



# Key Requirements for a Sustainable European Virtual Worlds Ecosystem – Partners, Ethical and Legal Requirements and Governance



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OLLSCOIL NA GAILLIMHE  
UNIVERSITY OF GALWAY



OPENVERSE Webinar

June 16th, 2026

# Welcome



- The webinar will be recorded (recording will be distributed in the next days)
- Only the speakers can use camera, mics and share the screen
- Please feel free to put your questions in the Q+A box, if you'd like to interact with the speakers

# OPENVERSE WEBINAR SERIES – Virtual Worlds Market Sustainability



OpenVerse

## State of the market of Virtual Worlds in Europe – Key Technologies and Adoption

May 5 | 10:30 -11:30 CEST | Online

open-verse.eu

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OpenVerse

## Concrete applications of Virtual Worlds in Europe – Use Cases, Drivers & Challenges

May 26 | 10:30 -11:30 CEST | Online

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# Agenda

- BDVA – Openverse Ecosystem & National Initiatives
- University of Galway – Technology Framework
- Trust-It – a Walkthrough of OpenVerse Observatory sandbox initiatives
- Q&A

# Today's Speakers



**Lapo Fioretti, IDC**



**Abdul Wahid, University  
of Galway**



**Mattia Trino, BDVA**



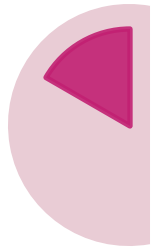
**John Favaro, Trust-It**



# OPENVERSE Ecosystem

*Mattia Trino - BDVA*

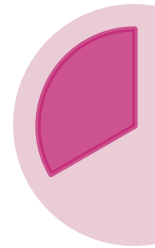
# Ecosystem building – Summary and objectives



## What

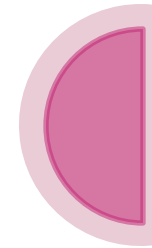
**Network of collaborations with national, European and international programs, initiatives, organisations, and different bodies.**

**OpenVerse Technological Framework**



## Why

**Build synergies, and reinforce the links among the different technological areas, infrastructures, and disciplines behind the different elements that compose the Virtual Worlds.**



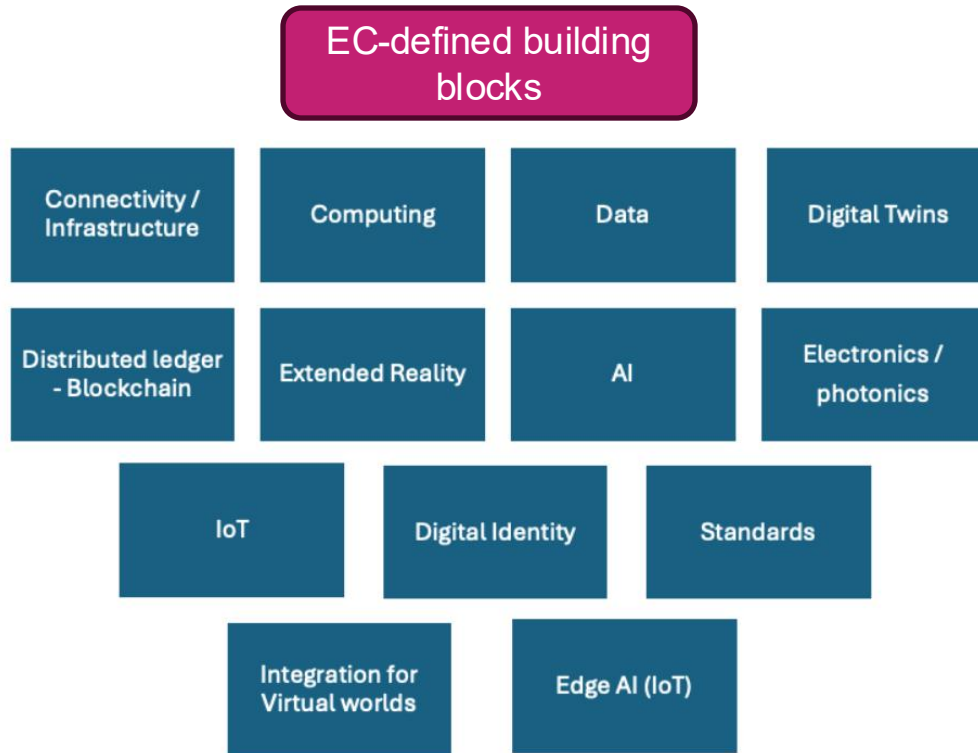
## How

**Identification  
Outreach  
Bi-lateral and combined workshops**

Ongoing knowledge sharing

Co-creation Technological Framework and other project's assets

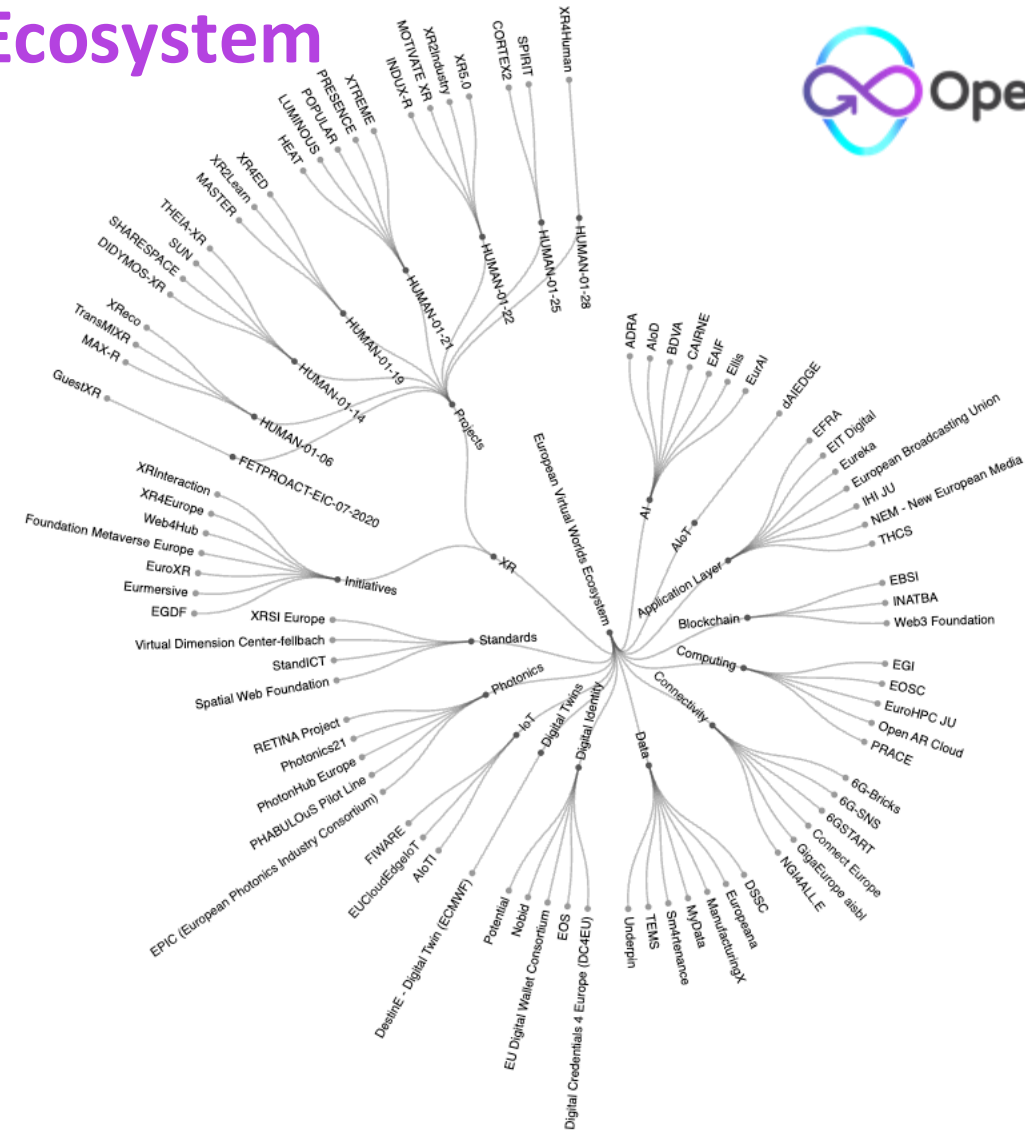
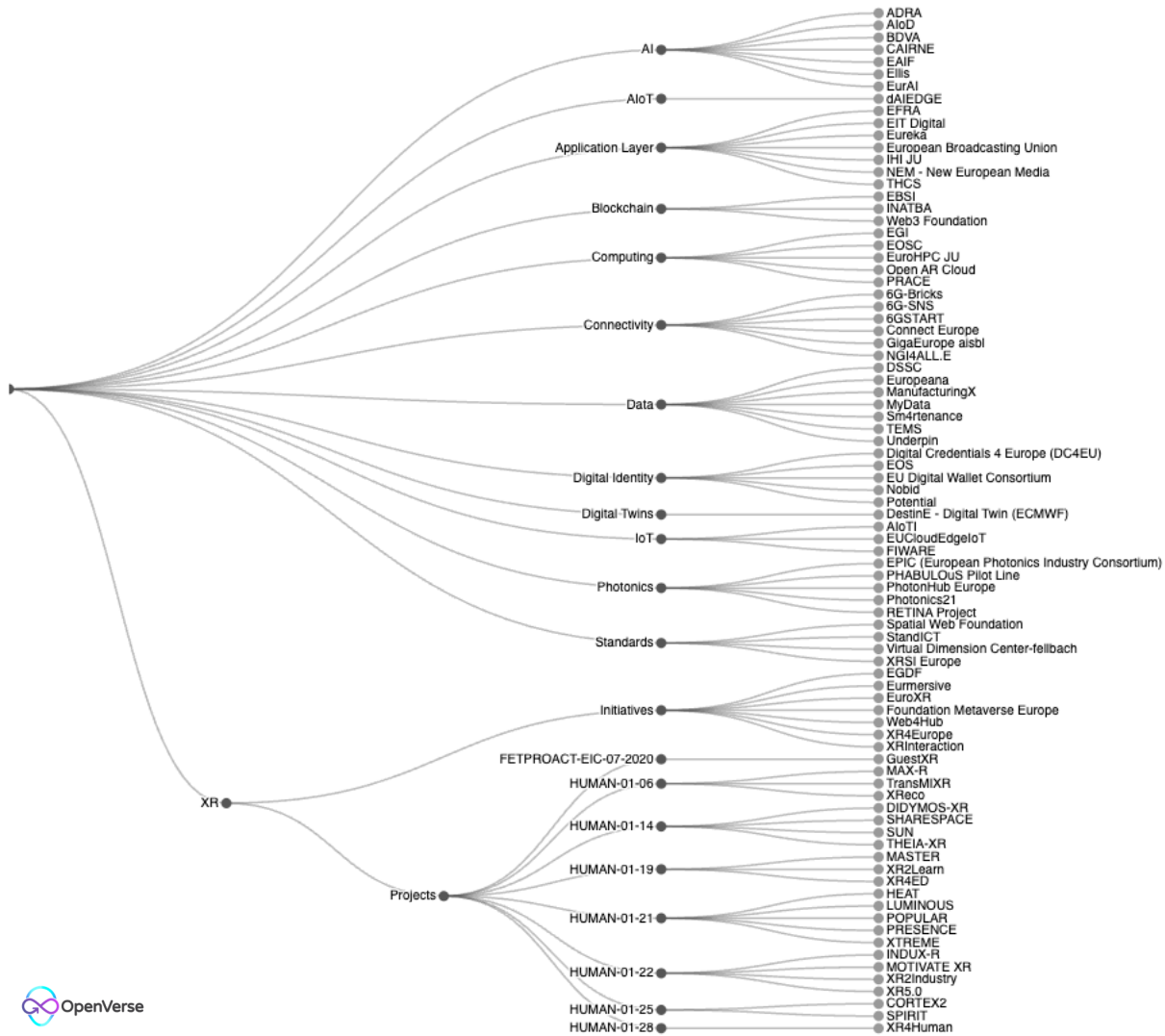
# Where to start?



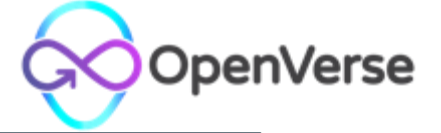
This approach is essential for two main reasons:

- **Strategic alignment** – It ensures that EU projects, policies and funding priorities are built on a shared understanding of what Virtual Worlds require.
- **Collaboration facilitation** – It allows OPENVERSE to map and engage with relevant EU initiatives, matching their scope with precise domains of innovation.

# Mapping of the EU virtual World Ecosystem



# Analyse PPPs Strategic Agendas



✓ EU Initiatives on wiki

## SRIAs and SRIDAs

Page Discussion

This page provides a comprehensive list of the **Strategic Research Agendas** relevant to European Virtual Worlds.

- 6G SNS
- ADRA
- BDVA
- EFFRA
- EIT Culture & Creativity
- EIT Digital
- EIT Health
- EIT Manufacturing
- EIT Urban Mobility
- EOSC
- EUCloudEdgeIoT
- Eureka
- EuroHPC
- European Game Developers Foundation
- European
- IHI JU
- MyData
- NEM
- Photonics21
- THCS
- XR Interaction

**BDVA**

**BDVA Strategic Agenda 2022**

BDVA's 2024 agenda is a practical plan to secure computing continuum, and green computing, and to explore the potential of digital twins (DTs), TFA) to move from pilots to real world use cases, and operationalise computing continuum.

