THE FUTURE OF AI AND AI GOVERNANCE IN AN AUTONOMOUS WORLD

Geneva, August 24th 2023

VERSES

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Welcome, it' great to be here!

In this session I will....

- Present VERSES and our **unique way of governing and simulating the behavior of autonomous things**
- Talk about regulating AI, the **Spatial Web, new standards and a new breed of AI** (not generative)
- **Watch a video** to showcase the applications in real life
- Open the floor with **questions**
- Leave you with some **additional resources** to explore

- VERSES is a publicly listed **cognitive computing company** specializing in next generation AI
- Founded in 2018. EU HQ in **Eindhoven**. US HQ in **Los Angeles**
- VERSES is the developer of KOSM™, the world's **first network operating system for enabling distributed intelligence.**
- Our technology technology is based on the **Spatial Web standards**
- Our technology allows **YOU** to **build AIs for operating autonomous things in the real world**
- **Horizon Europe - Flying Forward 2020** - Governance of autonomous intelligent drones in urban areas.

In Summary

IEEE + SPATIAL WEB FOUNDATION

1. PROTOCOLS

KOSM

2. VERSES AI PLATFORM

3. INTELLIGENT AGENTS

SOLUTIONS

AI-BASED AUTOMATED & AUTONOMOUS SOLUTIONS FOR :

SUPPLY CHAIN

- Wayfinding to exact location
- Spatial Tasks and Instructions
- Capacity Optimization
- Rapid Asset Location
- Dynamic IOT Integration
- Spatial Analytics & Simulation

FACILITY MANAGEMENT

- Inventory & Equip Management
- Optimized Routing
- Activity Validation
- Facility Management
- Regulatory Compliance
- Emergency Response

SMART CITY & MOBILITY

- Land Title Management
- Mobility / Drone Compliance
- Climate Accounting
- Identity & Facial Recognition
- Public Services
- Digital Certificate Issuance

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INDUSTRY LEADERS

Deep technology veterans and scientists with decades of experience in AI, Neuroscience, Robotics, Enterprise Software and Global Sales.

Gabriel Rene
CEO

Dan Mapes
President

Capm Petersen
Innovation

Steven Swanson
Administration

Michael Wadden
Sales

Philippe Sayegh
Adoption

Jason Fox
Product

Karl Friston
R&D

Microsoft

accenture

IBM

intel

BERKSHIRE GREY

amazon

Honeywell

UCL University College London

SAP

ICANN

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VERSES CHIEF SCIENTIST

WIRED

The Genius Neuroscientist Who Might Hold the Key to True AI

"Professor Karl Friston's free energy principle might be the most all-encompassing idea since Charles Darwin's theory of natural selection."

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TOP RESEARCHERS

VERSES AI TEAM

World's leading Neuroscientists, and Award Winning Academics in Active Inference-based AI for real-world applications

UCL University College London

University of Oxford

Monash University

McGill

University of Sussex

Max Planck Institute of Animal Behavior

Stony Brook University

The University of Newcastle Australia

UQÀM

netsi

Northeastern University Network Science Institute

- Active Inference / Free Energy Principle
- Model-based Reinforcement Learning
- Cognition & Neuroscience Modeling
- Computational Phenomenology
- Category and Gauge Theory
- Cybernetics and Control Theory
- Multi Agent Swarm Intelligence
- Bayesian Scene Graphs

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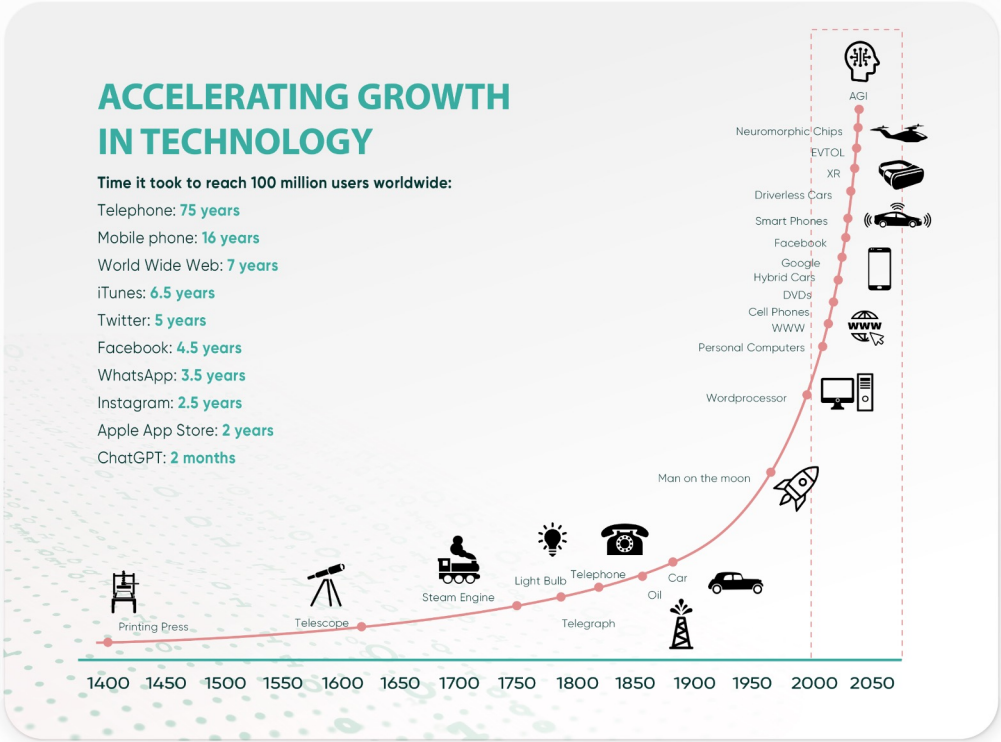
What’s different today ?

Generative AI took the world by storm



Automation & Efficiency
Augmented decision making
Scientific and medical advances
Solving world scale problems
Good for CONTENT creation

Safety & Accountability,
Ethical alignment & bias
Accuracy & privacy
IP rights and fairness
Suboptimal for ACTIVITY
Management

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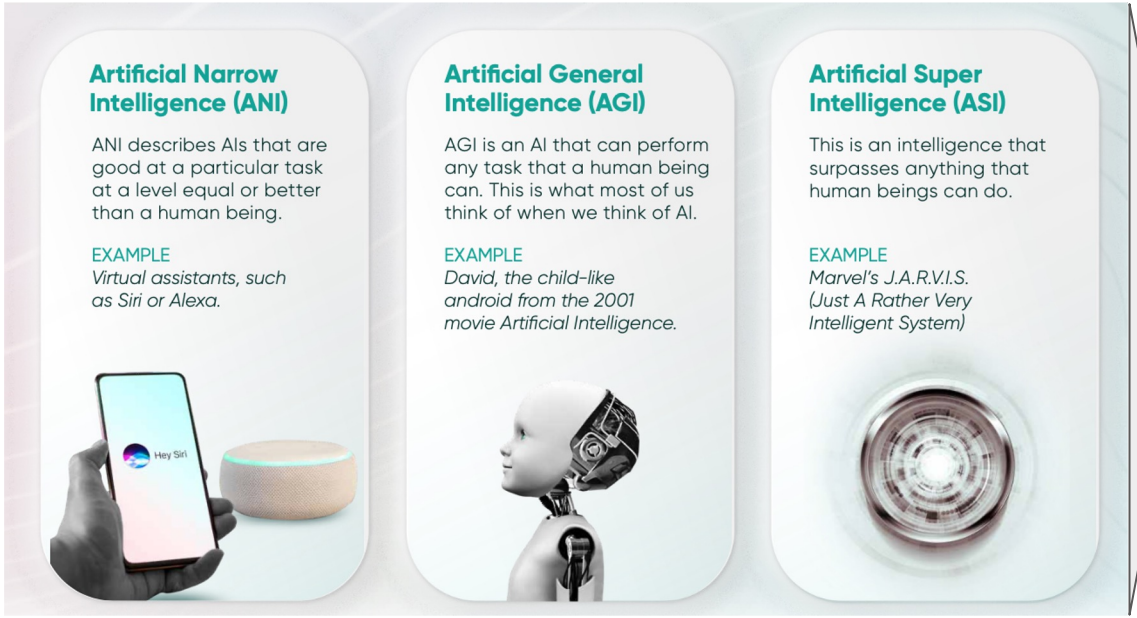
AI is moving towards greater levels of intelligence and autonomy

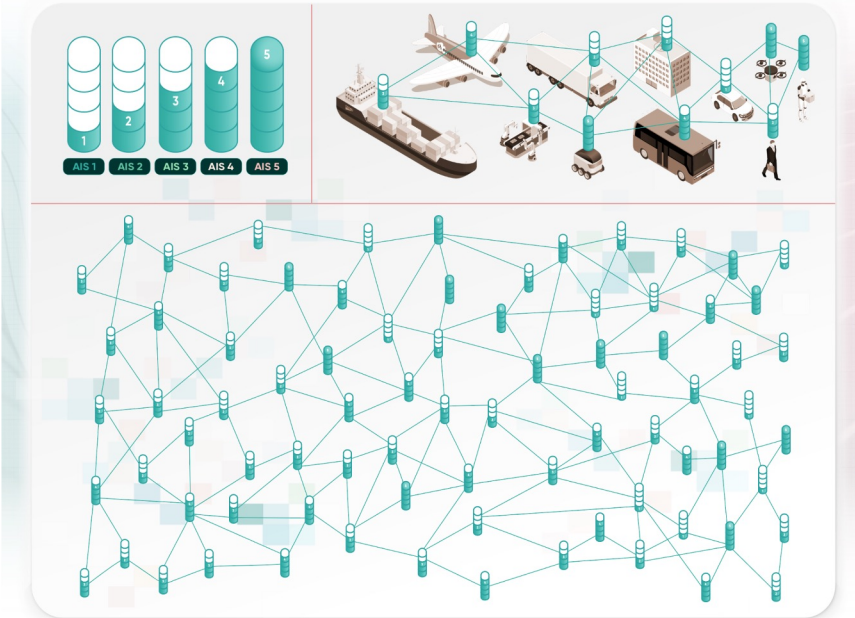


Novel governance frameworks that depend on factors such as **intelligence** capabilities, **autonomy** levels, and **trust** will be unlocked.

