UBIROAD

The Future of Context-Aware Smart Traffic

SEMANTIC MIDDLEWARE FOR THE GLOBAL UNDERSTANDING ENVIRONMENT

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THE DRIVER AS A CONNECTED NODE

Scenario: Timo's Journey / Helsinki – Jyväskylä

System Status

	Driver Status: **FATIGUED**
	Active Mode: **EXHAUSTION PROTOCOL**
	Climate Control: **-2°C Temp / +15% O2 Level**
	Hazard Broadcast: **RED LEVEL active**

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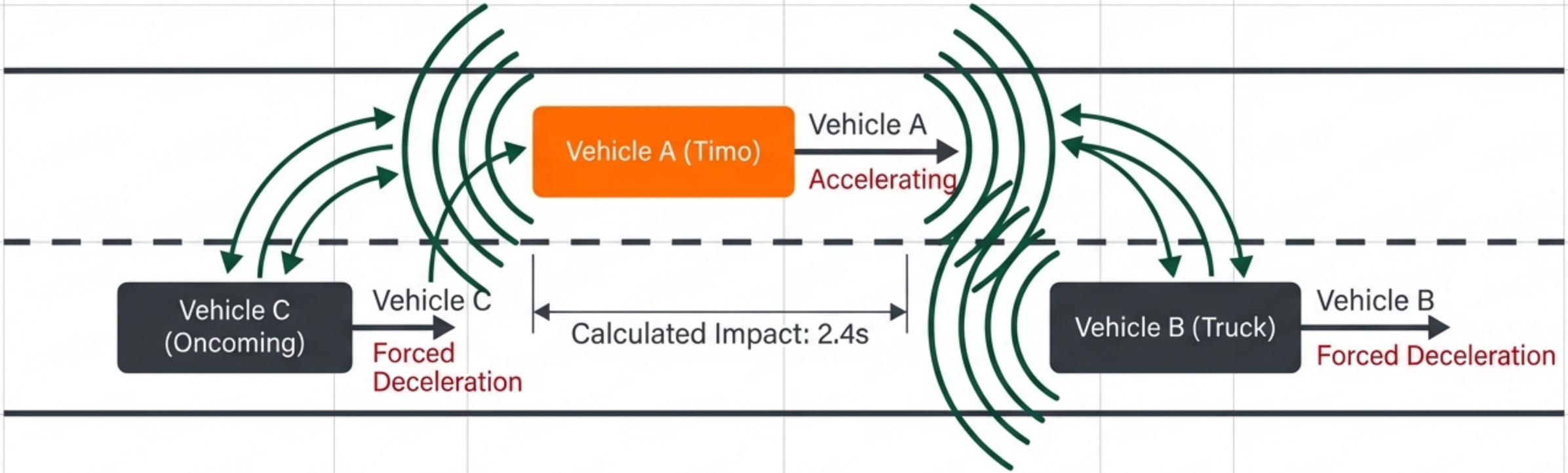
SPLIT-SECOND NEGOTIATION

Averting the Crash through Agent Cooperation



THE INTERVENTION: Agents detected the non-standard situation, negotiated priority, and executed simultaneous acceleration/deceleration commands faster than human reaction time.

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THE CHALLENGE: A CHAOTIC INTERNET OF THINGS

The Fragmentation of the IoT Landscape

The Problem: Heterogeneity.

- Millions of devices.
- Different vendors & standards.
- Prohibitive integration costs.
- Uncontrolled physical actuators.