**Basic Identification**

- Initiative / Partnership Name: Big Data
- Full SRIDA Title & Version: BDVA 08
- Publication / Last Update Date: 2024
- Governing Body / Association: BDVA
- Type: Industry association; private and public
- Website / Source: BDVA Strategic Agenda

**Strategic Orientation**

- Vision Statement: Empower European data AI to drive competitiveness and innovation
- Core Mission / Objectives:
  1. Define BDVA scope & priorities
  2. Inform policy & industry
  3. Coordinate Task Forces and initiatives
- Key Strategic Pillars / Themes:
  1. Human-centric digital future
  2. Data-driven ecosystems & data
  3. Fit data/AI for emerging infra
  4. Sustainable data & AI
  5. Integrating innovation, ethics, and standards engagement and impact
- Policy Alignment:
  - EU Data Strategy v1.0
  - Data Governance Act v1.0
  - GDPR v1.0
  - Artificial Intelligence Act v1.0
  - Open Data Directive v1.0
  - Digital Decade Policy Programme v1.0
  - The European Green Deal v1.0
  - Digital4Growth v1.0
  - AI Innovation Package v1.0 (AI Factories)

**Technological & Thematic Priorities**

- Main Technological Domains:
  - Common European Data Spaces
  - Computing Continuum: cloud-4G
  - AI Foundations & GenAI Usage (AI for All)
  - Sustainability/Green AI (emerging)
  - Cross-cutting Topics: semantic interoperability (SEM-CEN/IEEE JTC1)
  - Related Infrastructures / Platforms: EOSC v1.0; European v1.0; national v1.0
- Interdependencies / Synergies: inputs to Quantum Flagship v1.0; CEI Continuum v1.0

**Governance & Ecosystem**

- Leading Organisations / Association: Data Week v1.0
- Stakeholder Groups: Industry (incl. SMEs); HPC; Research
- Engagement Mechanisms: dedicated working group; ethics toolkits (atoms)
- Update Frequency: "Dynamic" document
- Contact / Participation Info: Participate in CloudEdgeIoT; open-verse.eu

**EFFRA**

**EFFRA's Factories of the Future SRIA**

EFFRA's Factories of the Future SRIA defines Europe's manufacturing R&I vision factories. It advances digital twins, AI, robotics, and circular processes across end-to-end form its foundation, bridging industrial excellence with societal and environmental responsibility.

**Basic Identification**

- Initiative / Partnership Name: European Factories of the Future Research Association
- Full SRIDA Title & Version: EFFRA Vision for a Manufacturing Partnership in Horizon Europe
- Publication / Last Update Date: 2019
- Governing Body / Association: EFFRA v1.0 – representing the manufacturing ecosystem
- Type: Public-Private Partnership (PPP) under Horizon Europe (Cluster 4; Digital, Industry, Research, and Policy Actors)
- Website / Source: effra.eu

**Strategic Orientation**

- Vision Statement: "To ensure that European society and innovation..."
- Mission: Establish and operate the European computing, and analytics services for research
- Core Objectives:
  1. Implement the EOSC Core and Exchange
  2. Foster interoperability between data space
  3. Promote sustainable governance and trust
  4. Drive capacity building and digital skills
- Expected Outcomes / KPIs:
  - 80% of European research outputs access
  - 70 thematic and cross-disciplinary data spaces
  - Fully operational EOSC Core and Federated Data Spaces
- Policy Alignment: Horizon Europe Cluster 4 Directive v1.0; Data Governance Act v1.0; Artificial Intelligence Act v1.0

**Technological & Thematic Priorities**

Domain	Focus / Activities
FAIR Data & Interoperability	Implement
Cloud-Edge-HPC Continuum	Federated
Data Federation & Trust Frameworks	EOSC Core
AI & Machine Learning Readiness	Trusted AI
Digital Twins & Simulation Environments	EOSC as a platform
Sustainability & Business Models	Long-term
Skills & Capacity Building	Data Skills

**Governance & Ecosystem**

- Leading Organisations: EOSC Association of Research Centres
- Stakeholder Groups: Research Infrastructure; Industry; Academia
- Engagement Mechanisms:
  - EOSC Association Working Groups: AI, Digital, Industry, Research, and Policy Actors
  - EOSC Future Projects: Implementation & Evaluation
  - Public Consultations: Conducted annually
  - Update Frequency: Updated approximately every 2 years
  - Contact / Participation Info: Open members

**Building-Block Crosswalk (EC Staff Working Document Crosswalk)**

Technical Building Block	EOSC SRIDA
Technical Building Block	EOSC SRIDA

**EOSC**

**EOSC SRIA v1.3 (2024)**

The EOSC SRIA v1.3 (2024) is Europe's key research agenda for computing continuum, and AI into a secure, sustainable, and sovereign digital infrastructure. It addresses fragmentation by fostering open standards, data spaces, and trust frameworks aligned with European values.

**Basic Identification**

- Initiative / Partnership Name: European Digital Infrastructure
- Full SRIDA Title & Version: Strategic Research Agenda for EOSC v1.3
- Publication / Last Update Date: 31 October 2024
- Governing Body / Association: EOSC Association
- Type: Co-programmed European Partnership
- Website / Source: 2024/0201\_SRIA\_v1.3\_Inf

**Strategic Orientation**

- Vision Statement: "To ensure that European society and innovation..."
- Mission: Establish and operate the European computing, and analytics services for research
- Core Objectives:
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**Building-Block Crosswalk (EC Staff Working Document Crosswalk)**

Technical Building Block	EOSC SRIDA
Technical Building Block	EOSC SRIDA

**EUCloudEdgeIoT**

**EU Cloud-Edge-IoT Continuum R&I Roadmap (2024)**

The EU Cloud-Edge-IoT Continuum R&I Roadmap (2024) defines a unified trajectory for Europe's computing continuum – merging cloud, edge, IoT, and AI into a secure, sustainable, and sovereign digital infrastructure. It addresses fragmentation by fostering open standards, data spaces, and trust frameworks aligned with European values.

**Basic Identification**

- Initiative / Partnership Name: European Cloud, Edge & IoT Continuum v1.0
- Full SRIDA Title & Version: Cognitive Computing Continuum Research & Innovation Roadmap for Europe – 2nd Public Version
- Publication / Last Update Date: October 2024 (mid-term roadmap update; final due 2026)
- Governing Body / Association: NextForum EU consortium supported by Horizon Europe; coordinated with the European Alliance for Industrial Data, Edge and Cloud v1.0
- Type: Coordination and Support Action (CSA) v1.0 / multi-stakeholder roadmap
- Website / Source: eucloudedgeiot.eu – roadmap document

**Strategic Orientation**

- Vision Statement: "Achieve a federated, secure, AI-driven European computing continuum bridging cloud, edge, IoT, and AI to deliver digital sovereignty and competitiveness."
- Mission:
  1. Federate Europe's cloud-edge ecosystem through interoperability and open standards.
  2. Enable trustworthy, energy-efficient infrastructures for AI deployment.
  3. Strengthen Europe's sovereignty and reduce dependency on non-EU hyperscalers.
- Strategic Drivers:
  - Competitiveness Compass, Connected Collaborative Networks White Paper.
  - EU Digital Strategy, NIS2, Cyber Resilience Act, Chips Act, and upcoming EU Cloud Certification Scheme (EUCS).
- Expected Outcomes / KPIs:
  - Establish a European cognitive computing continuum by 2030.
  - Integrate multi-provider infrastructures with sovereign control.
  - Integration of AI, edge, and cloud with sustainability and trust metrics.
- Policy Alignment: Digital Europe Programme; Data Strategy; AI Act; Green Deal; Chips Act; Cyber Resilience Act.

**Technological & Thematic Priorities**

Priority Area	Main Goals / Activities
1. Secure, Interoperable, Sovereign Continuum	Harmonise EU markets; strengthen open-source governance (RISC-V); ensure compliance with NIS2, CRA, EUCS
2. Intelligent, Autonomous, Resilient Management	AI-driven orchestration across federated infrastructures; privacy-preserving federated computing; confidential computing
3. Data-Driven AI & Innovation Enablement	Expand common European Data Spaces; portable AI apps; federated AI model training; middleware & compiler research
4. Sustainable, Energy-Efficient Computing	Carbon-aware orchestration; AI-based energy optimisation; co-designed hardware/software for efficiency; renewable integration
5. Tele-Cloud-AI Convergence	Open RAN, next-gen telco-cloud; predictive hardware; IIoT integration; digital twins & smart environments for Industry 4.0

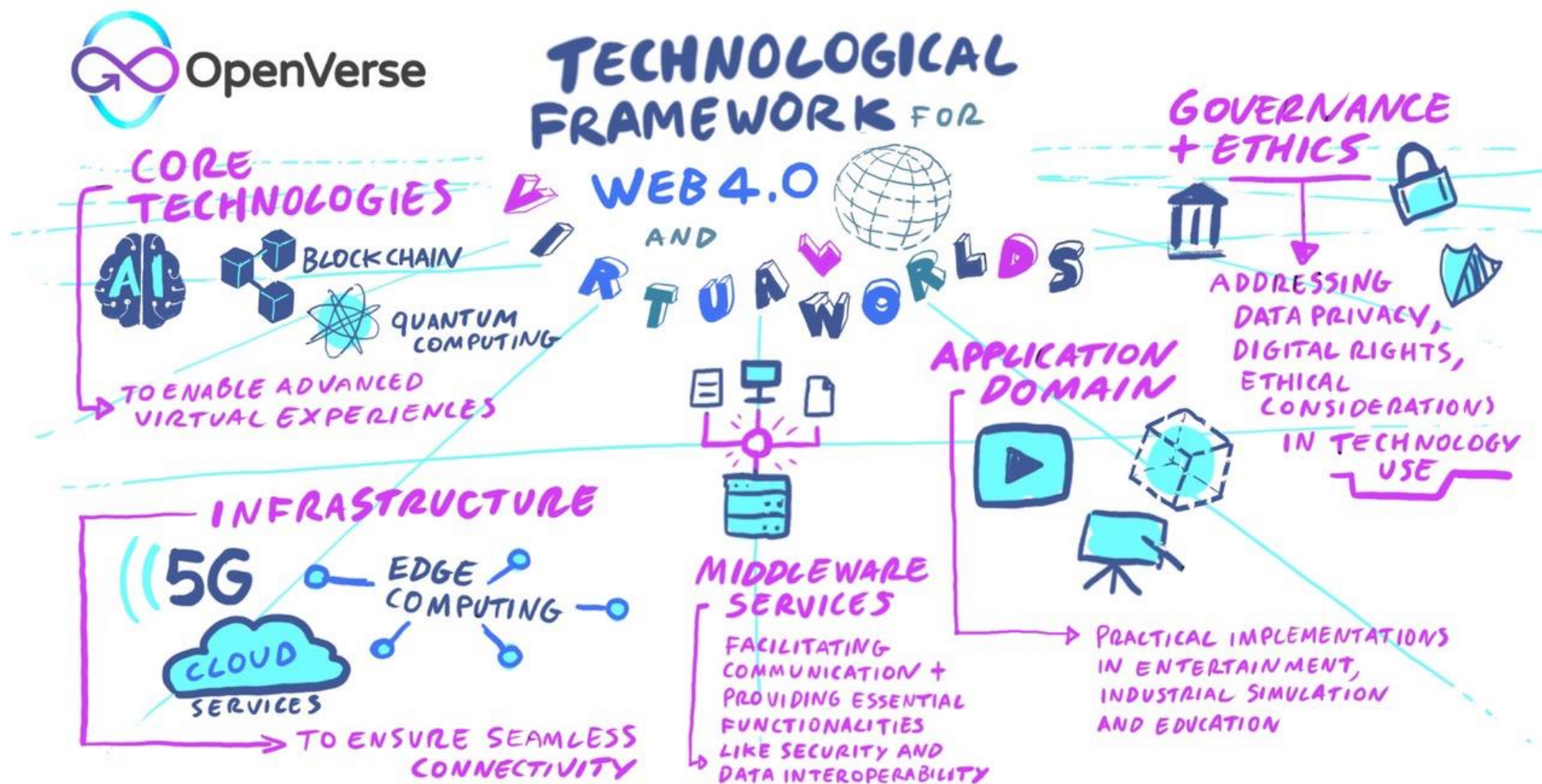
**Governance & Ecosystem**

- Cross-Cutting Topics: Open standards, interoperability, ethics, sustainability, international cooperation (Japan, Korea).
- Synergies: Alliance for Industrial Data, Edge & Cloud v1.0; PCEI-CIS v1.0; EuroHPC v1.0; Data Spaces Support Centre v1.0; SNS JU v1.0; ADRA v1.0
- Leading Organisations: NextForum EU consortium (representing eucloudedgeiot stakeholders) under Horizon Europe.
- Ecosystem: Providers (cloud, telco, AI, edge), industrial users, research, and public authorities.
- Engagement Mechanisms:
  - Working Groups and Public Consultations (2024–26) for roadmap updates.
  - Lesson with European Alliance for Industrial Data, Edge & Cloud.
  - Open participation via NextForum portal.
- Update Frequency: Biennial; final version due mid-2026.
- International Dimension: Planned cooperation with Japan and Korea for cross-federation alignment.

**Building-Block Crosswalk (Staff Working Document Alignment)**

Technical Building Block	Continuum Roadmap Focus
Cloud-Edge-IoT Continuum	Core concept: multi-provider federated architecture
AI & ML	AI-driven orchestration, federated learning, generative AI support
Data Spaces & Interoperability	Expansion of Common European Data Spaces

# High level – user view



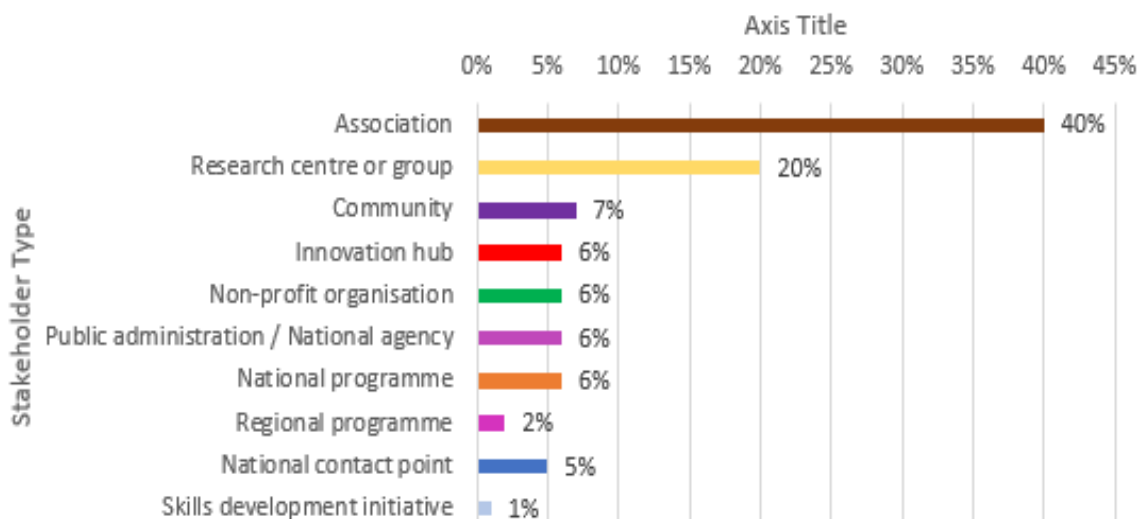
## Definition national initiatives

- National initiatives in the format of **associations, NGOs, technology platforms**, or similar structures, that work on the topic of Virtual Worlds as a central topic, or with a dedicated working group (e.g. a working group within an ICT industry association).
- **Entities running collaborative projects** at national level, either publicly or privately funded contributing to Virtual Worlds.
- **Skills development initiatives** with national and international outreach (e.g. summer schools)
- Any **other initiative** (e.g. private collaboration in between several companies) **with different collaboration models** to the ones described above but of relevance to this exercise.
- **Multi-country initiatives** (e.g. European Digital Infrastructure Consortia).