These frameworks may range from centralized to federated to distributed governance.

Each framework varies in terms of degree of **control**, decision-making authority, and trust.

AI is moving towards greater levels of internetworking and ecosystems



Heterogeneous

Self-improving

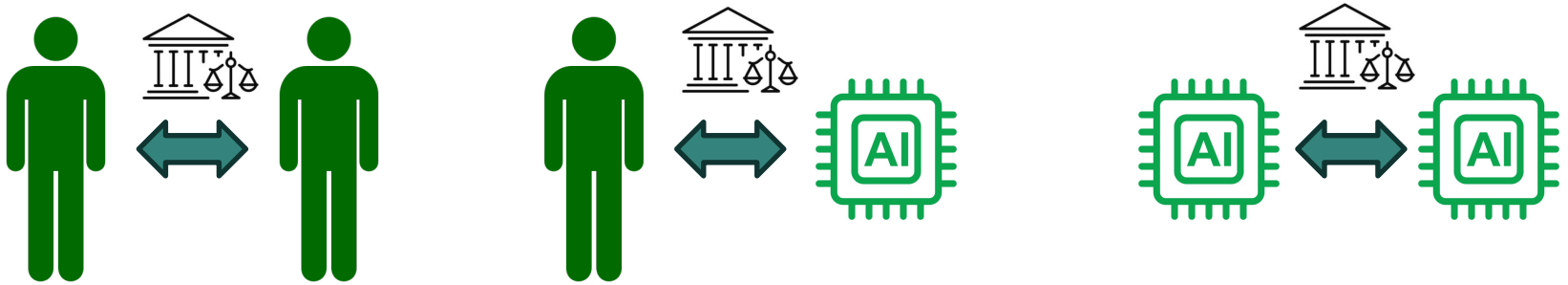
Self-adapting

Networking with other AIs, sensors, and robotics systems

Resulting in **Autonomous Intelligent Systems (AIS)**

ADAPTIVE SHARED LANGUAGE AS LAW'S PERIMETER EVOLVES

Governance today → Governance tomorrow → Governance after tomorrow



Words
Ambiguous/General
Slow
Negotiation-based

Case Law?
Common Law?

Code
Explicit/Specific
Real-time
Smart contract based

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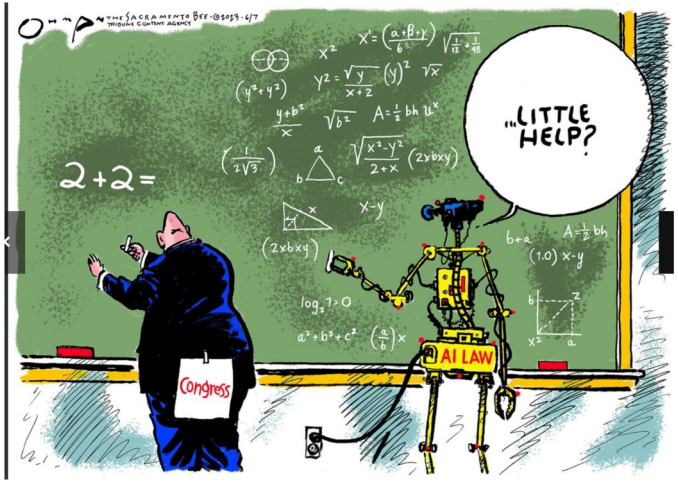
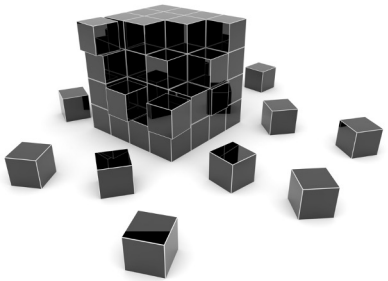
AI REGULATION IS CENTER-STAGE AND CHALLENGING





- How can governments keep up and regulate AI systems that are on a path to regulating themselves?
- How can humans stay in the loop to ensure AI alignment with our values, principles, and laws, while guaranteeing fair and equitable services for all individuals and communities?
- How do we encode and enforce AI laws directly in AI systems themselves?

https://www.verses.ai/aigovernance

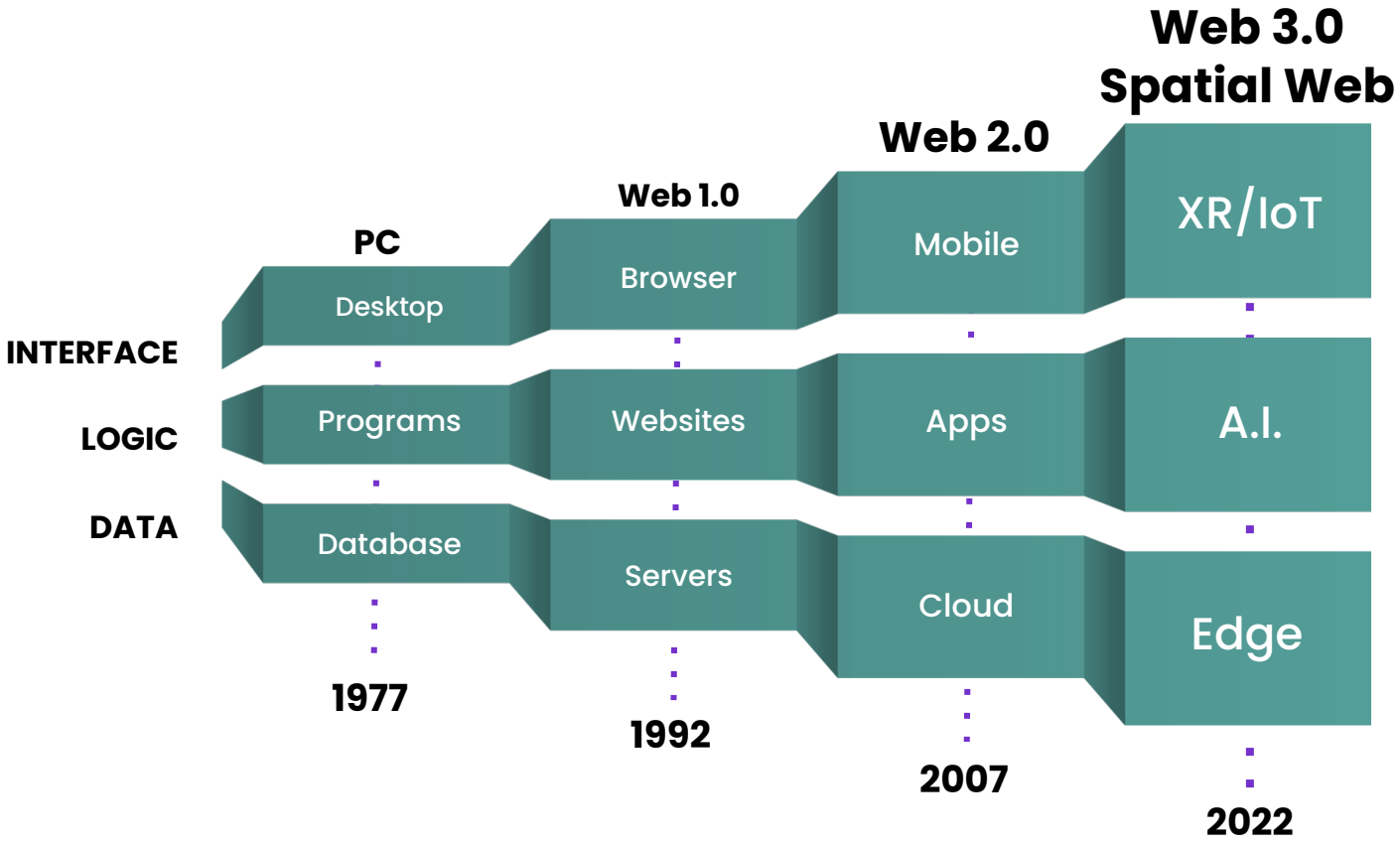
- This first-of-its-kind AI industry report combines the legislative expertise from : **DENTONS** the world's largest multinational law firm the AI acumen of **VERSES AI** with the guidance on technical standards from the **Spatial Web Foundation** to provide an in depth analysis of the legal status and global legislative trends on AI regulation, with recommendations for a new path forward.

- Managing the interoperability of these increasingly autonomous AI systems and various governance frameworks will likely **demand a holistic and adaptive approach to governance**.
- Traditional market-driven and government-driven paths may not take us the distance; however, there is another road that could: **the development of sociotechnical standards** for AI and Autonomous Intelligent Systems that integrate technical, social, legal, and physical factors.

What’s new?