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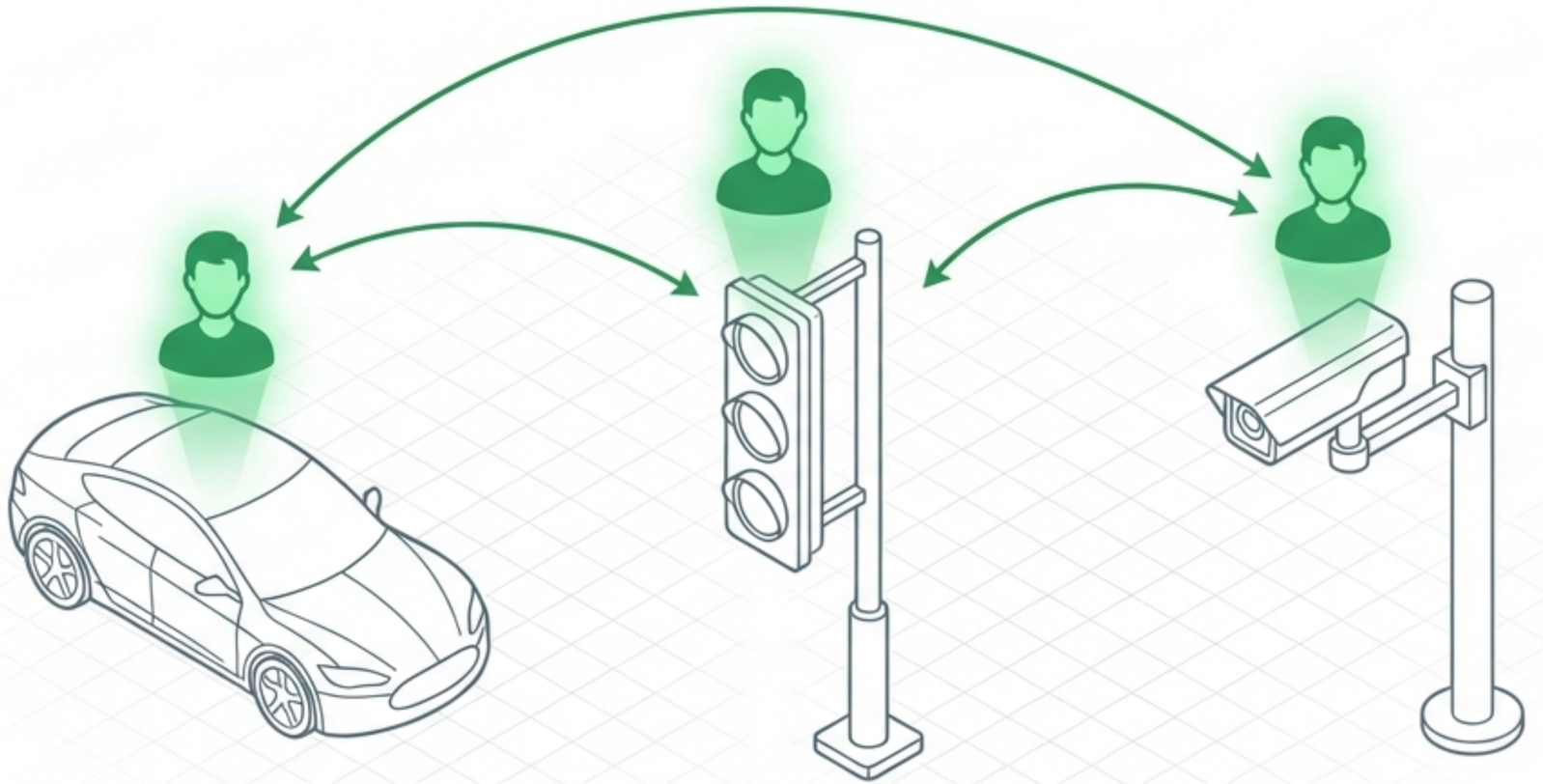
THE SOLUTION: REPRESENTATIVE AGENTS



Every physical resource is assigned a Digital Representative Agent to negotiate, discover, and coordinate on its behalf.

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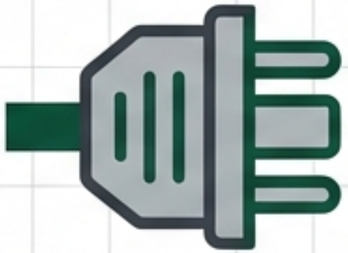
LAYER 1: UNIVERSAL SEMANTIC ADAPTERS

RscDF: Resource State/Condition Description Framework

Heterogeneous Devices



Universal Semantic Adapter

Context Categories:
- Device Ontology
- Context Ontology
- Data Ontology
- Domain Ontology

S-APL (Semantic Agent Programming Language)

Universal reusable semantically-configurable adapters funnel different physical inputs into a single language.