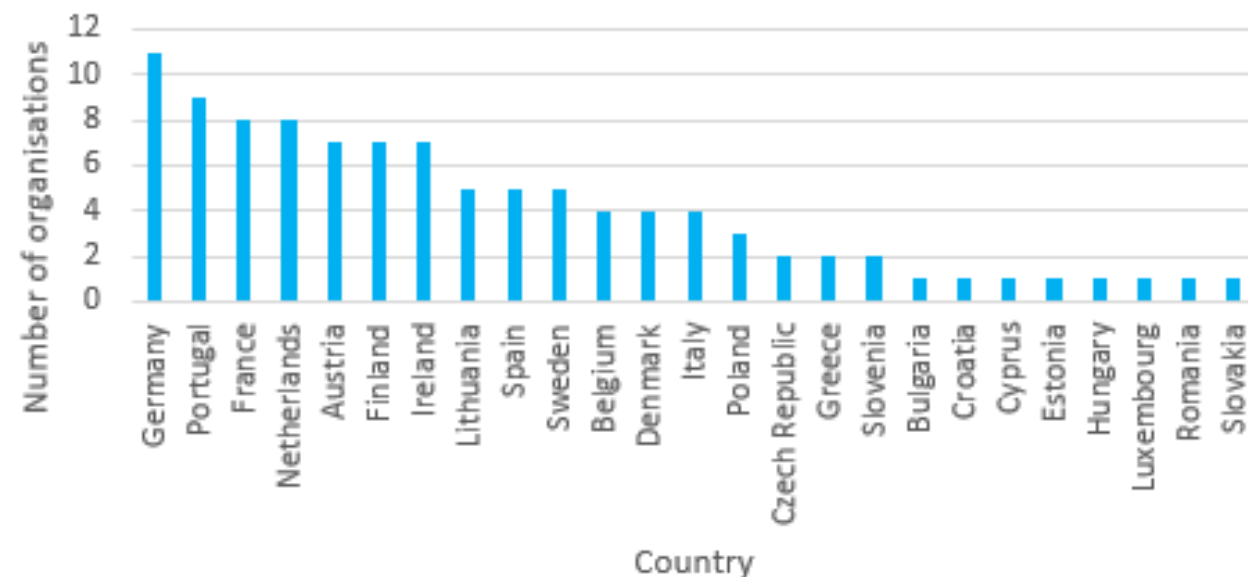
# National Initiatives



### Distribution of Organisations by Stakeholder Type (Percentage)



### NUMBER of Organisations per Country in EU Member States



# Observatory



The screenshot displays the OpenVerse Observatory interface. At the top, there are navigation links for 'Explore', 'Learn', 'Contribute', and 'Sign Up / Log In'. The main heading is 'Observatory'. Below this, there is a search bar and a filter sidebar on the left. The sidebar includes sections for 'Type' (Case study, Company, National Initiative), 'Country', 'User & Experience Dimensions', 'Interaction & Enabling Technologies', 'Economic & Business Layer', 'Data Processing and PR', 'Purposes', and 'Sectors'. A 'Reset filters' button is at the bottom of the sidebar. The main content area shows a grid of 15 national initiative cards, each with a logo, name, and a brief description. The cards are arranged in a 5x3 grid. The first row includes ADAPT, AGEFE, and Agência Nacional de Inovação. The second row includes AL-VR (360 laipsnių filmai), Alliance for OpenUSD (AOUSD), and Alliance Française des Industries du Numérique. The third row includes ALPA/XR, AMETIC, and Anitec-Asainform. The fourth row includes APDC, ArtTech agency Lithuania, and Asociace pro aplikovaný výzkum v IT. The fifth row includes Asociación Española de la Economía Digital, Asociația Patronală a Industriei de Software și Servicii, and Association des Professionnels de la Société de l'Information.



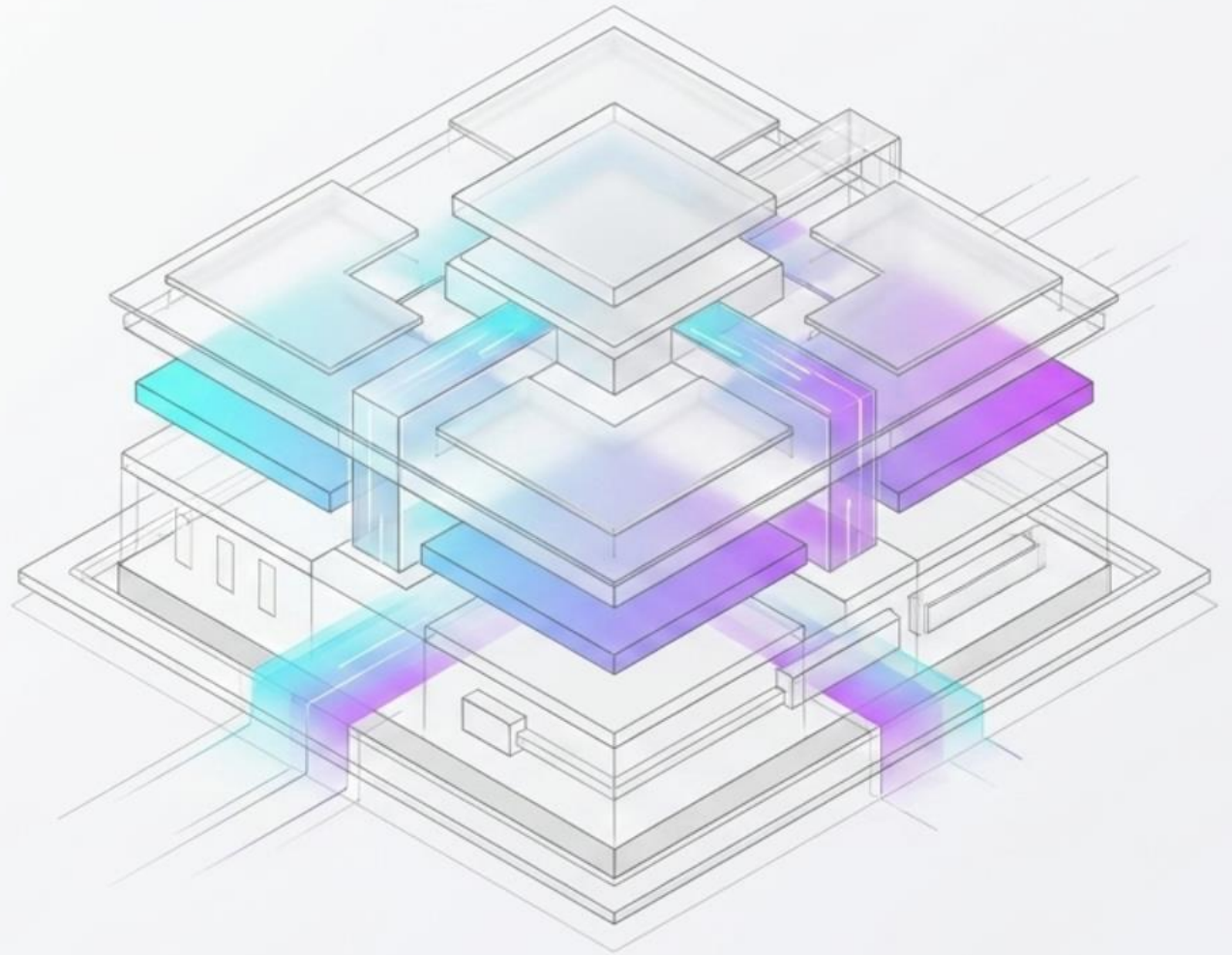
# Technological Framework

*Lukasz Porwol  
Abdul Wahid*

*Insight Centre for Data Analytics, University of Galway*

# The OpenVerse Technological Framework

A Blueprint for Web 4.0  
& Virtual Worlds



Funded by  
the European Union



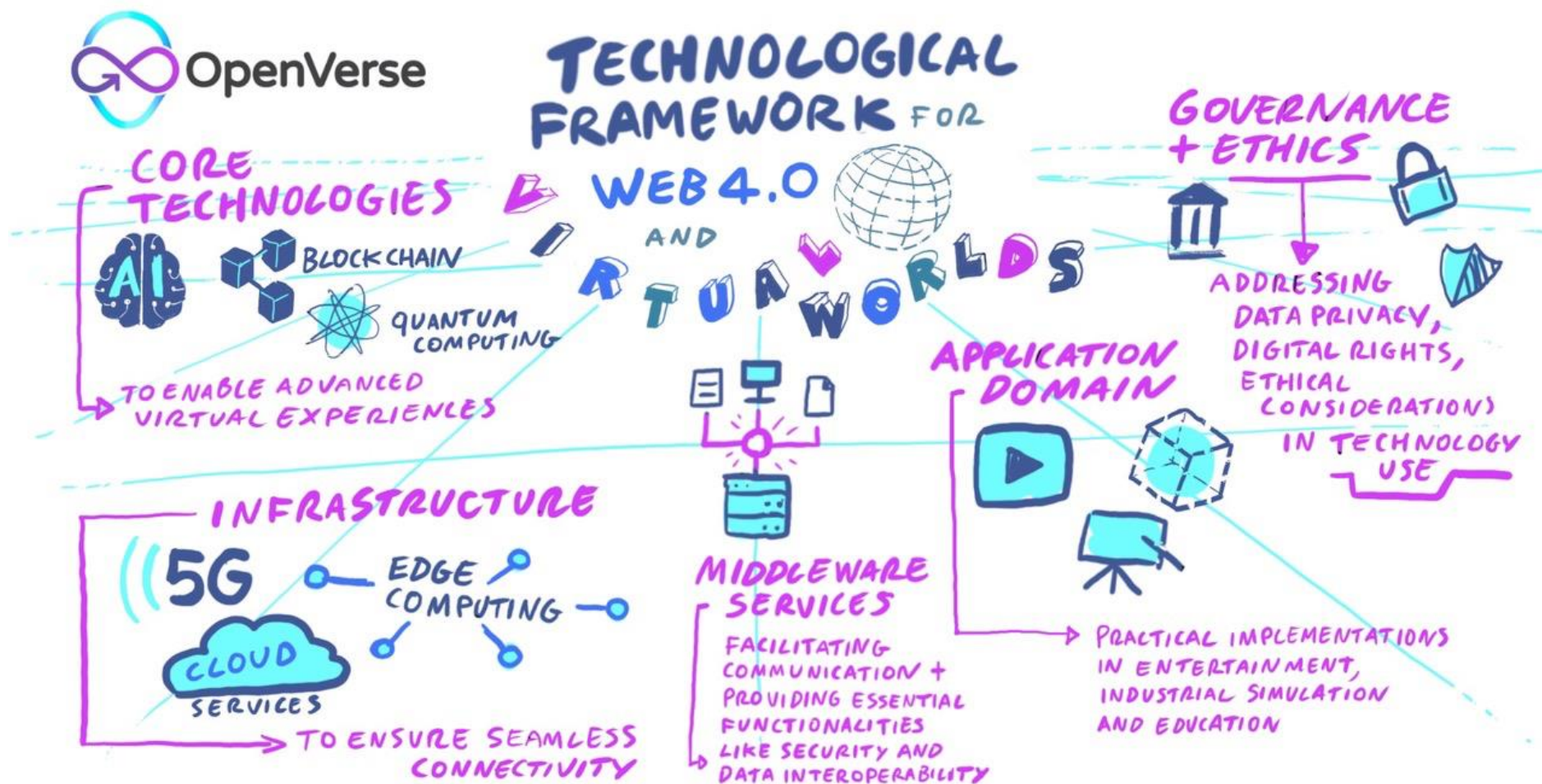
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# Positioning Europe's Digital Future

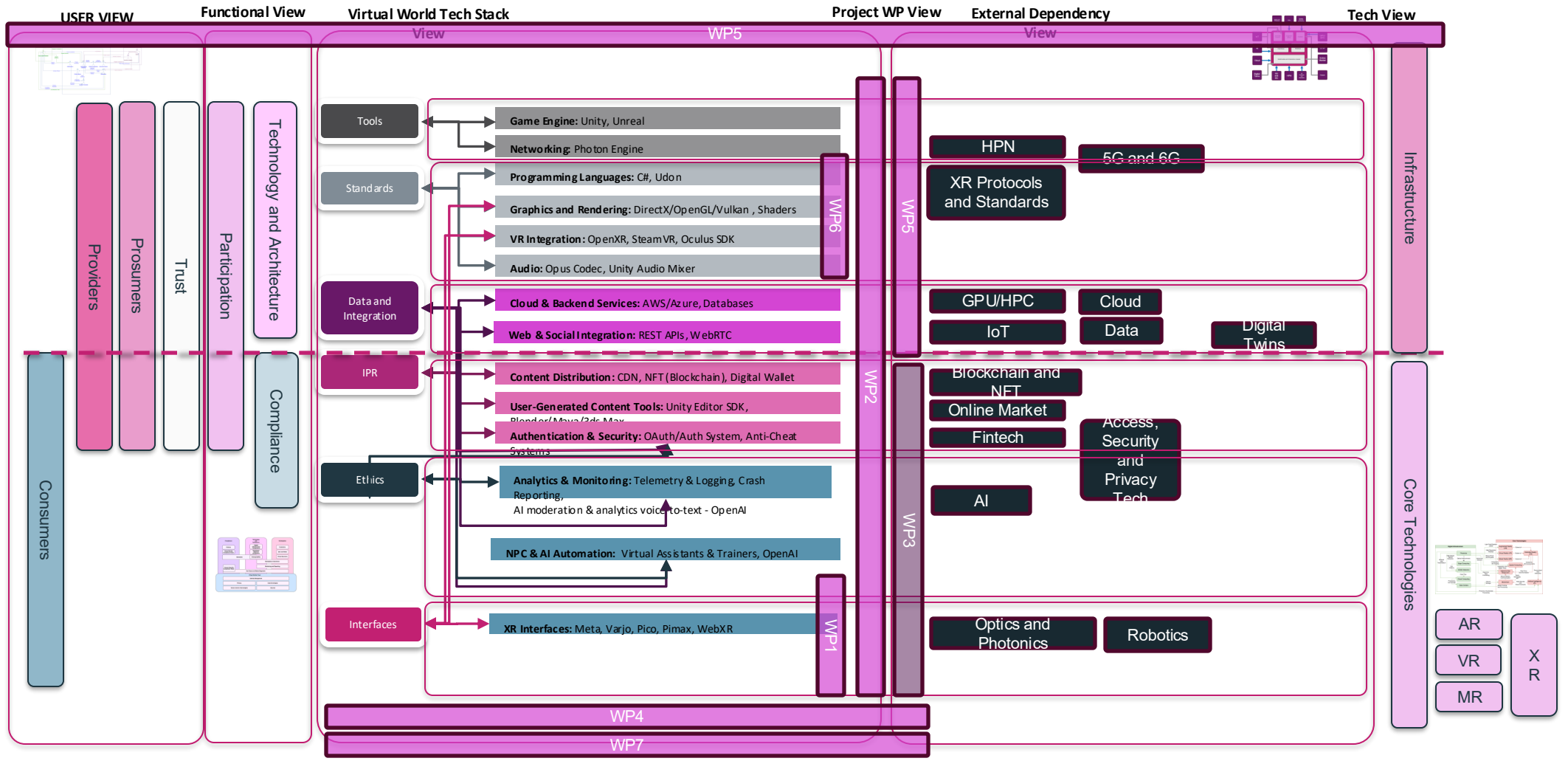
Transitioning from fragmented technologies to a unified, human-centric ecosystem that enables SMEs and enterprises to successfully navigate and innovate within the Virtual Worlds landscape.