THE NEW STACK

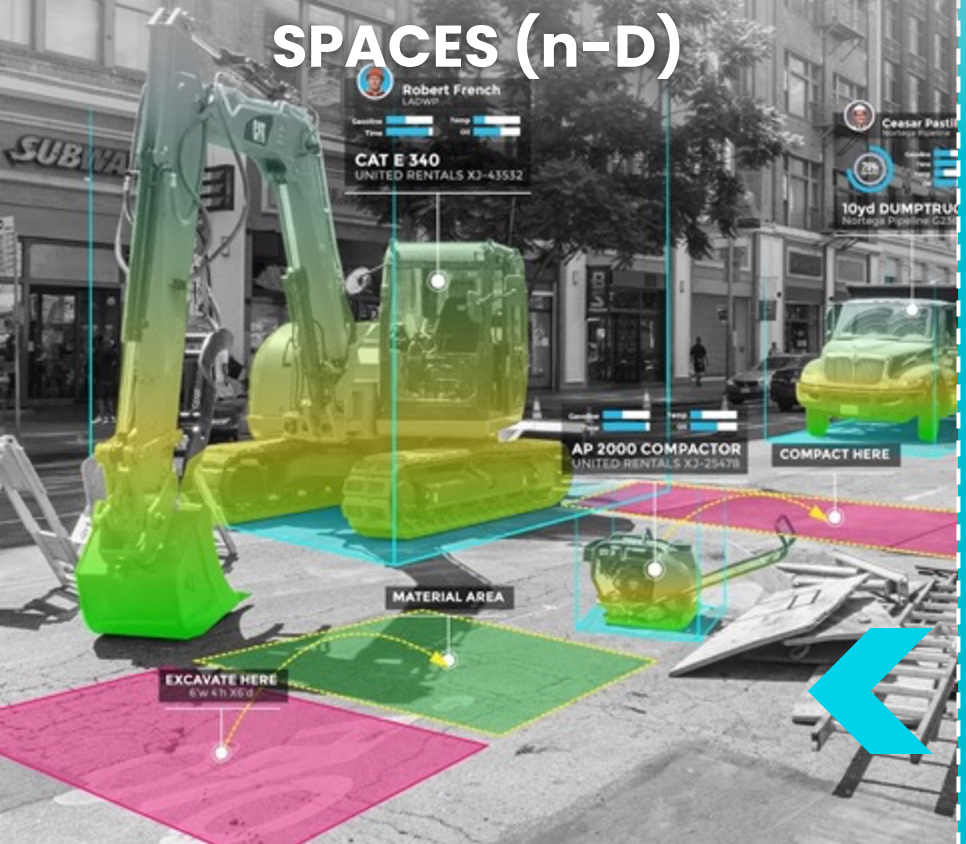
Every ***15 years*** the Tech Stack Evolves



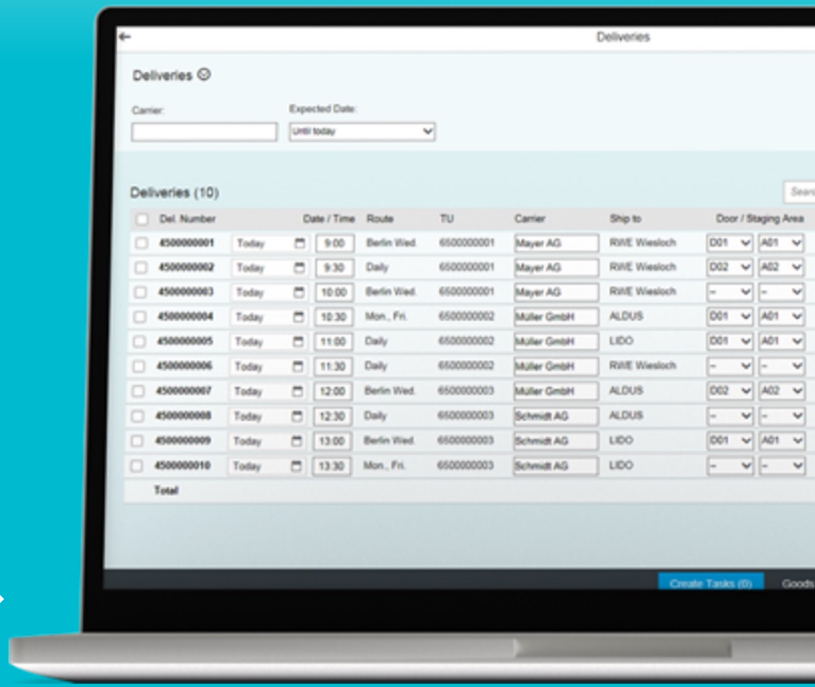
PROGRAMMING AND COMPUTING IN SPACE

Today's Enterprise Systems are "Dimensionally-Challenged"

SPACES (n-D)



PAGES (2-D)



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NEW SOCIO-TECHNICAL STANDARDS

IoT / XR / AI / DLT
AR & VR, AI, IOT, ROBOTICS

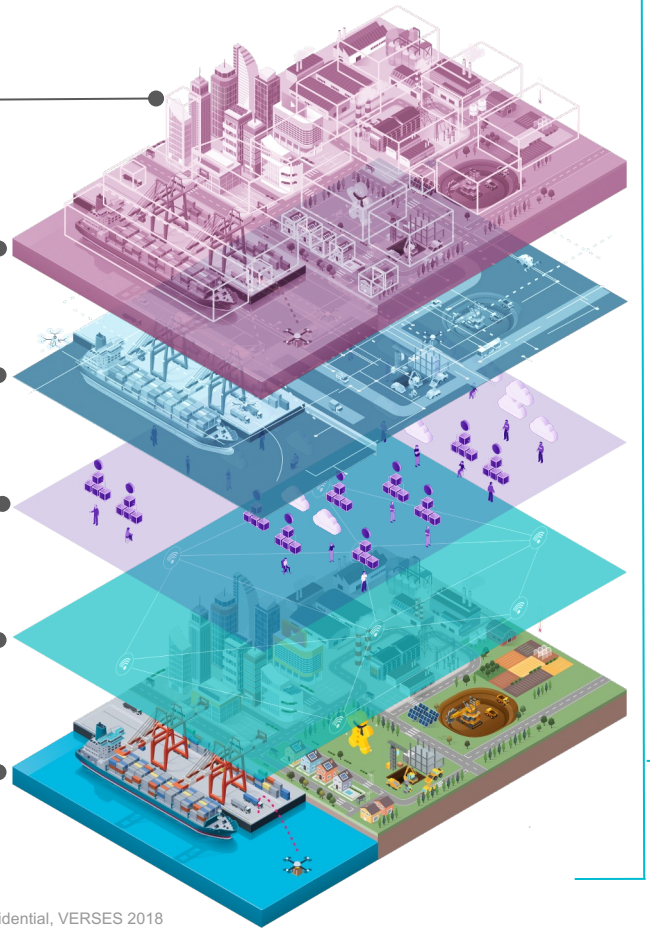
SPACES & PLACES
(REALITIES, SPACES, TIME, CHANNELS)

ACTIVITIES
(RIGHTS, CREDENTIALS, CLAIMS, ACTIVITIES)

IDENTITIES
(AUTHORITIES, DOMAINS, USERS, ASSETS)

ENTERPRISE STACK
(ERP/WMS/CRM/GIS)

NETWORKS (4G,5G,6G)



INTEROPERABILITY

SECURITY

PRIVACY

POLICY

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100 + GLOBAL MEMBERS

(Academia, government, business leaders)

IEEE

INTERNATIONAL STANDARDS ASSOCIATION

Hyperspatial Transaction Protocol (HSTP) & Hyperspatial Modeling Language (HSML)

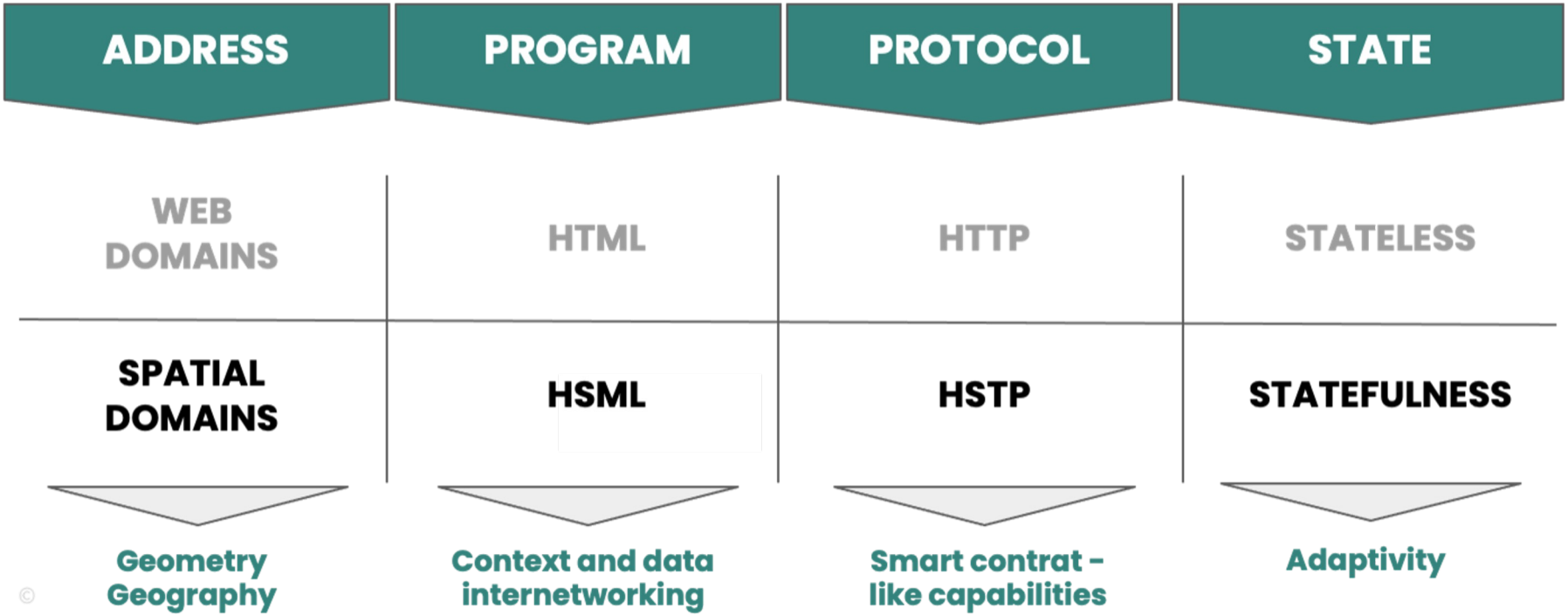
SPATIAL WEB WG P2874

Also informed by IEEE's Ethically-Aligned Design P7000 Series of standards that provide guidance for the support of human rights, well-being, accountability, and transparency for AI and Autonomous Intelligent Systems