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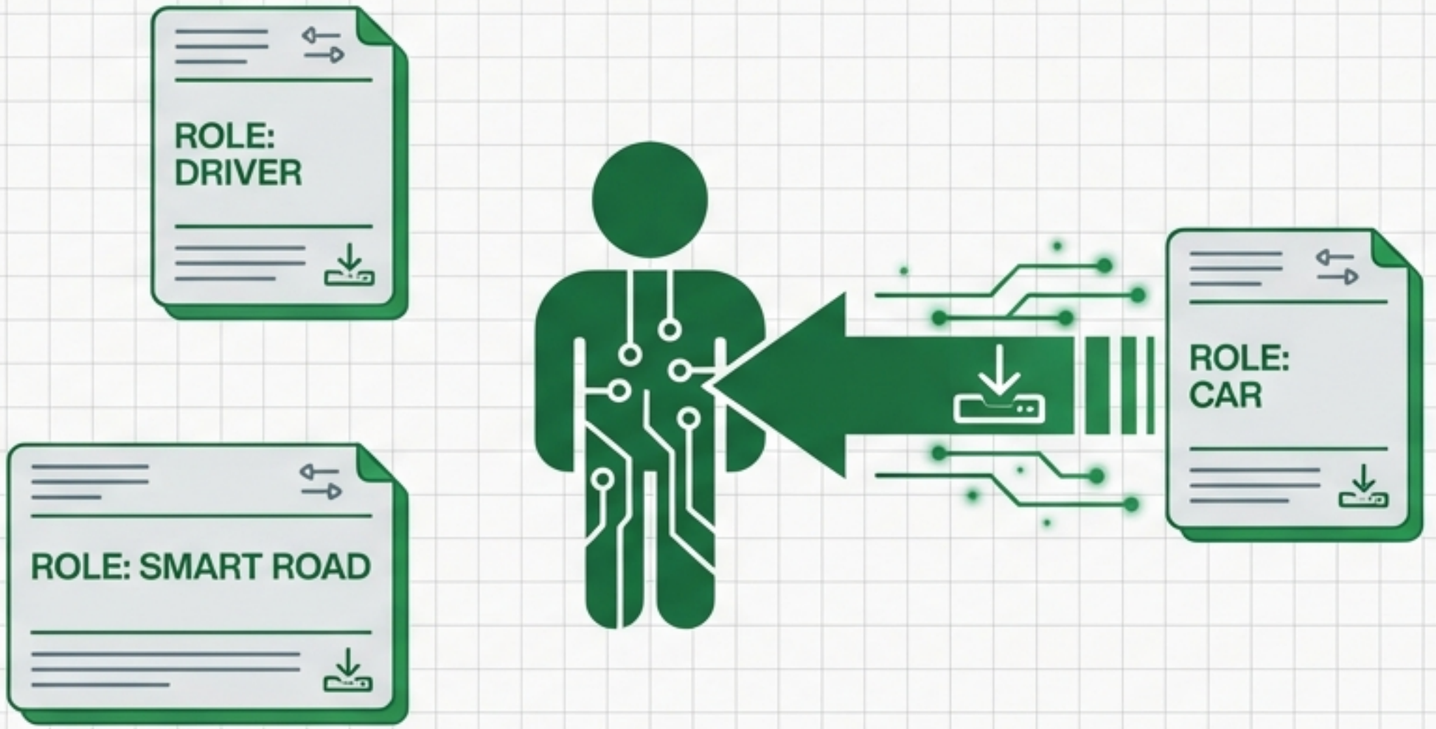
LAYER 2: DOWNLOADABLE ROLES & BEHAVIORS

RgbDF: Resource Goal/Behavior Description Framework



Agents are not hard-coded. They utilize a Universal Behavior Engine to download declarative roles (goals, plans, intentions) from a shared repository based on context.