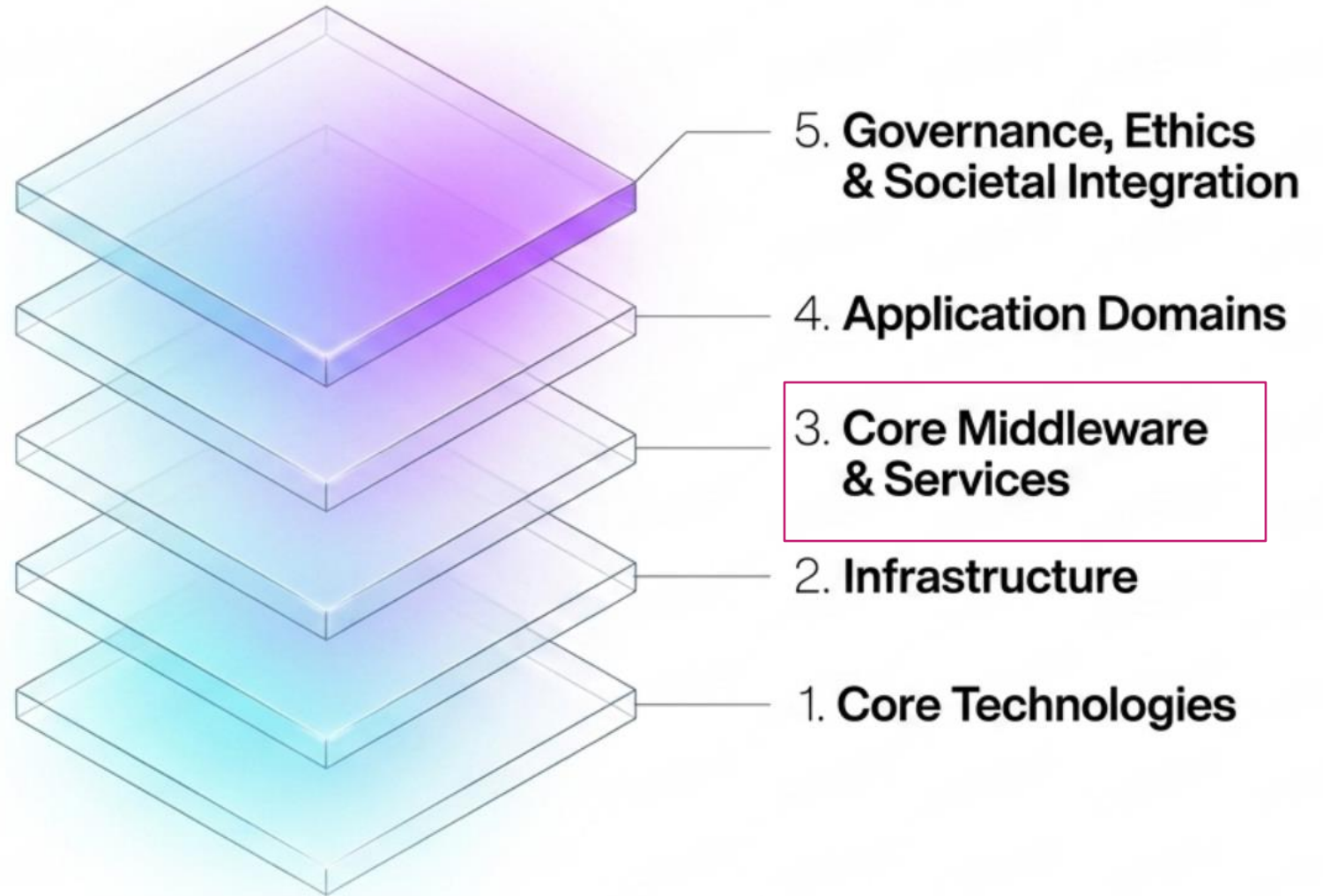
# High level – user view



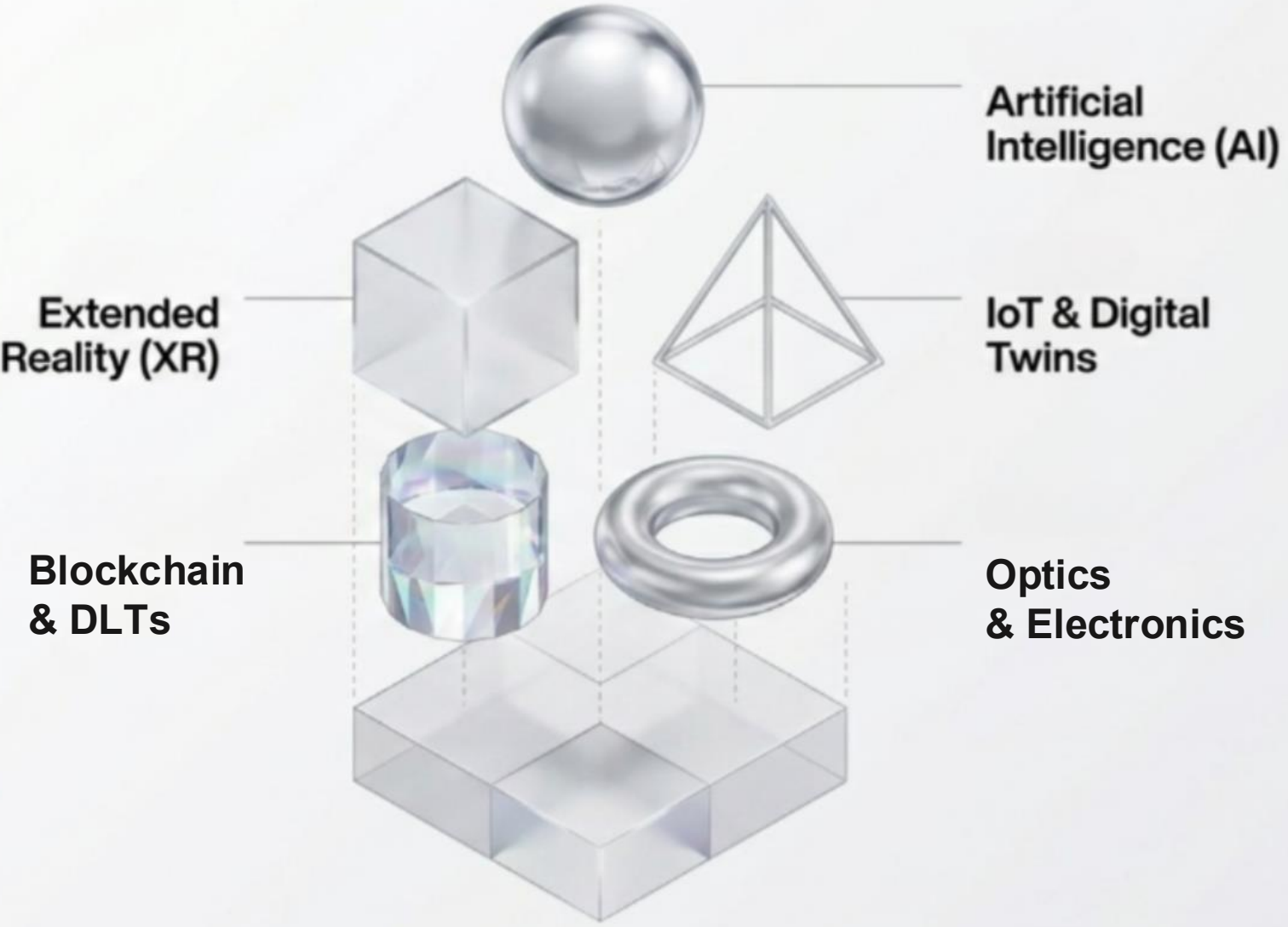
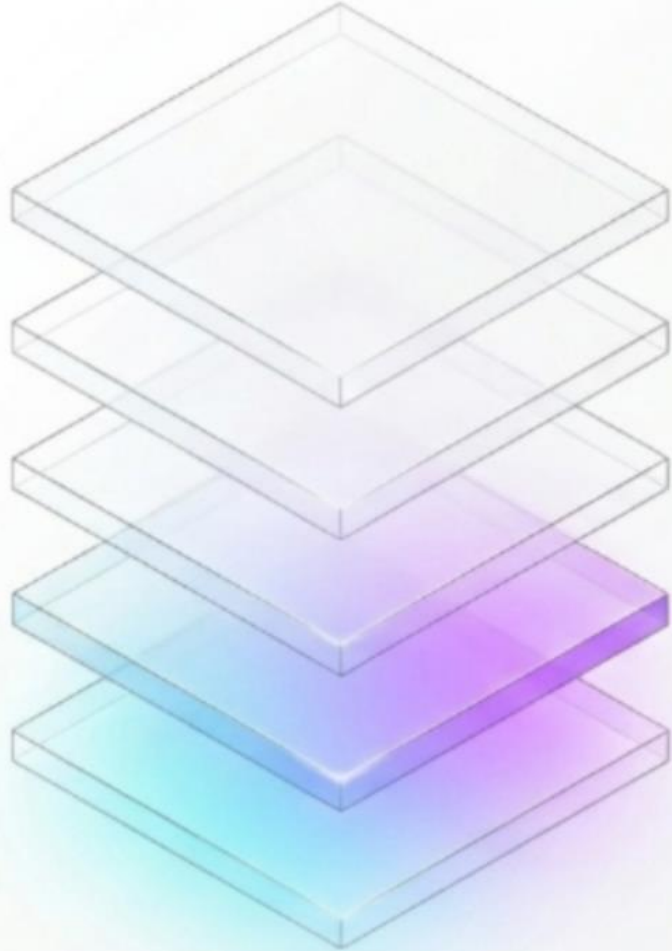
# Fine Grain - Technical View



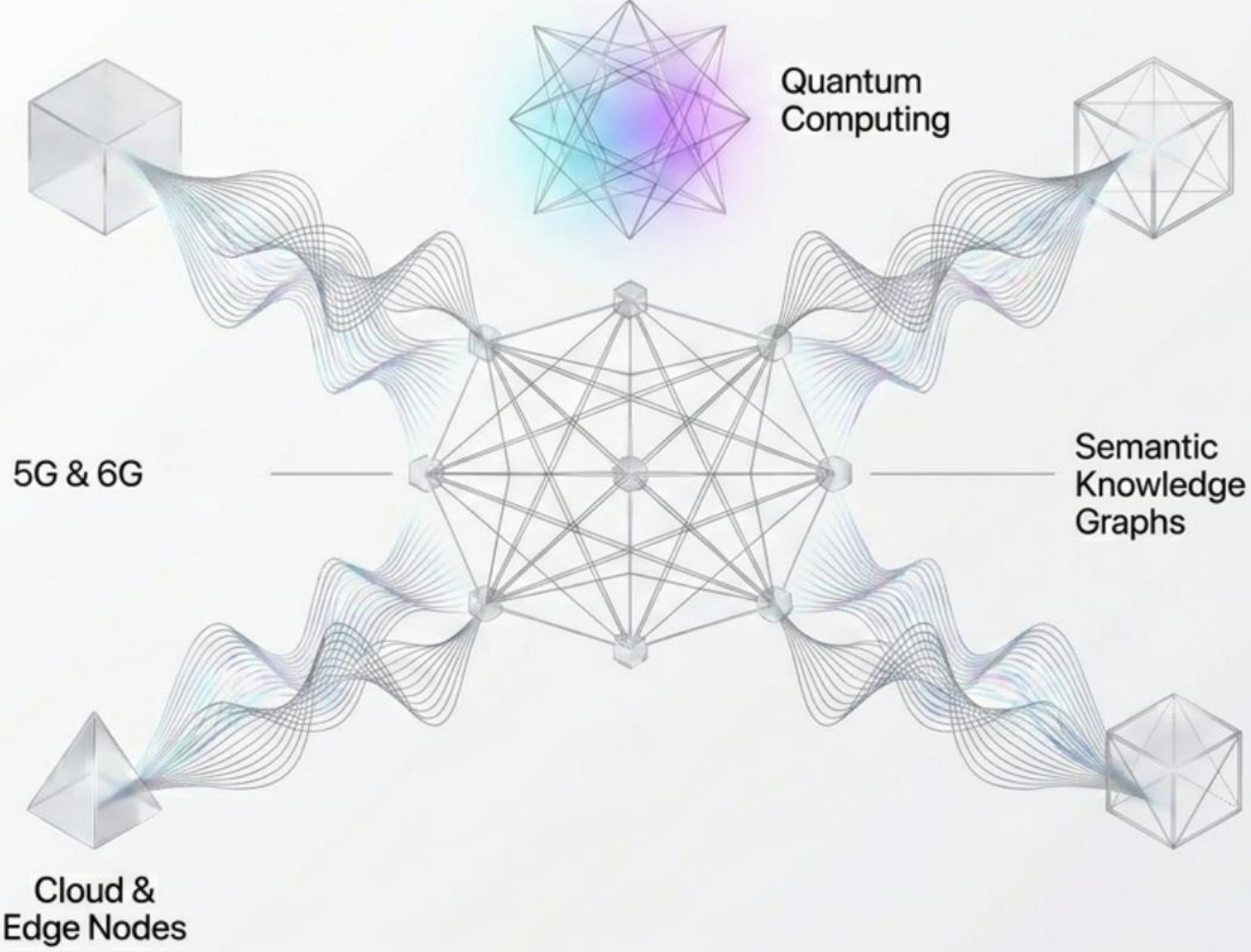
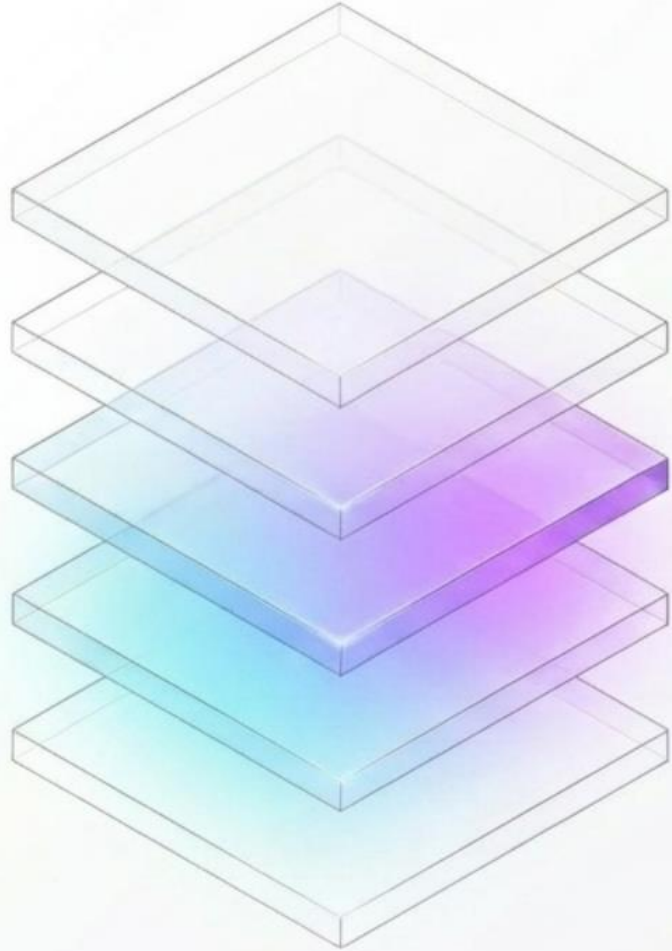
# The Five Dimensions of OpenVerse



