial aspect.
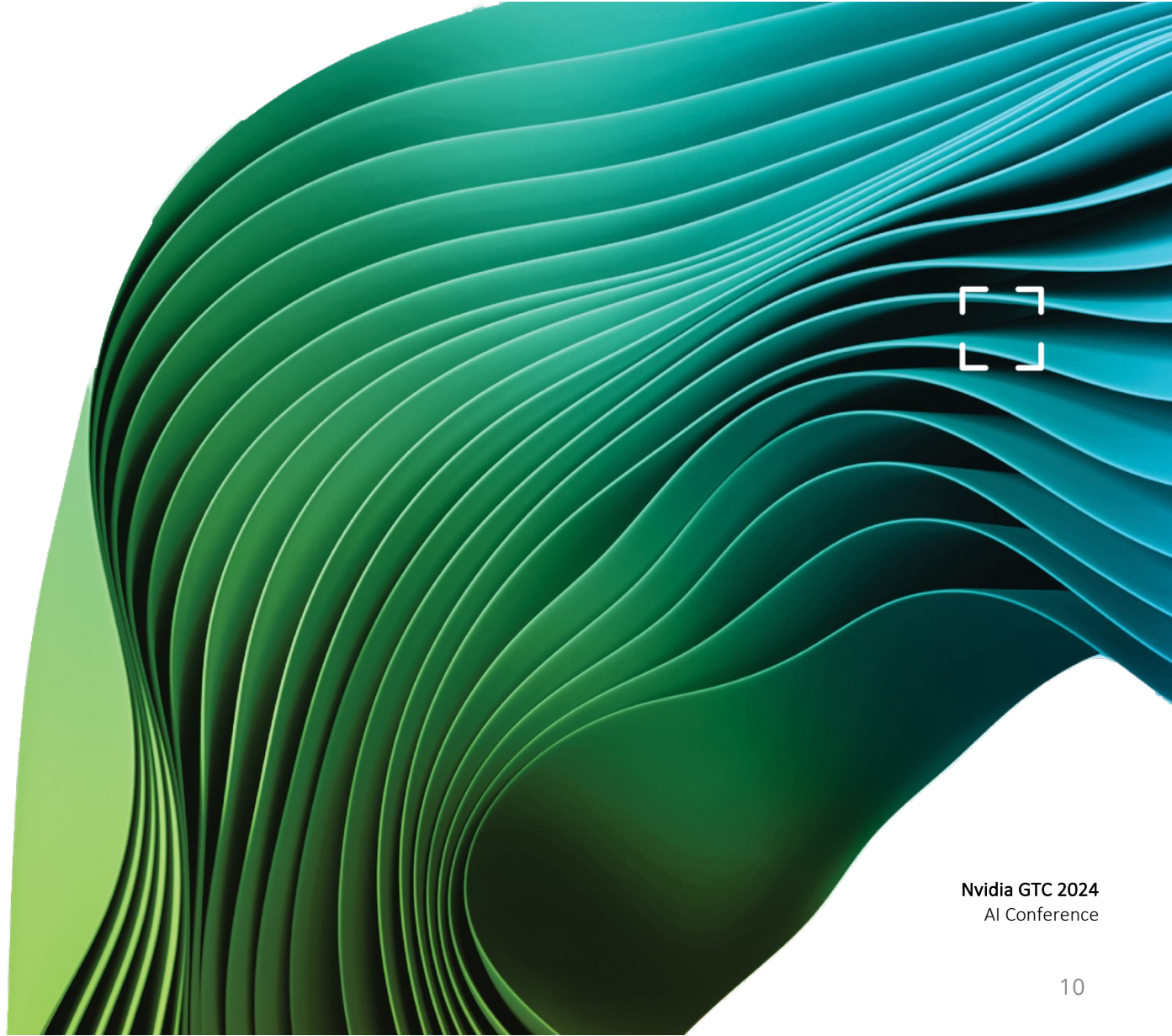
Challenge 3: Costs & Coverage

The adoption of VRU safety solutions depends on affordability and compatibility across vehicle generations.