"Public Imperative Standard"

MULTI-DIMENSIONAL STANDARDS ARE KEY

– SPATIAL WEB STANDARDS AND PROTOCOLS –



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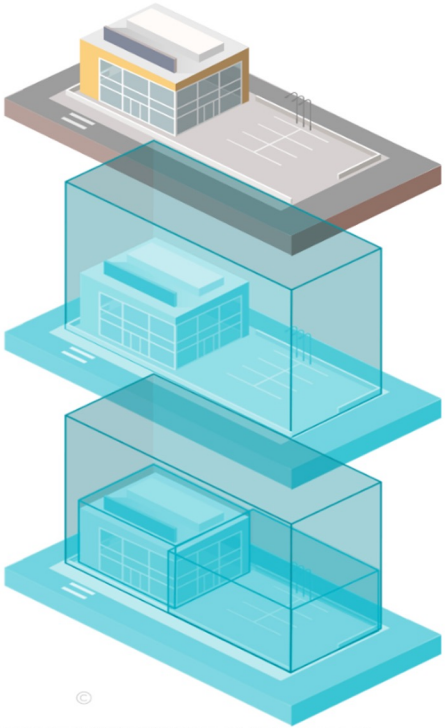
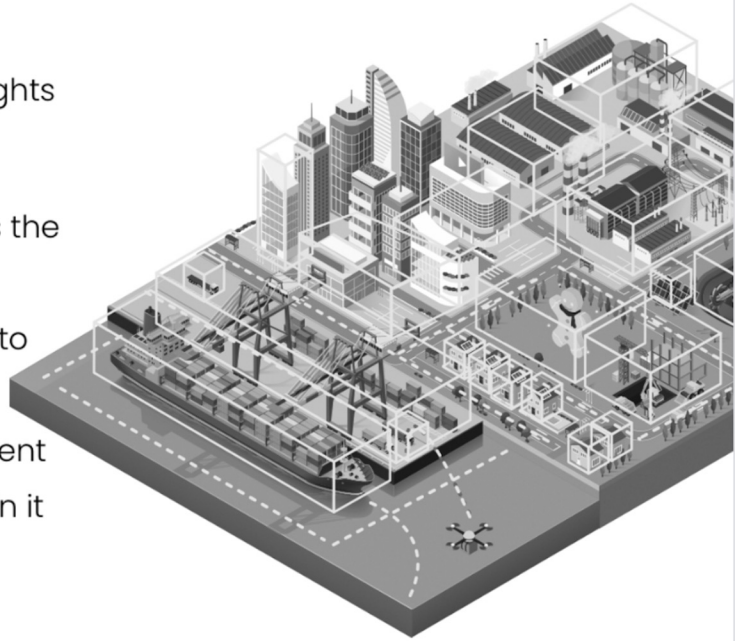
It all starts with SPATIAL WEB DOMAINS

Spatial Domains are **digital titles linked to 3D volumetric locations** such as buildings, parks, streets, or larger regions such as cities, states, continents and trading blocs. Spatial Subdomains represent sub-spaces that have **holonic structure** confer additional **rights**.



Spatial Domains enable secure management of digitally mediated rights and permissions for:

- Who/What is authorized to access the domain
- What content or data is available to view
- Who can publish and modify content
- Who can transact or interact within it



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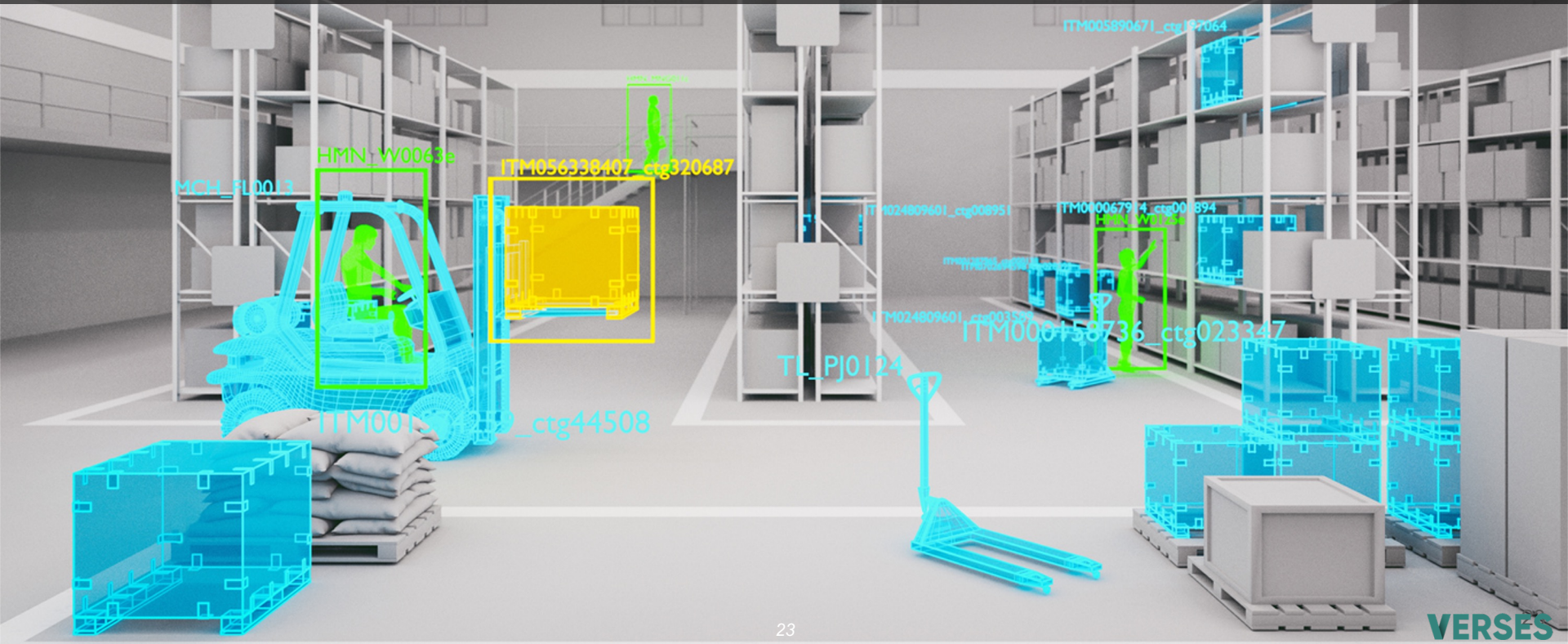
INDOOR SPATIAL DOMAINS

Combining **Digital Twin** (3D + ID's) + **Digital Thread** (Data Integrity) + **Spatial Contracts** (Rules) results in a spatial network that **links** people, places, things and their activities.