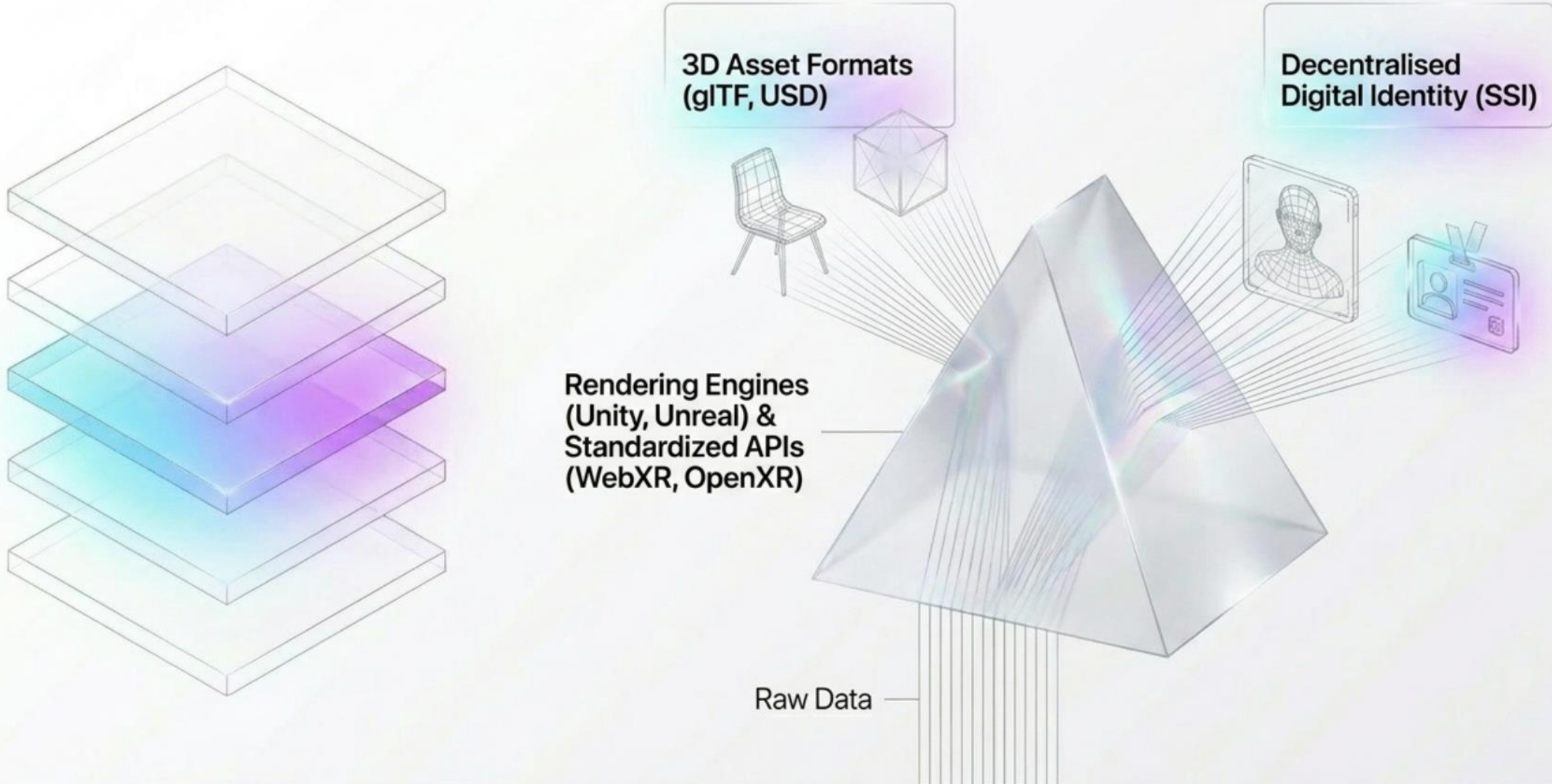
# Dimension 1: Core Technologies



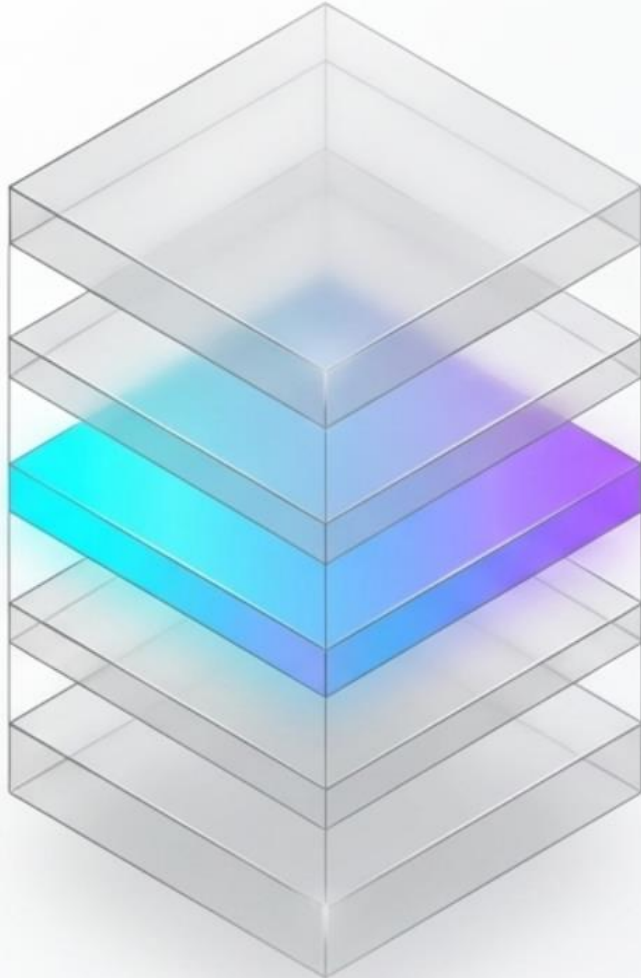
# Dimension 2: Infrastructure Backbone



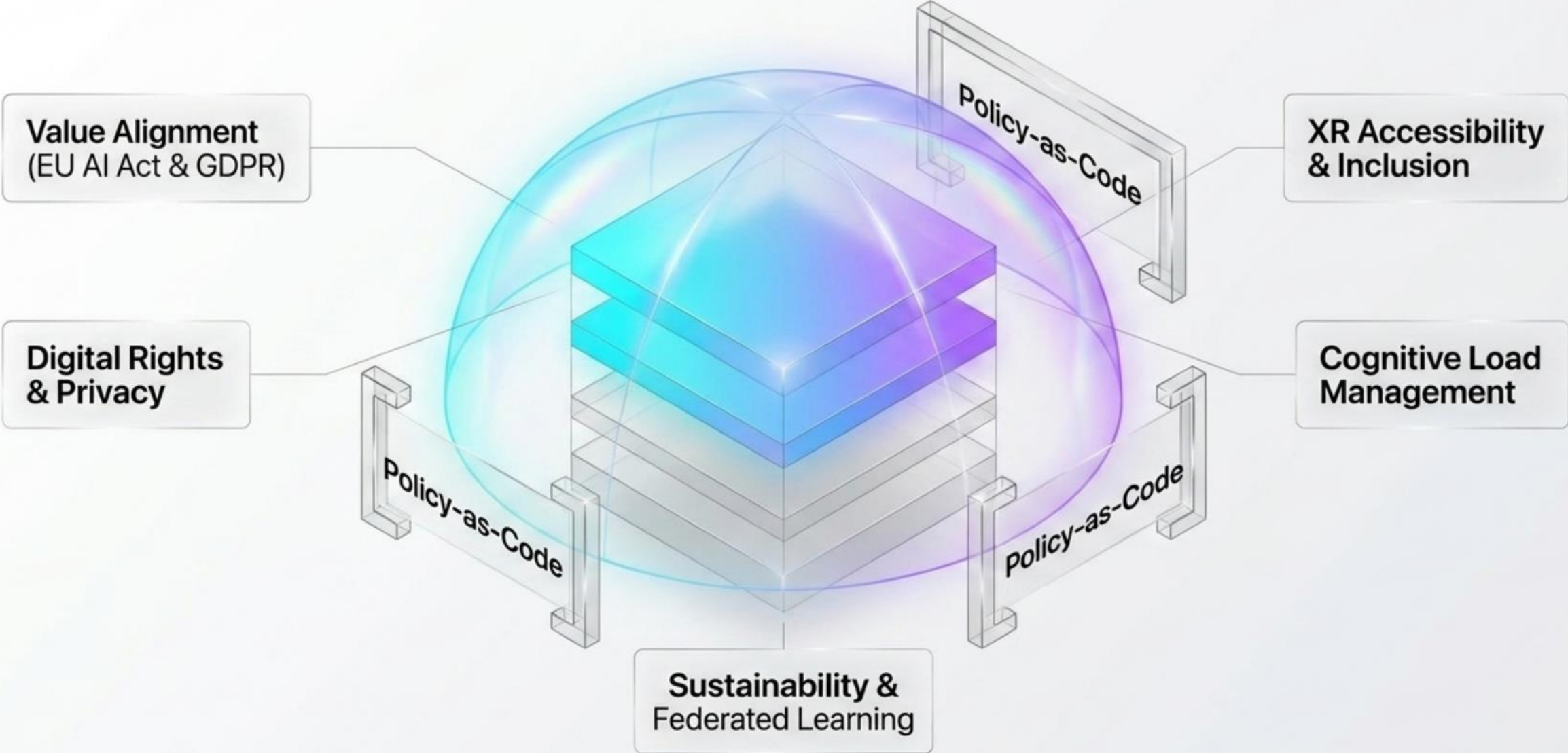
# Dimension 3: Middleware & Services



# Dimension 4: Application Domains



# Dimension 5: Governance, Ethics & Societal Integration



# The Stakeholder Matrix

## Consumers



- ✓ Focus: Quality, Privacy, Trust
- ✓ Demand **absolute transparency**
- ✓ Require **strict GDPR adherence**
- ✓ Expect **ethical, bias-free AI**

## Producers



- ✓ Focus: Interoperability, Scalability, Compliance
- ✓ Navigate **EU AI Act & regulations**
- ✓ Select **rendering engines & APIs**
- ✓ Implement **ethics-by-design**