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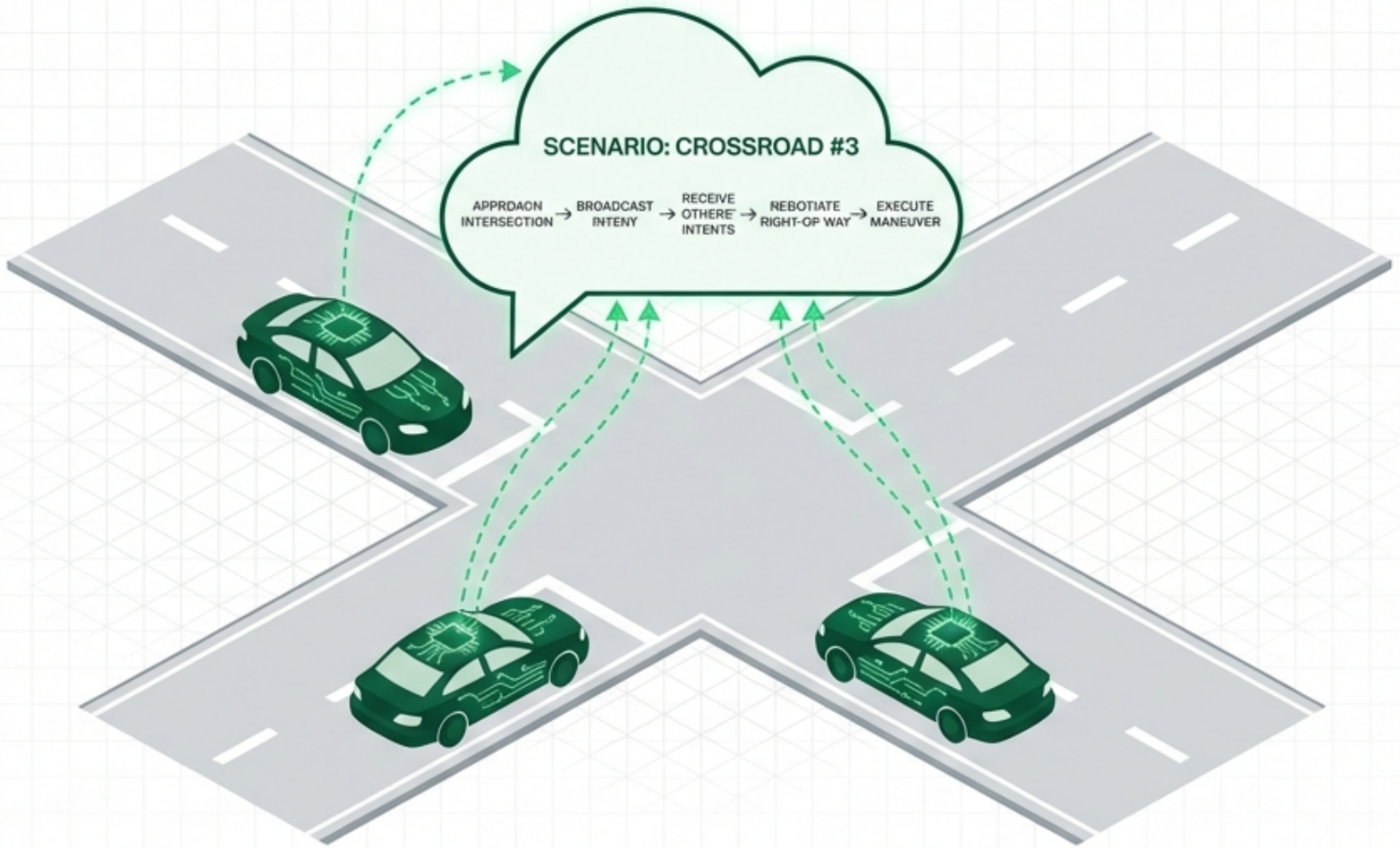
LAYER 3: ORCHESTRATING INTERACTION

RpiDF: Resource Process/Integration Description Framework



Moving from individual autonomy to collective consensus. Agents download collaborative scenarios (choreography) to negotiate complex interactions like right-of-way.