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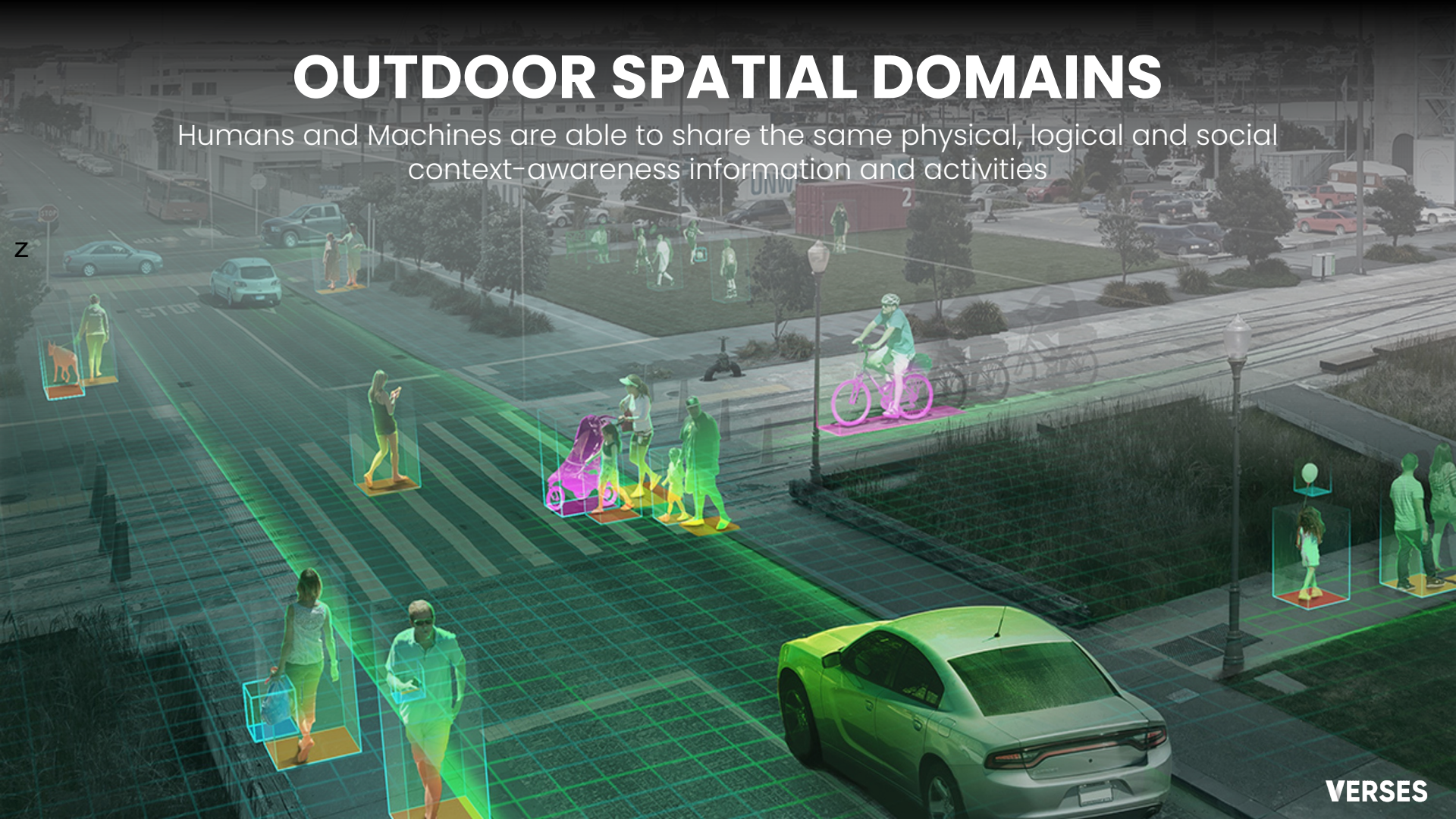
OUTDOOR SPATIAL DOMAINS

Humans and Machines are able to share the same physical, logical and social context-awareness information and activities



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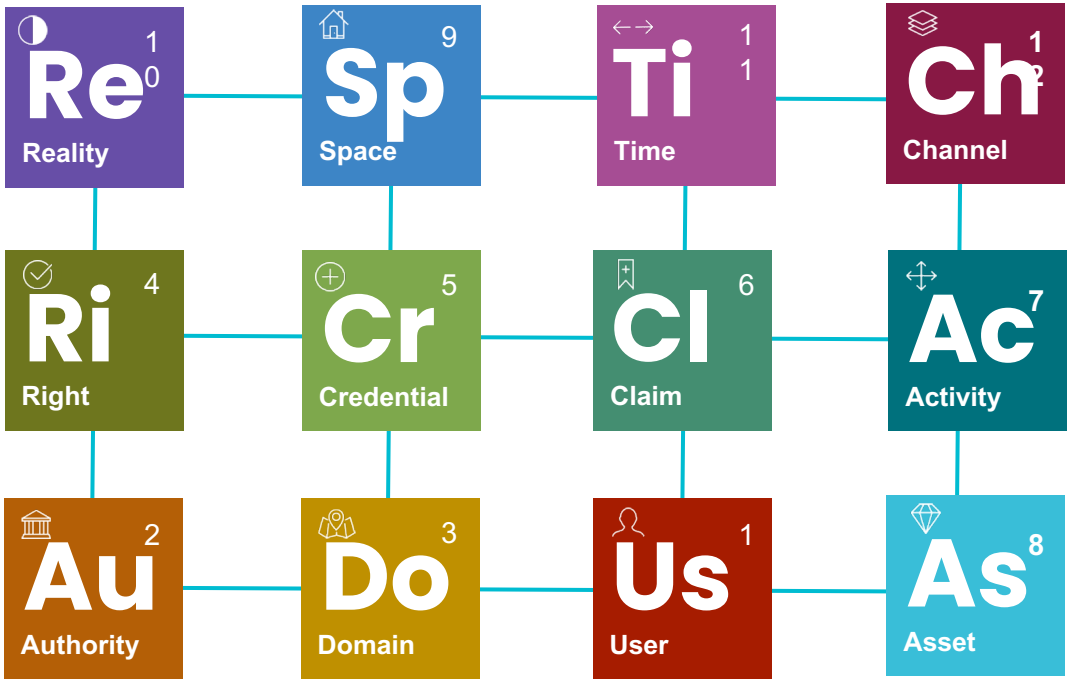
HSML MODELS CONTEXT (META-DATA)

HSML - Hyperspace Modeling Elements form a canonical data model that can be used to digitally describe any class of user, object, policy and activity in physical, digital and virtual space.

WHERE/WHEN
SPACES & PLACES

WHAT/HOW
ACTIVITIES

WHO/WHAT
IDENTITIES



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Autonomous Delivery Drone

Us 1 User — An Identified **Drone**

Au 2 Authority — by virtue of the **European Commission**

Do 3 Domain — within **a certified construction site**

Ri 4 Right — shall have the Right to **autonomously operate**

Cr 5 Credential — as represented by **EASA certificates**

Cl 6 Claim — is **to autonomously operate in specific zones and routes**

Ac 7 Activity — to **deliver building materials**

As 8 Asset — an identified **non flammable material up to 20kgs**

Sp 9 Space — in **specified delivery zones**

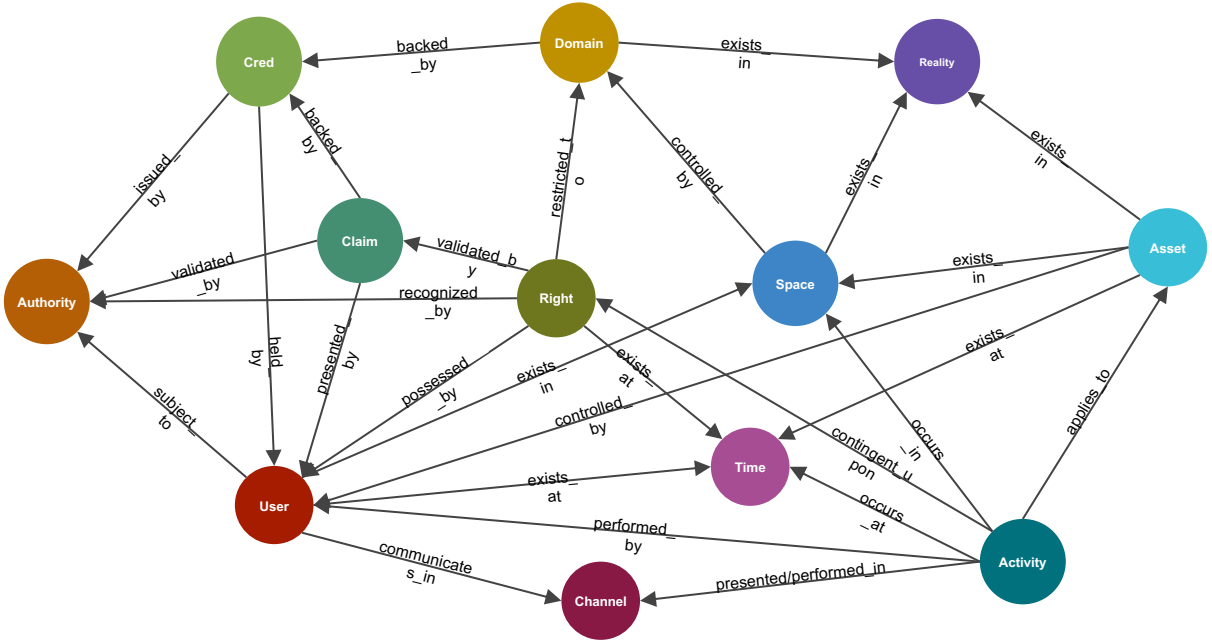
Re 10 Reality — in **Physical Reality**

Ti 11 Time — in **Present Time**

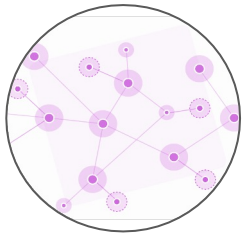
Ch 12 Channel — on the **private construction channel**

HSML KNOWLEDGE GRAPH

HSML Elements are mapped into a knowledge graph that define their interrelationships and interdependencies. Creating a universal governance ontology that allows for any application specific use case to be programmed.