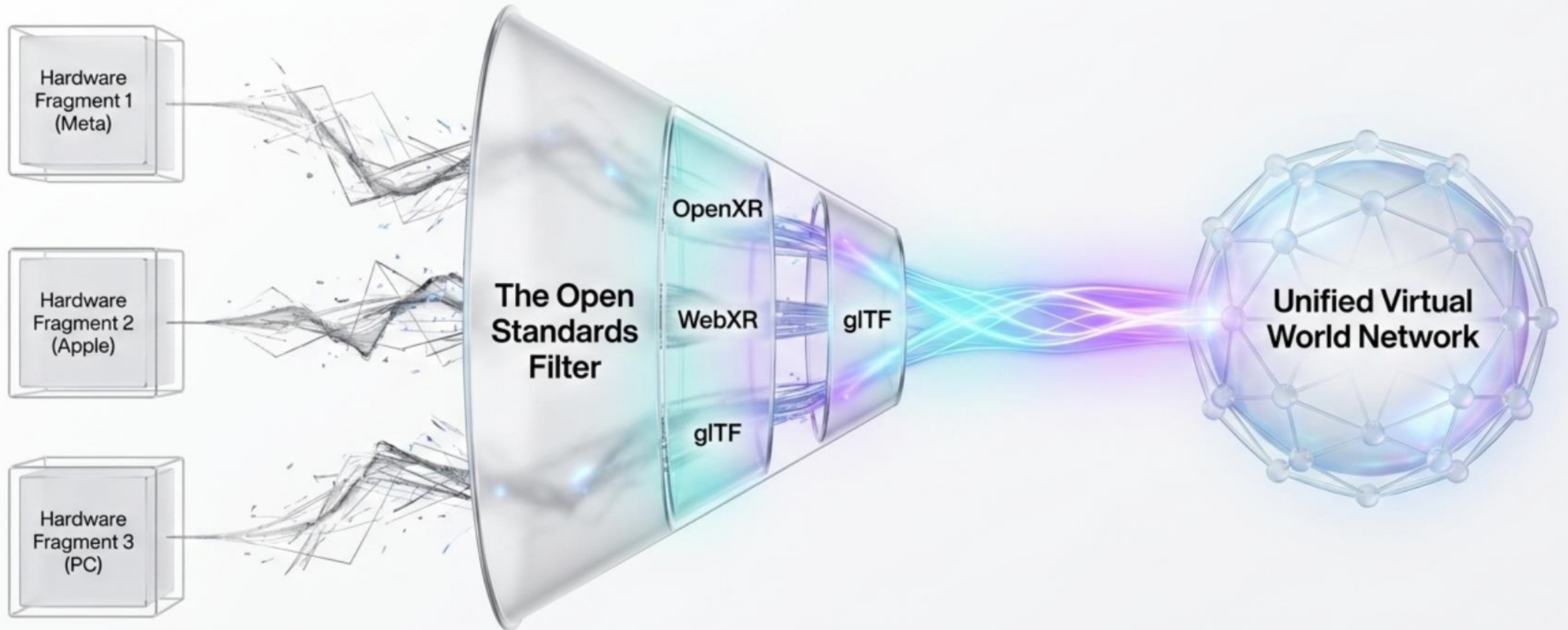
## Prosumers



- ✓ Focus: Openness, Co-creation, Digital Rights
- ✓ Demand **open standards**
- ✓ Require **NFT licensing tools**
- ✓ Participate in **decentralized governance**

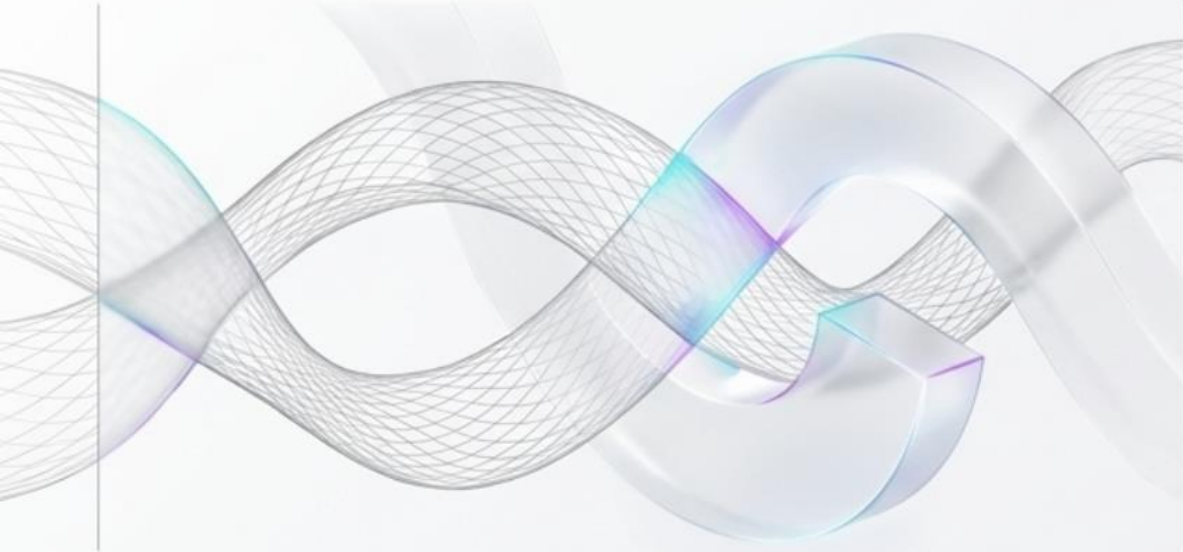
# The Interoperability Engine

Preventing siloed ecosystems via 'write once, run anywhere' open standards.



# Industrial vs. Consumer Realities

## Consumer Worlds

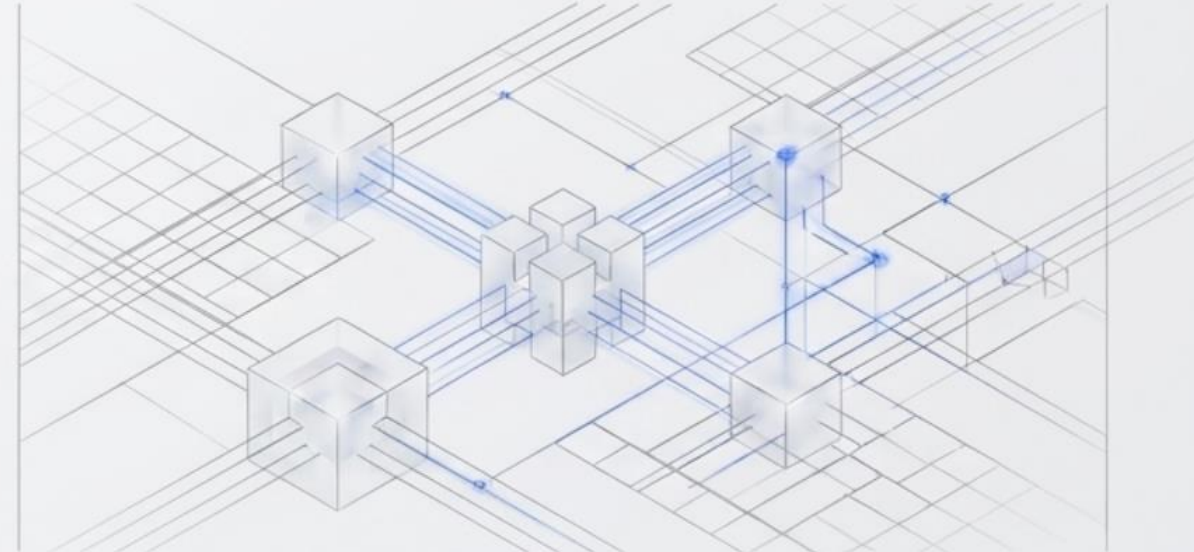


Simulated content generation

Entertainment and social focus

Moderation-heavy environments

## Industrial Digital Twins



Live IoT data synchronization

Predictive maintenance & real-time monitoring

Strict GDPR & physical security protocols

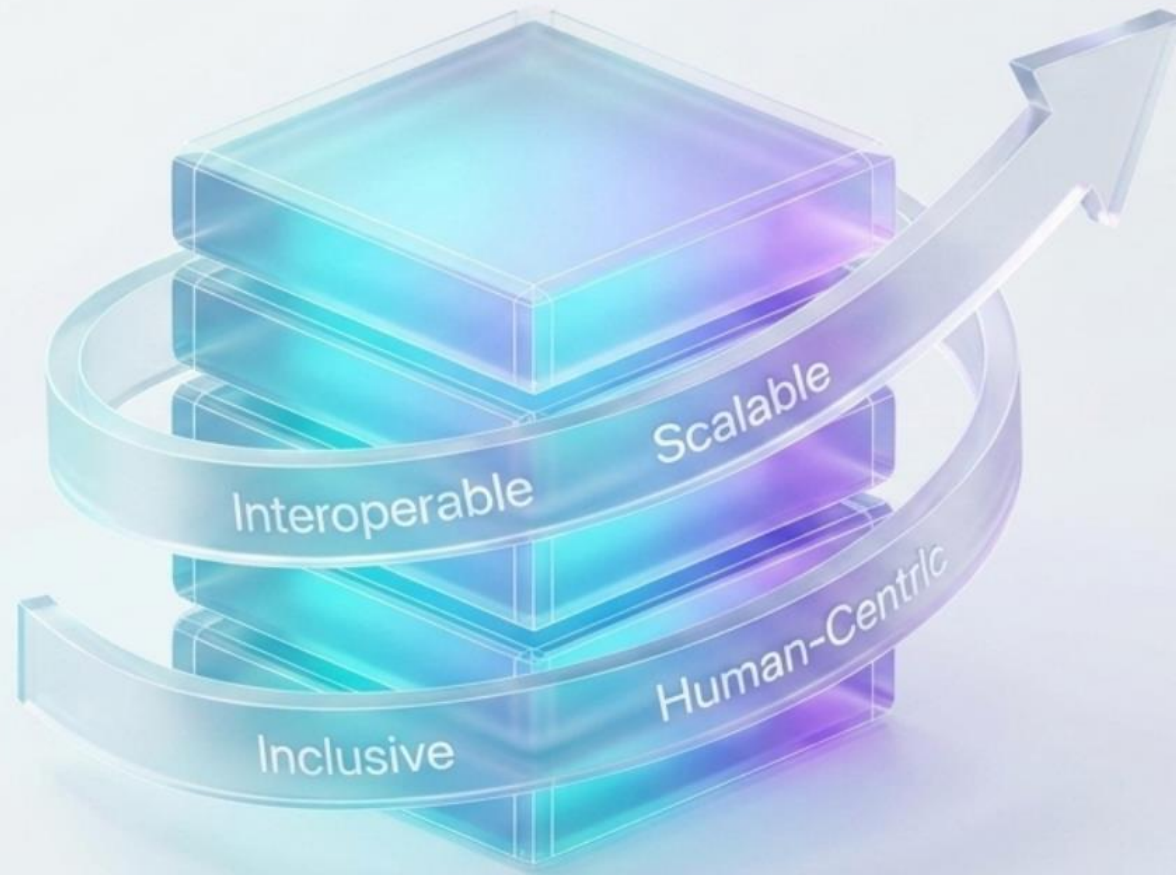
# Actionability: The VWTFT

Virtual Worlds Technological Framework Tool - A structuring instrument for SMEs to evaluate requirements and accelerate innovation.



# A Blueprint for Responsible Innovation

A robust, scalable, ethically grounded foundation positioning Europe at the forefront of the emerging Metaverse.



# Towards a Sustainable European Virtual Worlds Ecosystem

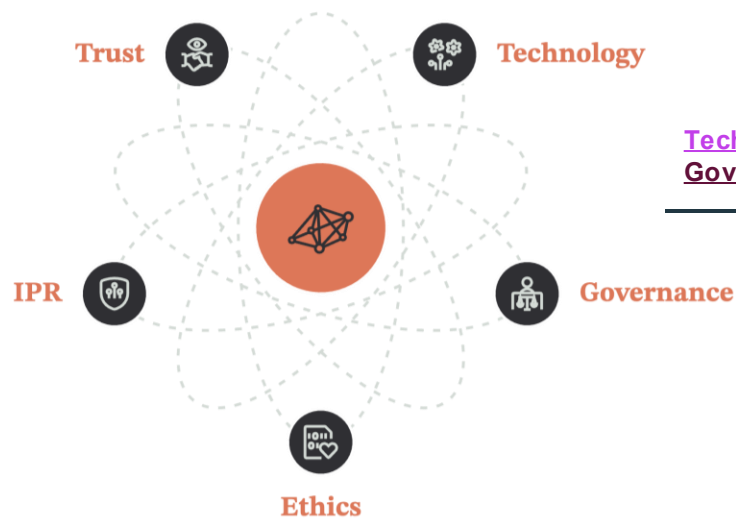


How can Europe build virtual worlds that are technologically advanced, economically sustainable, and governed by trust, transparency and human values?

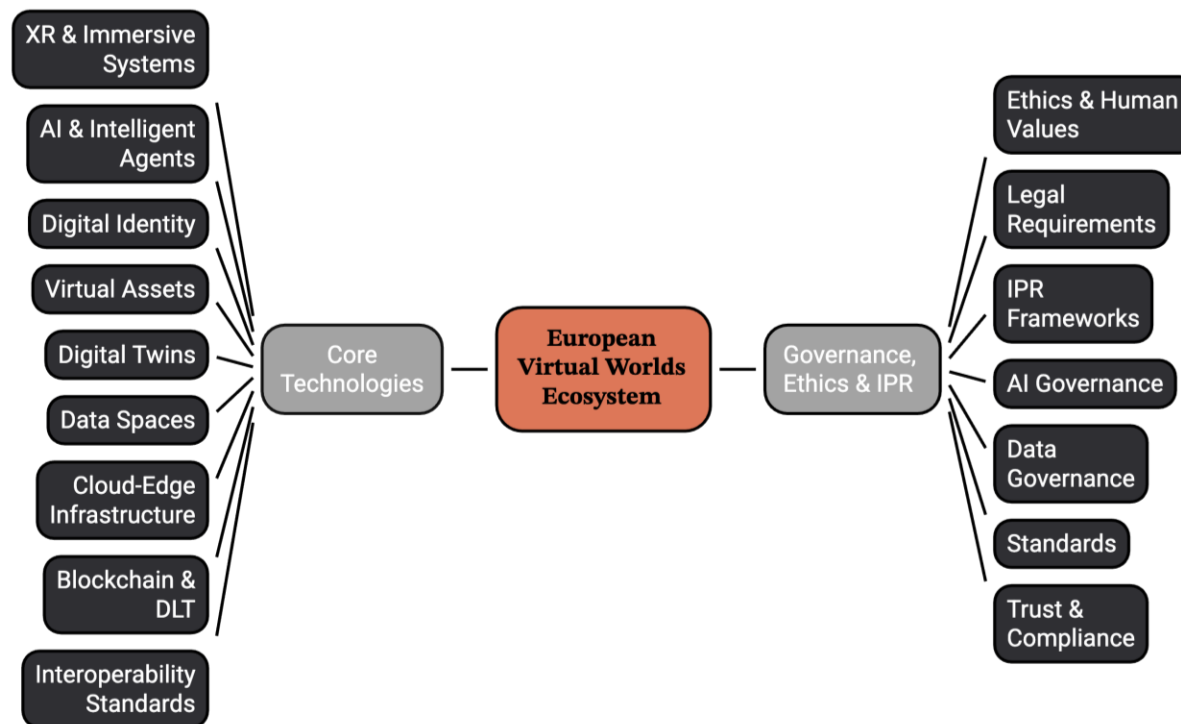
## European Virtual Worlds Ecosystem

Open • Interoperable • Human-Centric • Sustainable

### Building a Sustainable Virtual World



Technology enables innovation.  
Governance enables sustainability.