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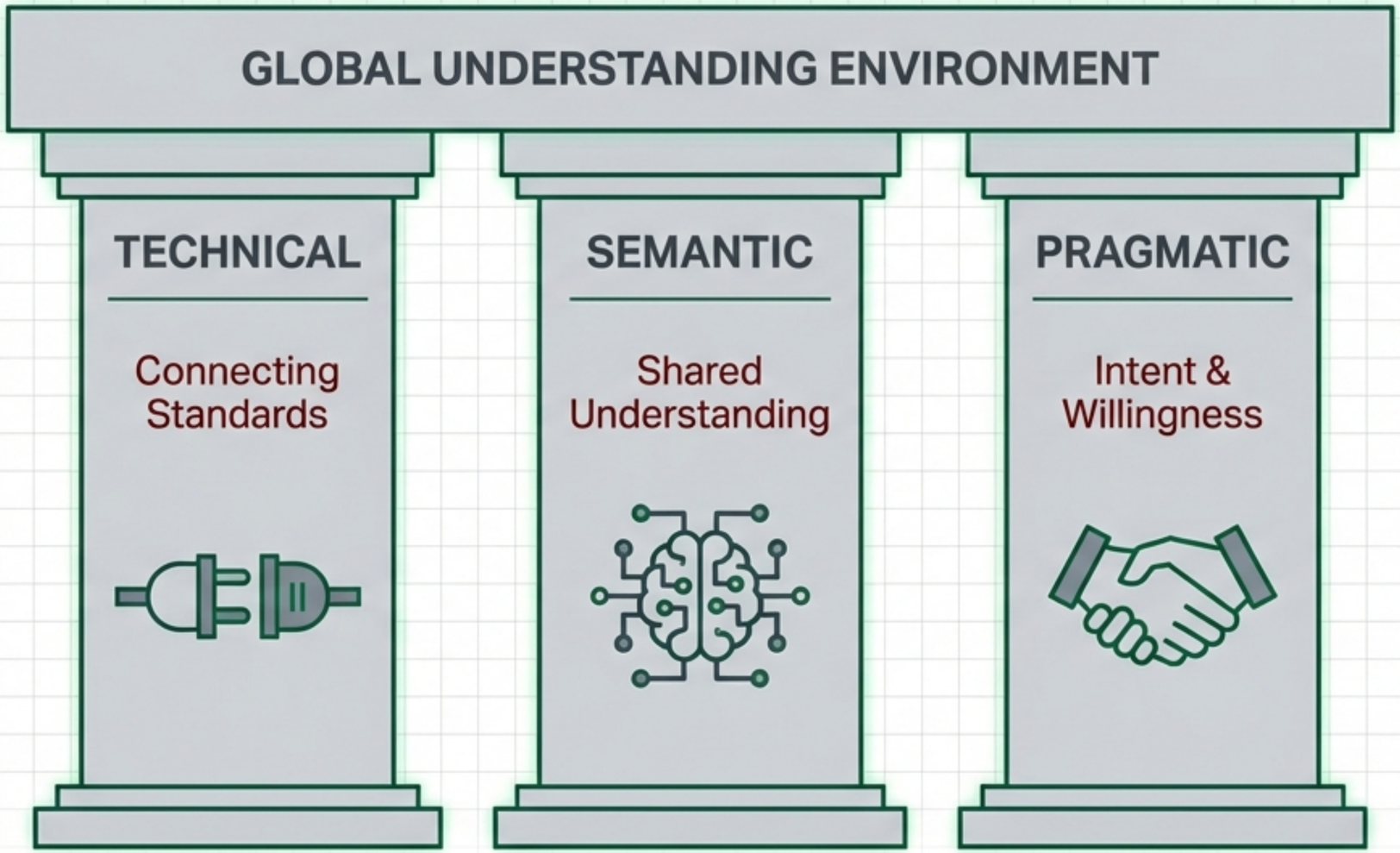
THE THREE PILLARS OF INTEROPERABILITY



UbiRoad moves beyond connecting wires (Technical) to connecting minds (Semantic) and intentions (Pragmatic).

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SELF-MANAGEMENT & SEMANTIC TRUST

- **Self-Management**
  Agents proactively monitor the environment and reconfigure architecture based on "Business Models" encoded as configuration plans.
- **Trust & Reputation**
  Trust is semantically annotated. Before acting on a critical command (e.g., "Brake Now!""), the agent verifies the reputation of the source.

CRITICAL COMMAND

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SEAMLESS SERVICE INTEGRATION

Context-Aware Services: The system detects network availability for video calls and uses infrared sensors to project invisible hazards directly onto the driver's field of view.

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UNLOCKING THE POTENTIAL OF COOPERATIVE TRAFFIC

Global Knowledge Reuse

Agents access external sources via P2P infrastructure.

Data Mining

Utilization of accumulated statistics for accident prevention.

Contextual Filtering

Information displayed only when relevant to current context.