LAW AS CODE



HSML MODELS 3 TYPES OF POLICIES

LEGAL (TEXT)

SPATIAL / PHYSICAL

SOCIETAL

KOSM
Knowledge Oriented Software Model


KOSMOS
Build, Run, Sell AI Agents
INFRASTRUCTURE FOR AI
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KOSM

KOSM uses General Intelligent Agents to continuously SHARE Knowledge models between EDGES

DATA SPACES / FORMATS / SCHEMAS

SENSE — LEARN — PLAN — ACT

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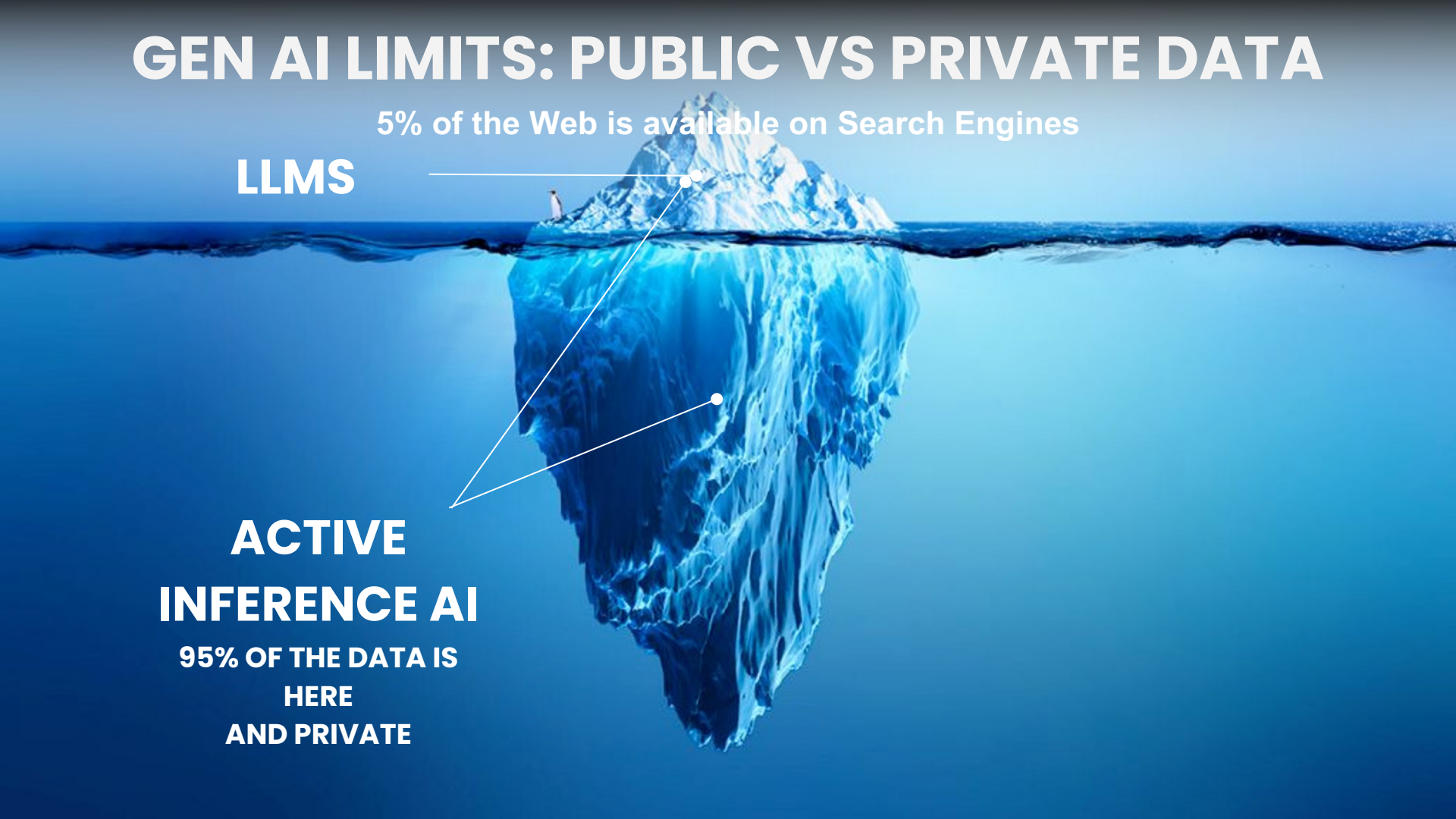
AI REIMAGINED

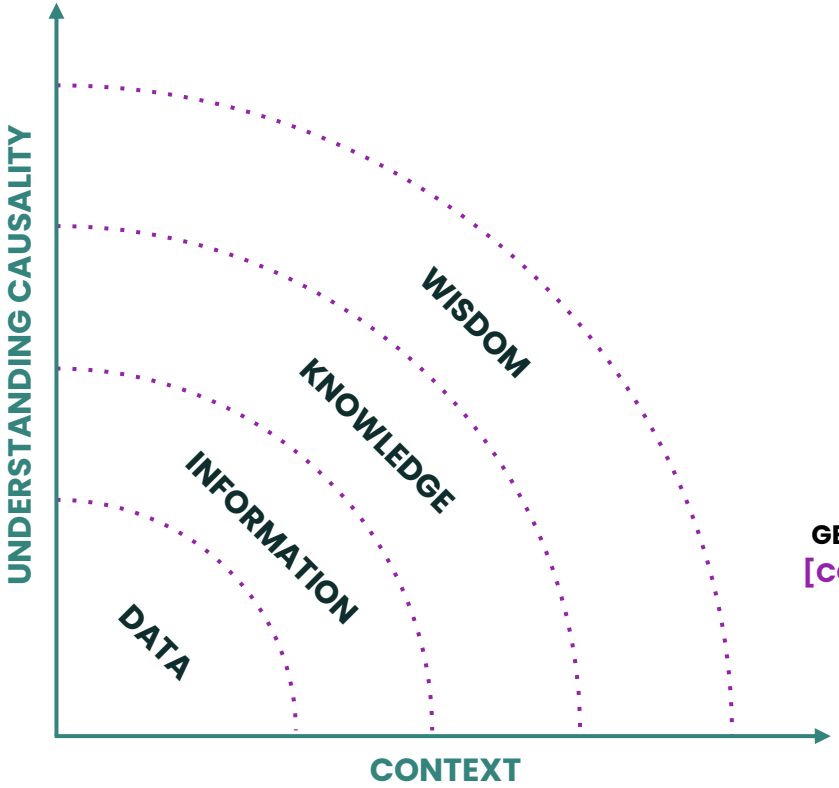
Research anchored around **Model-Based Artificial Intelligence** and **Agent-Based Modeling**

GENERATIVE	REGENERATIVE (VERSES)
Reinforcement Learning	Active Inference
Big Data (Correlation)	**Beliefs (Causation)**
Reward	Reduce Uncertainty
Unstructured	Structured
Blackbox	**Explainable**
Narrow Purpose	Generalisable
Generic	Hyper-Personalizable
Bespoke | Custom	Interoperable | Modular
Monolithic | Massive	**Distributed**
Expensive	Efficient
Supervised	**Self-Learning**
Static/ Frozen	Adaptive
Big Data	**Smart Data**

GEN AI LIMITS: PUBLIC VS PRIVATE DATA



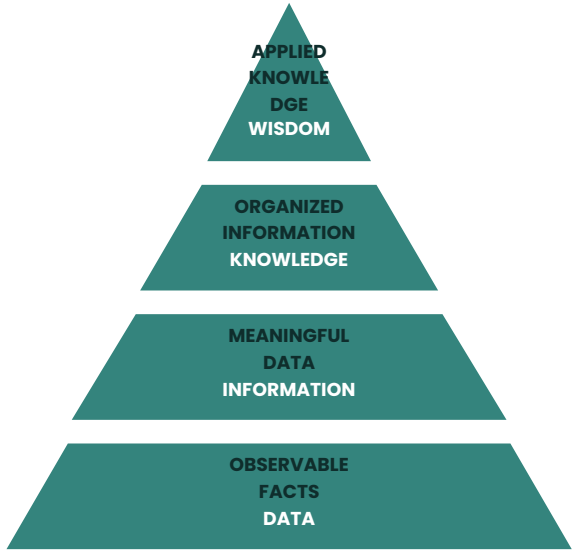
Agents (GIA) use HSML + ACTIVE INFERENCE = EXPLAINABILITY BY DESIGN



MODELS
PRINCIPLES
WHY

PARAMETERS
PATTERNS
HOW

STATES (HIDDEN)
RELATIONS
WHO, WHAT, WHEN



GENERATIVE AI
[CORRELATION]

ACTIVE INFERENCE
[CAUSATION]

Agents (GIA) use HSML + ACTIVE INFERENCE = EXPLAINABILLTY BY DESIGN

Computer Science > Artificial Intelligence

[Submitted on 6 Jun 2023]

Designing explainable artificial intelligence with active inference: A framework for transparent introspection and decision-making

Mahault Albarracin, Inês Hipólito, Safae Essafi Tremblay, Jason G. Fox, Gabriel René, Karl Friston, Maxwell J. D. Ramstead

This paper investigates the prospect of developing human-interpretable, explainable artificial intelligence (AI) systems based on active inference and the free energy principle. We first provide a brief overview of active inference, and in particular, of how it applies to the modeling of decision-making, introspection, as well as the generation of overt and covert actions. We then discuss how active inference can be leveraged to design explainable AI systems, namely, by allowing us to model core features of ``introspective" processes and by generating useful, human-interpretable models of the processes involved in decision-making. We propose an architecture for explainable AI systems using active inference. This architecture foregrounds the role of an explicit hierarchical generative model, the operation of which enables the AI system to track and explain the factors that contribute to its own decisions, and whose structure is designed to be interpretable and auditable by human users. We outline how this architecture can integrate diverse sources of information to make informed decisions in an auditable manner, mimicking or reproducing aspects of human-like consciousness and introspection. Finally, we discuss the implications of our findings for future research in AI, and the potential ethical considerations of developing AI systems with (the appearance of) introspective capabilities.

Subjects: **Artificial Intelligence (cs.AI)**
Cite as: arXiv:2306.04025 **[cs.AI]**
(or arXiv:2306.04025v1 **[cs.AI]** for this version)

1- Explicit labelling of the inference model with HSML-> Priors and beliefs are **explainable by design**

2- Self access and self report : reasoning about your own reasoning becomes possible -> **auditable AI**.