# The Building Blocks of a European Virtual Worlds Ecosystem

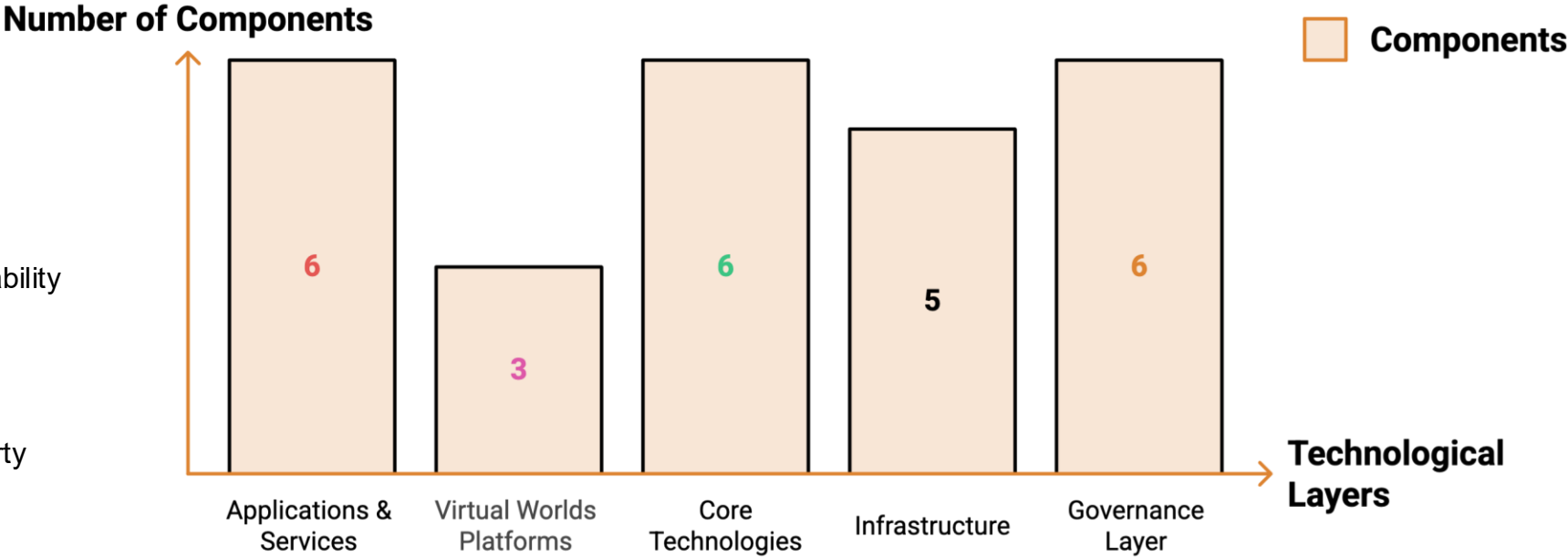


A multi-layer ecosystem integrating technology, governance, identity, economy, and trust

### Ecosystem Components

A sustainable European Virtual Worlds Ecosystem extends beyond immersive technologies and encompasses:

- Technological infrastructure and interoperability
- Digital identity and trust services
- AI-enabled intelligent agents and services
- Virtual assets and digital economies
- Data spaces and digital twins
- Governance, ethics, and intellectual property frameworks



Technological Stack Layers and Components

✓ *Virtual worlds should not be viewed as isolated platforms, but as interconnected socio-technical ecosystems where technology, governance, and economic value creation coexist.*

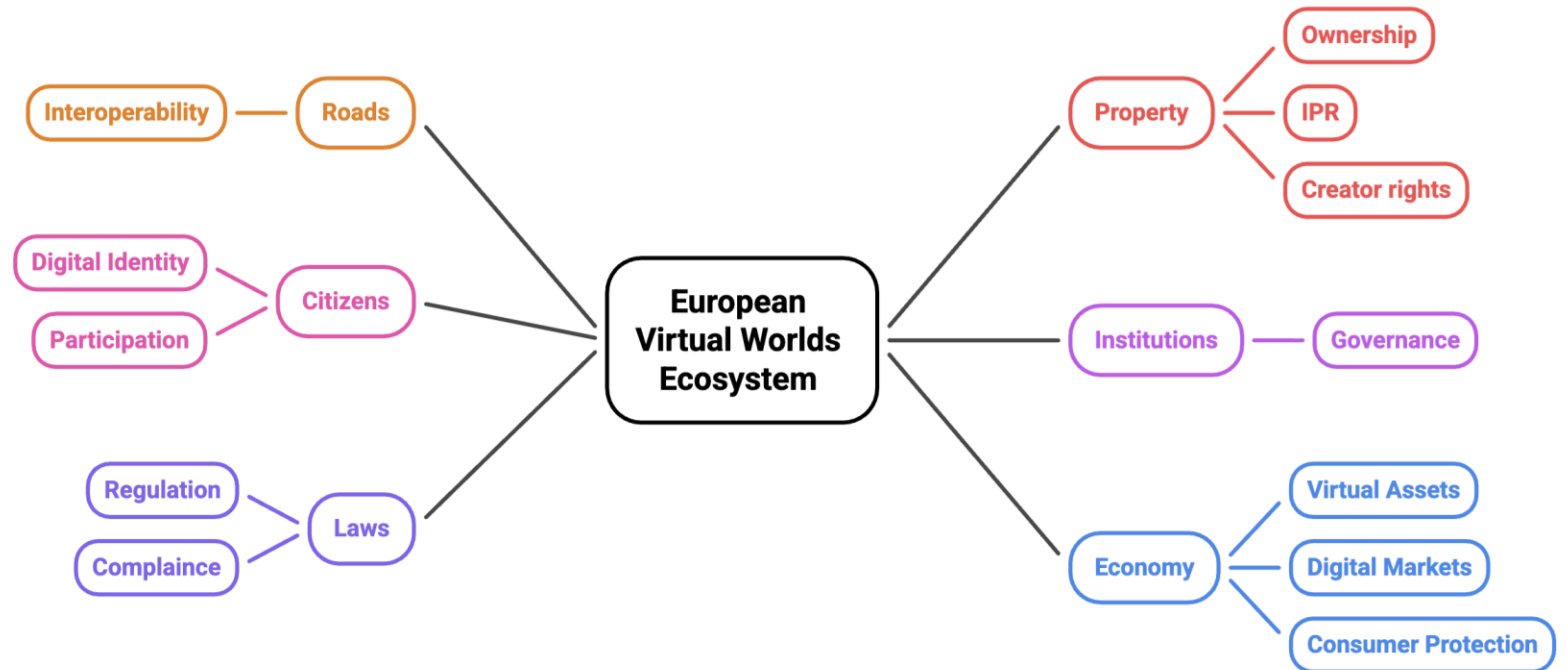
# Why Governance Matters in Virtual Worlds

*From Technology Platforms to Digital Societies*



- Virtual worlds increasingly combine social interaction, digital economies, AI-driven services, and immersive experiences.
- As these environments mature, governance becomes a foundational requirement, ensuring that innovation is balanced with accountability, trust, and protection of users and creators.

## Virtual Worlds as Digital Societies



Technology enables virtual worlds. Governance enables sustainable virtual worlds.

# Governance Challenges Across the Virtual Worlds Ecosystem

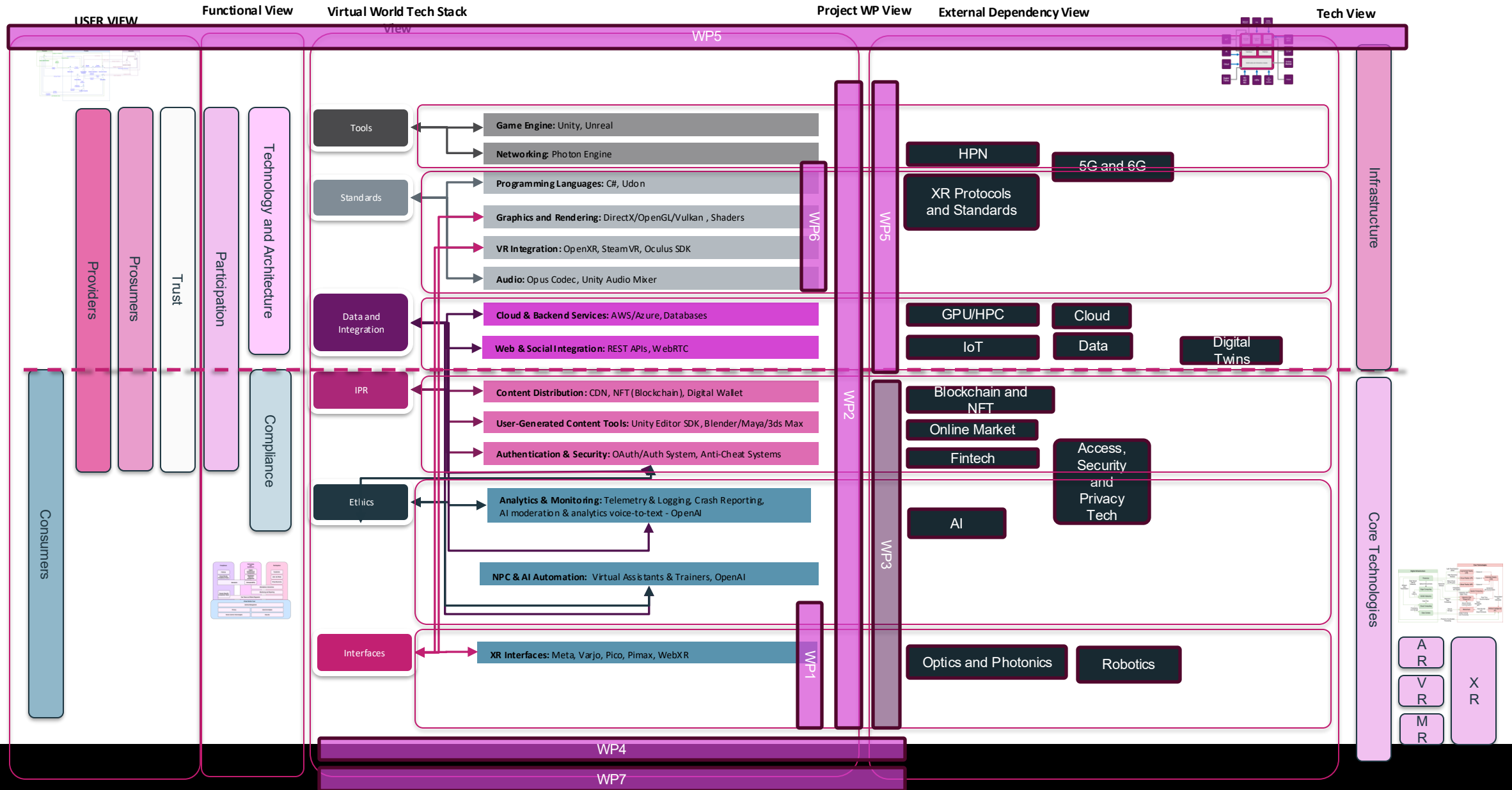
*Emerging challenges at the intersection of technology, society, and regulation*



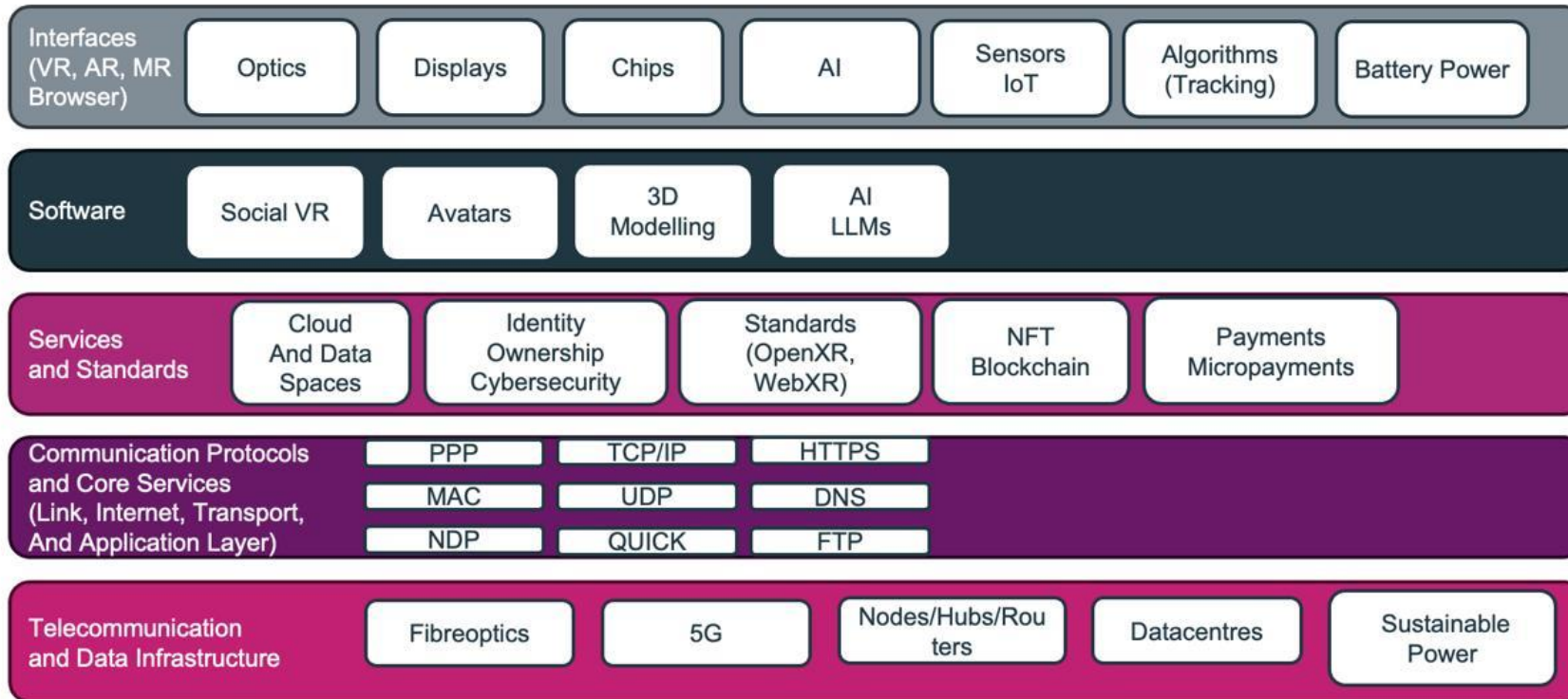
Ecosystem Component	Governance Challenge	Why It Matters
<b>AI Agents &amp; Virtual Assistants</b>	Accountability, Transparency & Explainability	Decisions and interactions must be understandable, auditable, and aligned with human values.
<b>Digital Identity</b>	Authentication, Trust & User Control	Users need secure, portable, and privacy-preserving identities across platforms.
<b>XR &amp; Immersive Technologies</b>	Biometric and Behavioural Privacy	XR systems collect highly sensitive behavioural, spatial, and physiological data.
<b>Virtual Assets &amp; User-Generated Content</b>	Ownership, IPR & Creator Rights	Clear ownership and protection mechanisms are required for digital goods and creative content.
<b>Digital Twins &amp; Data Spaces</b>	Data Sovereignty & Access Control	Industrial and personal data must remain secure, governed, and compliant.
<b>Virtual Economies &amp; Marketplaces</b>	Consumer Protection & Fair Competition	Users require safeguards against fraud, manipulation, and unfair market practices.
<b>Interoperable Virtual Worlds</b>	Cross-Platform Governance & Standards	Assets, identities, and services must function consistently across ecosystems.
<b>Platform Governance</b>	Moderation, Accountability & Dispute Resolution	Effective governance mechanisms are needed to manage behaviour, conflicts, and trust.