Case-Based Learning

Agents improve behaviors based on sets of traffic examples.

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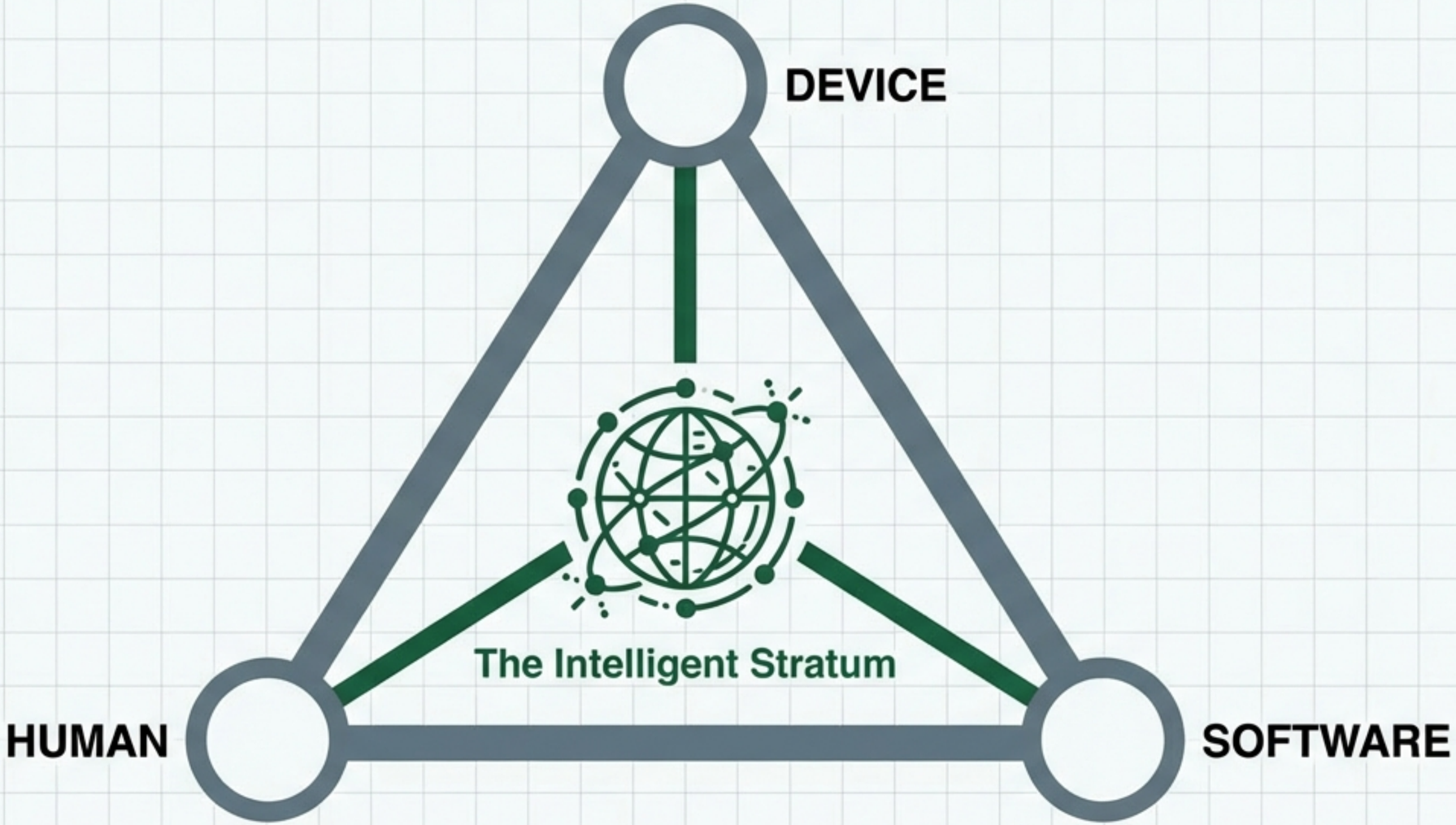
CONCLUSION: FROM INTERCONNECTIVITY TO INTEROPERABILITY



To manage the scale of the Future Internet, we must move from simply connecting wires to connecting intentions. UbiRoad provides the semantic intelligence to make the Global Understanding Environment a reality.

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