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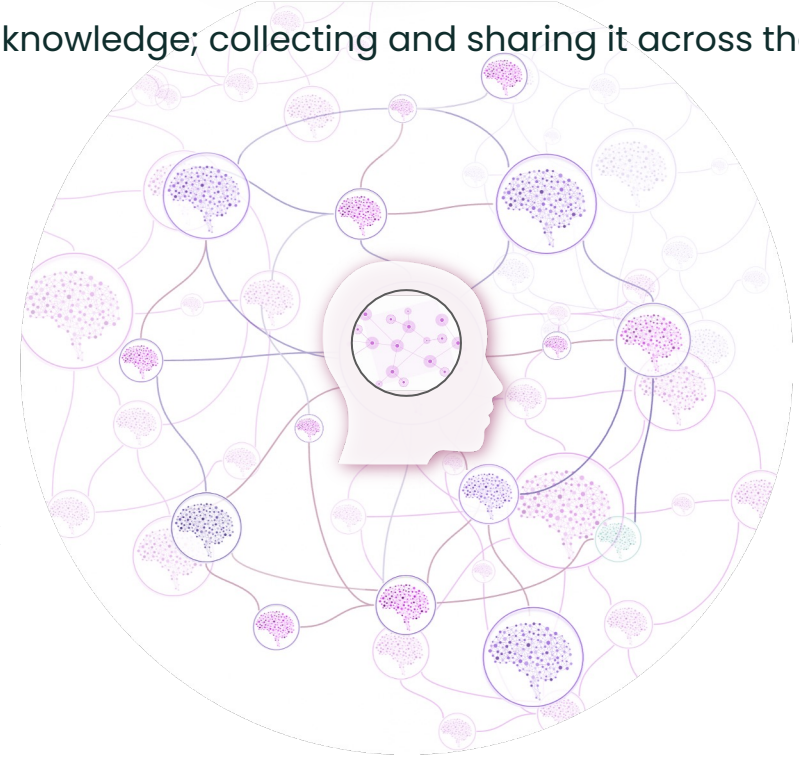
KOSM

Agents *grow* in knowledge; collecting and sharing it across the KOSM network.

KOSM Network

Free data from siloed schemas and systems enabling a globally shared knowledge base for data, devices, and AI across the universal computing network known as the Spatial Web.



KNOWLEDGE SHARING

- Interoperability
- Composability
- Scalability
- Governance
- Automation

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Agents *grow* in knowledge; collecting and sharing it across the KOSM network.

[Submitted on 2 Dec 2022]

Designing Ecosystems of Intelligence from First Principles

Karl J Friston, Maxwell J D Ramstead, Alex B Kiefer, Alexander Tschantz, Christopher L Buckley, Mahault Albarracin, Riddhi J Pitliya, Conor Heins, Brennan Klein, Beren Millidge, Dalton A R Sakthivadivel, Toby St Clere Smithe, Magnus Koudahl, Safae Essafi Tremblay, Capm Petersen, Kaiser Fung, Jason G Fox, Steven Swanson, Dan Mapes, Gabriel René

This white paper lays out a vision of research and development in the field of artificial intelligence for the next decade (and beyond). Its denouement is a cyber-physical ecosystem of natural and synthetic sense-making, in which humans are integral participants—what we call "shared intelligence". This vision is premised on active inference, a formulation of adaptive behavior that can be read as a physics of intelligence, and which inherits from the physics of self-organization. In this context, we understand intelligence as the capacity to accumulate evidence for a generative model of one's sensed world—also known as self-evidencing. Formally, this corresponds to maximizing (Bayesian) model evidence, via belief updating over several scales: i.e., inference, learning, and model selection. Operationally, this self-evidencing can be realized via (variational) message passing or belief propagation on a factor graph. Crucially, active inference foregrounds an existential imperative of intelligent systems; namely, curiosity or the resolution of uncertainty. This same imperative underwrites belief sharing in ensembles of agents, in which certain aspects (i.e., factors) of each agent's generative world model provide a common ground or frame of reference. Active inference plays a foundational role in this ecology of belief sharing—leading to a formal account of collective intelligence that rests on shared narratives and goals. We also consider the kinds of communication protocols that must be developed to enable such an ecosystem of intelligences and motivate the development of a shared hyper-spatial modeling language and transaction protocol, as a first—and key—step towards such an ecology.

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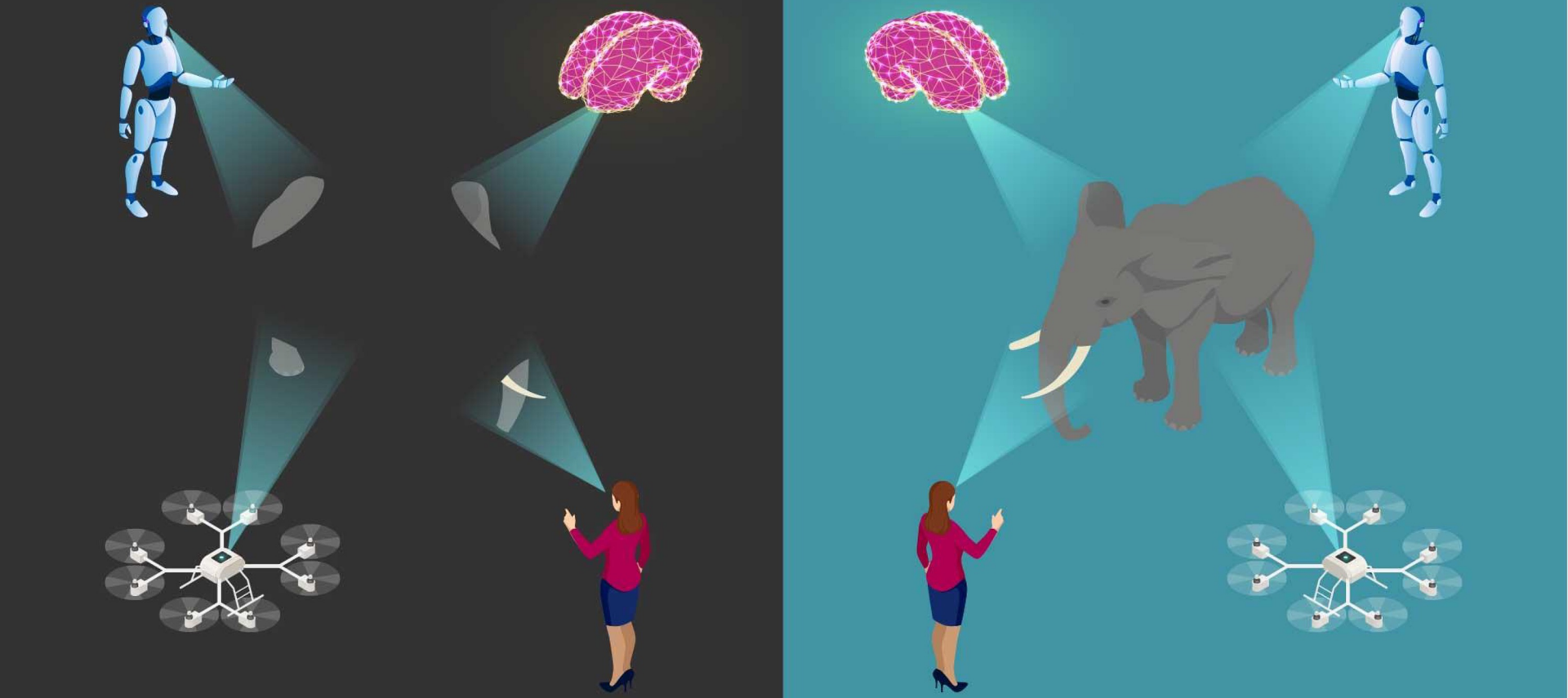
POLICIES & REALITY SHARED ACROSS EDGES