Intersection 3 → Cabinet 3

Physical RSU

Cabinet 1 → Deloitte's MEC

Physical RSU

Intersection 1

Virtual RSU

Virtual RSU

Cabinet 2 ← **Intersection 2**

Physical RSU

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Revolutionizing Transportation

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Next Steps

Paving the Way to Efficiency and Safety through V2X Innovation, Empowered by the Unparalled Intelligence of LLM
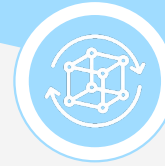
LARGE LANGUAGE MODELS

- Text based LLMs – Safety Planning
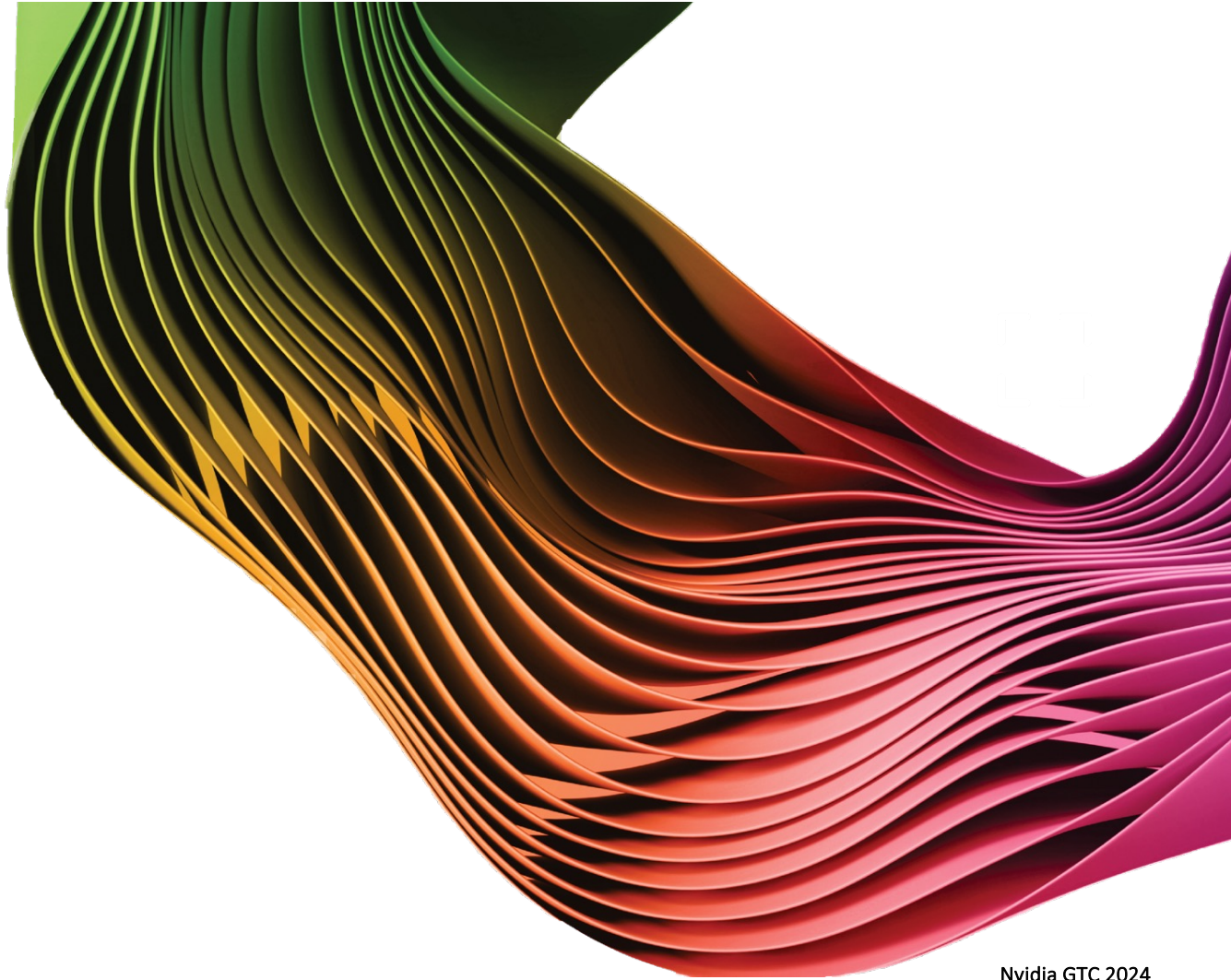
- Vision based LLMs – Evasive Action Detections

V2X COOPERATIVE PERCEPTION

- Share sensor data among vehicles and infrastructure – cooperative perception
- Level 3 driving automation levels with Class A & Class B cooperation class support

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THANK YOU.

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