ADAPTIVE INTELLIGENT TWIN FOR SIMULATION, TESTING AND EXECUTION

WORLD

Living. Real-time. Dynamic

KOSM

Cognitive Platform

Sense

Model

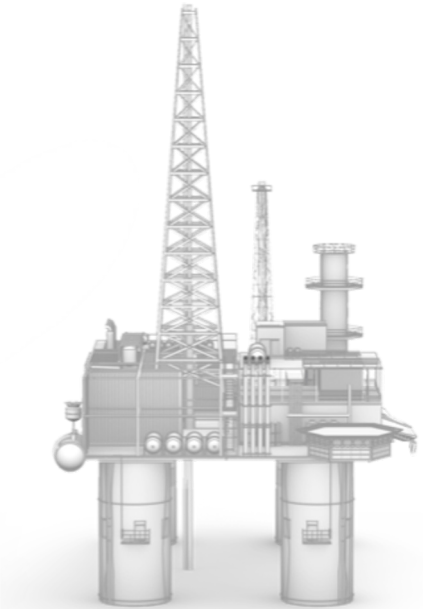
Act

Plan

Understand and search the world

AI based simulation & recommendation

Multi-party execution & operations



WORLD

3D Physics-based model

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KOSM

FIVE MODULES

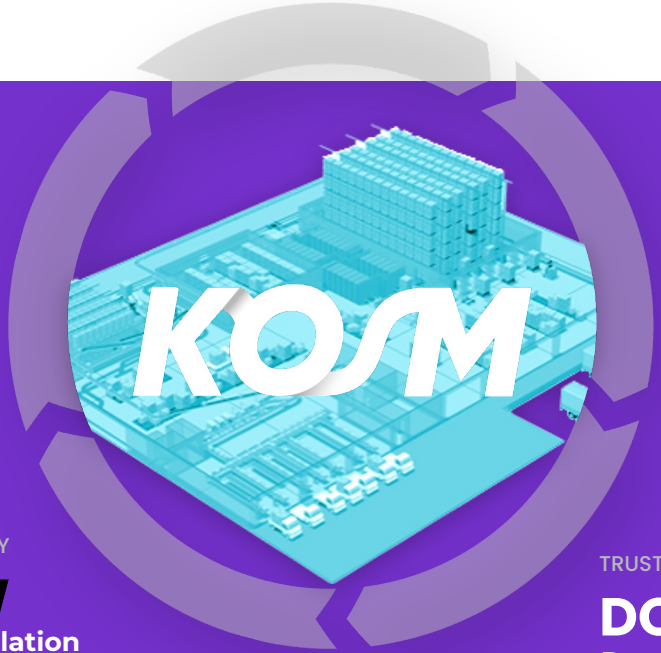
IOFLOW
IoT Sensor Fusion

PHYSICAL

DIGITAL

COORDINATION

WORKFLOW
E2E Workflow Automation



INTEROPERABILITY

DATAFLOW
Data Contextualization Fabric

ADAPTABILITY

SIMFLOW
Adaptive AI Simulation

TRUST

DOMAINFLOW
Data & Device Governance

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AUTONOMOUS MOBILITY USE CASES

VERSES

4-Minute VIDEO

1) **Demo of mobility portal (simulation/operation**

2) **Creating Code as law**

HIGH TECH CAMPUS EINDHOVEN

Zaragoza AYUNTAMIENTO

OSPEDALE SAN RAFFAELE

UNIVERSITY OF OULU

TARTU SCIENCE PARK

PROMISES AND CHALLENGES

- HSML allows us to **evaluate counterfactual actions** - what would happen if I *were* to perform activity *X*
  - We can use this to perform (abstract) routing - find (optimal) series of legal activities that get from HSML graph *A* to HSML graph *B*

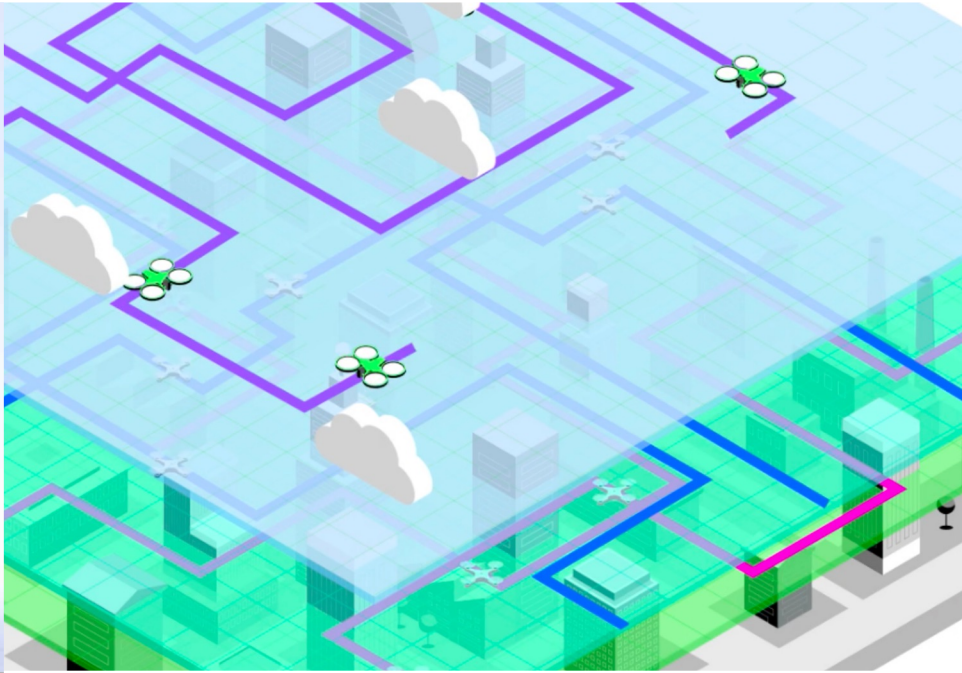
- HSML is updated from a range of real-time data sources; allows autonomous agents to **dynamically operate within the confines of any defined policy**
  - If there is a law about maximum wind speed, dynamically update route given changing wind-speed conditions

- HSML **can be extended beyond laws** - any “rules of the games” can be constructed and abided by using the same schemas and systems

- The law is inherently ambiguous (“UA operator must fly safe”). HSML can help automatically identify ambiguous laws and can provide a feedback mechanism for developing future laws with machine-readability in mind

AUTONOMOUS EDGES OF ALL KINDS

Legal Routes, Flight Paths and Activities



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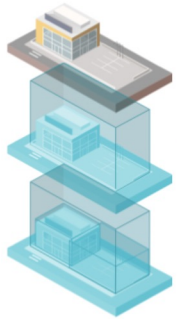
SUMMARY

Efficient, compliant, and secure flow of people and things across locations.

Spatial Web Standards

Spatial Domains



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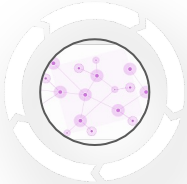
HSML & HSTP



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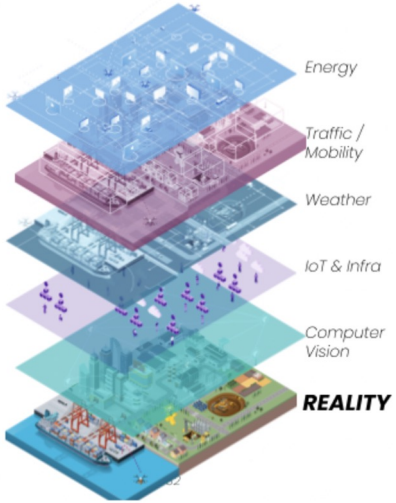
Models / Twins

Interoperable Maps & Twins / AI models



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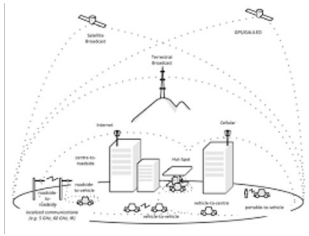
Policy abiding AI-Agents & Networked intelligence

Governance of activity, identity, locations and spaces



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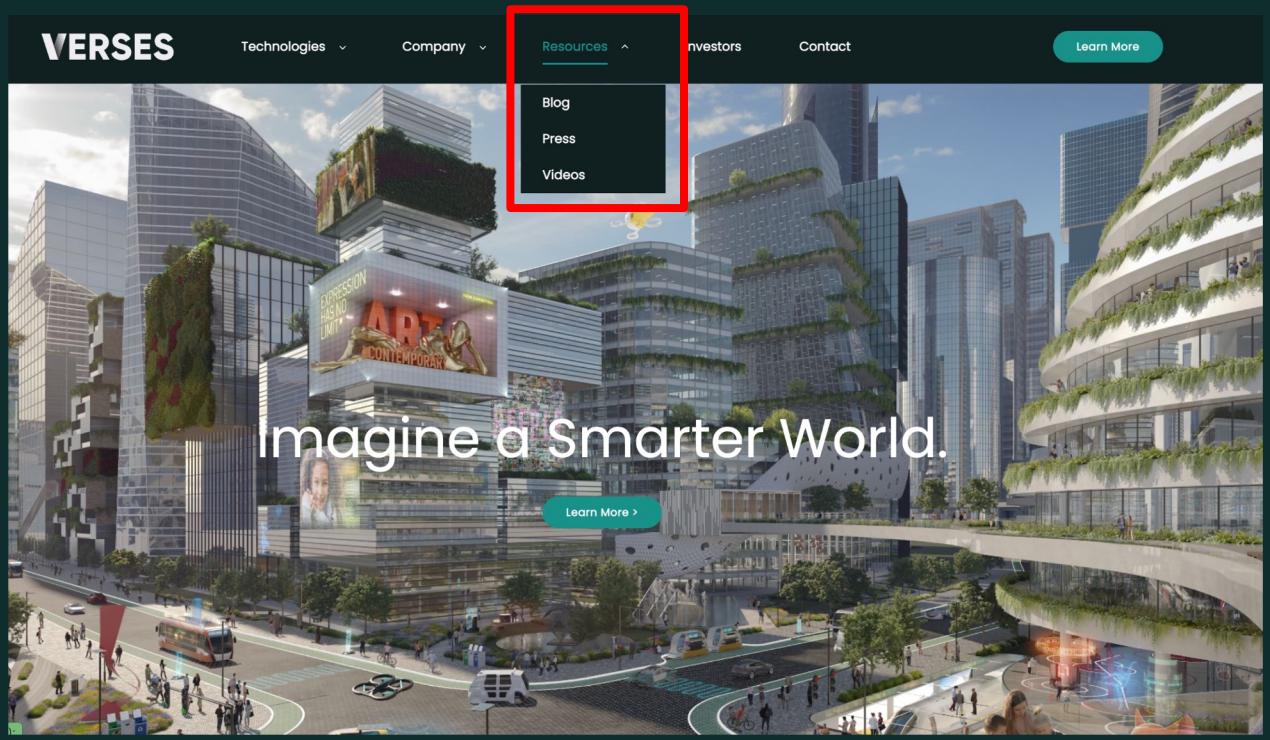
Thank you.



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