Many of the barriers to large-scale adoption of virtual worlds are no longer technological; they are increasingly related to governance, trust, ownership, accountability, and regulatory compliance.

# Technological Framework



## Virtual Worlds Technology Stack



# Technological Framework for Virtual Worlds & Web 4.0



## Core Technologies



- ✓ **Advanced AI** (Federated, Explainable, Ethical).
- ✓ **Extended Reality** (XR, AR, VR, MR).
- ✓ **IoT & Digital Twins** (Real Worlds synchronization)
- ✓ **Blockchain & DLT** (identity- transactions, asset provenance).
- ✓ **Ambient Intelligence** (Context-aware, adaptive environments)

## Infrastructure



- ✓ **Cloud/Edge Computing** (Real-time rendering, latency).
- ✓ **5G/6G** (immersive experience, Ubiquitous access).
- ✓ **Quantum Computing** (Dynamic environments, responsive interactions, immersive experiences).
- ✓ **Semantic Web Integration** (Context-aware experience, data integration).

## Application



- ✓ **Education & Training** (XR classrooms, Simulations labs).
- ✓ **Rendering & Interaction Engines** (ETSU, ARF integration).
- ✓ **Games, Social, Esports, Theater, Shopping**
- ✓ **Interoperability APIs & Protocols** (Open Standards, WebXR, OpenXR).
- ✓ **Security & Privacy** (GDPR, AI Act).

## Governance, Ethics, & Societal Integration



- ✓ **EU value Alignment** (Inclusion, Environment Safety, Gender Equality, Abuse).
- ✓ **Multistakeholder Governance Model.**
- ✓ **Sustainability Principles** (Green Data Centers, Next-gen VR devices, VR for Environmental Awareness and Conservation)
- ✓ **Audience Co-Design**(Using audience panels for policy shaping).

"This is perhaps the most important message of the framework. Governance is not treated as an external policy layer. Governance, ethics, and sustainability become architectural components of the ecosystem itself."

## Technological Framework for Web 4.0 & Virtual Worlds



### Core Technologies

- ✓ Foundational technologies like AI, blockchain, and quantum computing enable advanced virtual experiences.



### Infrastructure

- ✓ Elements such as 5G, edge computing, and cloud services ensure seamless connectivity.



### Middleware Services

- ✓ Facilitates communication and provides essential functionalities like security and data interoperability.



### Governance & Ethics

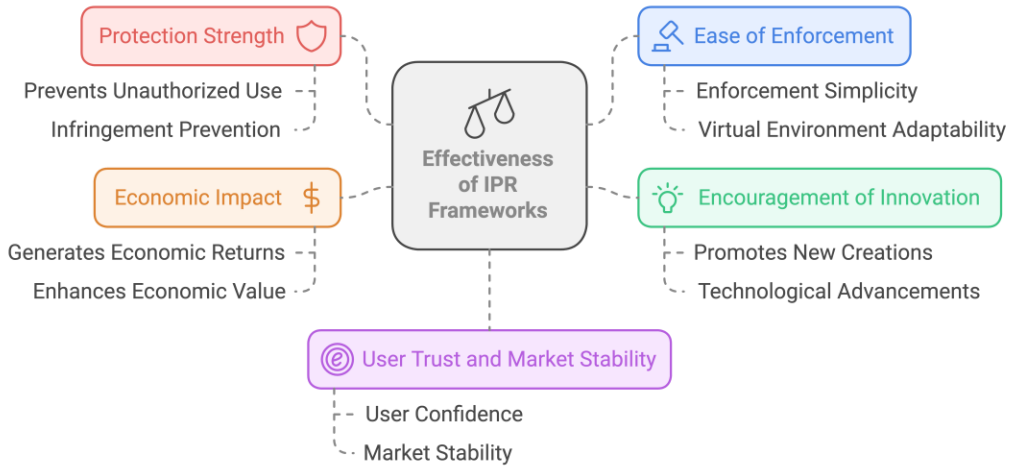
- ✓ Addresses data privacy, digital rights, and ethical considerations in technology use.



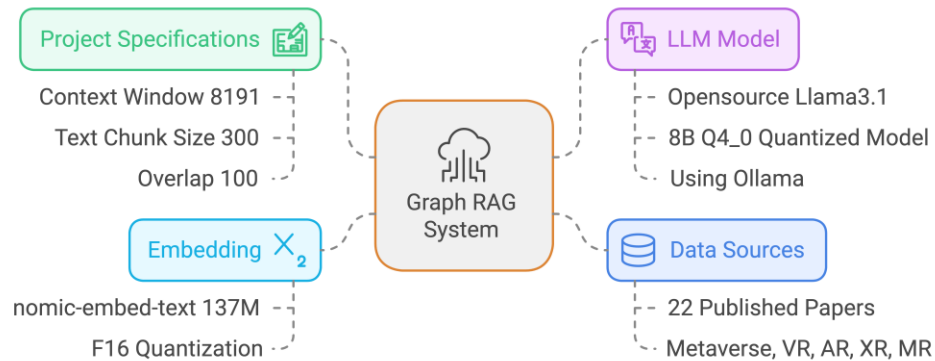
### Application Domain

- ✓ Practical implementations in sectors like entertainment, industrial simulations, and education.

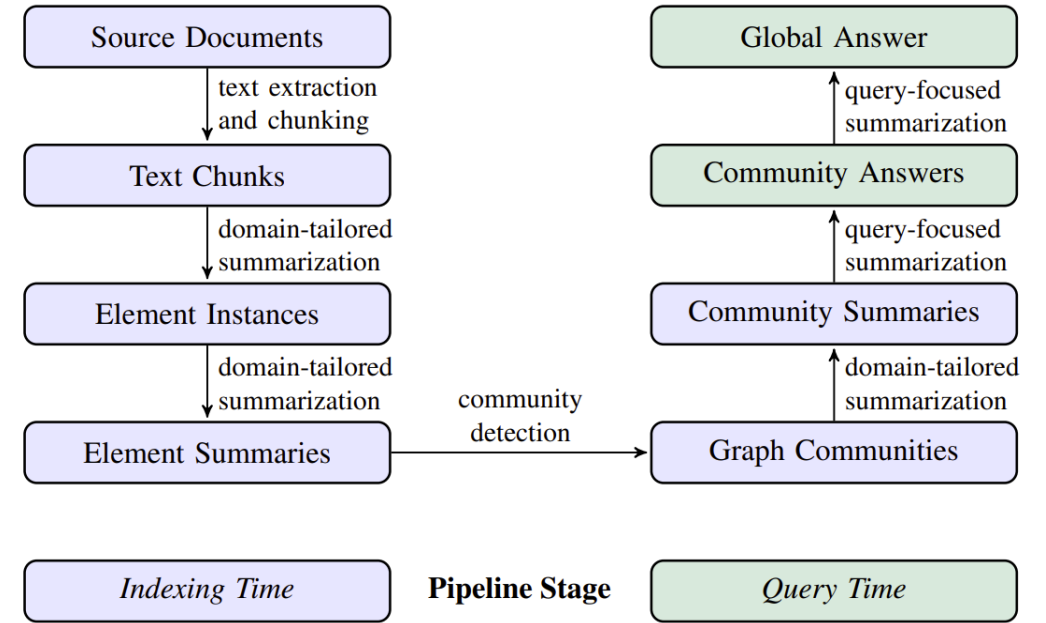
# Graph-RAG for Governance & IPR Intelligence



Different IPR frameworks are based on five key criteria: Protection Strength, Ease of Enforcement, Encouragement of Innovation, Economic Impact, and User Trust & Market Stability, highlighting how each framework performs in fostering secure, innovative, and economically viable virtual environments



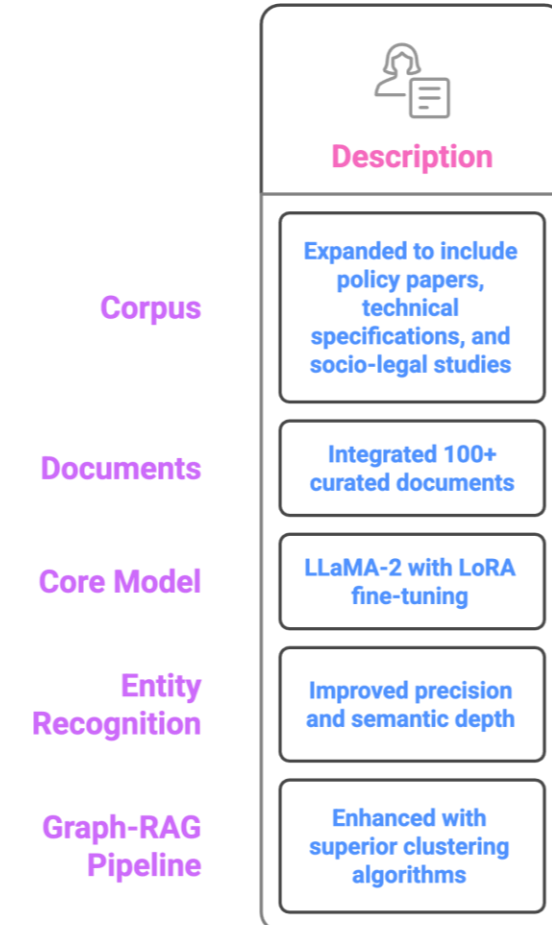
## Proposed Framework



Graph RAG pipeline using an LLM-derived graph index of the source document text.

## Model Upgrades Comparison

- **Expanded Corpus:** The source corpus has been expanded to encompass a wider range of materials, including current policy papers, technical specifications, and socio-legal studies related to immersive technologies.
- Integrated over 100 curated documents, including policy papers, technical standards (e.g., IEEE/ISO), and socio-legal analyses of immersive tech, enabling robust domain coverage.
- **LLaMA-2 with LoRA Fine-Tuning:** Utilised LLaMA-2 as the core model, fine-tuned via Low-Rank Adaptation (LoRA) for efficient, domain-specific ethical reasoning.
- **Enhanced Entity Recognition and Relationship Mapping:** The precision and semantic depth of entity recognition have been improved, enabling the capture of subtle ethical considerations such as algorithmic transparency, cultural inclusivity, and user autonomy.
- **Advanced Graph-RAG Pipeline:** The enhanced pipeline incorporates superior clustering algorithms for community summarisation and dynamic weighting of ethical dimensions, resulting in more contextually relevant responses.



# Example Queries and their responses (Results)



## Local RAG for Ethics/IPR Papers

Ask a question about your paper collection. Answers include citations like [S1].

Question

Ethical challenges in virtual worlds

### Answer

#### Concise Answer

The Metaverse poses several ethical challenges, including bias and discrimination in AI algorithms, privacy concerns, and transparency issues. Studies have demonstrated that biased AI systems can perpetuate inequality and discrimination within virtual environments (Buolamwini and Gebru [12], Ferrer et al. [35], Varona & Suárez [89]). The integration of AI technologies within the Metaverse introduces complex ethical challenges, including content moderation, user safety, and data protection (Alesia Zhuk [S1], Alesia Zhuk [S4]). Regulatory bodies must conduct a comprehensive analysis of current legal frameworks to identify areas where regulations may fall short in addressing these concerns (Maloney [56]). To address these challenges, a human-AI hybrid approach is necessary to strike a balance between creative freedom and user safety (Alesia Zhuk [S1], Alesia Zhuk [S4]).

### Sources

S1 — Ethical implications of AI in the Metaverse (pp. 1–2)

DOI: 10.1007/943681-024-00450-5

<https://consensus.app/papers/ethical-implications-of-ai-in-the-metaverse-zhuk/26f42047db735632b31e22b7e0dca6c7/>

ght of these concerns, this paper aims to contribute to the ongoing discourse surrounding the ethical implications of AI in the Metaverse. As the Metaverse continues to evolve, the integration of AI technologies demands a balanced approach that considers the potential benefits alongside the ethical risks. By taking proactive steps to address bias, discrimination, privacy concerns, and transparency issues, it is possible to cultivate an ethically sound and sustainable virtual world. The d...

## Local RAG for Ethics/IPR Papers

Ask a question about your paper collection. Answers include citations like [S1].

Question

What governance mechanisms are recommended for derivative works in virtual worlds?

### Answer

#### Concise Answer

Based on the provided sources, governance mechanisms recommended for derivative works in virtual worlds include:

- Modular governance approaches that enable portability and adaptability to different platforms and use cases ([S2])
- Decentralized autonomous organizations (DAOs) that allow users to be actively involved in decision-making processes ([S2])
- Personal data stores that enable users to own and sell their personal data via smart contracts and intuitive user-friendly interfaces ([S1])
- Data trusts in the form of DAOs that harness the collective power of Metaverse users to protect their interests and promote the public good ([S1])

#### Evidence Map

Key Points	Supporting Sources
Modular governance approaches are recommended for virtual worlds.	[S2]
Decentralized autonomous organizations (DAOs) can be used for decision-making in virtual worlds.	[S2]

### Sources

S1 — The Metaverse: Virtual Metaphysics, Virtual Governance, and Virtual Abundance (pp. 3–4)

DOI: 10.1007/943681-023-00666-2

<https://consensus.app/papers/the-metaverse-virtual-metaphysics-virtual-governance-and-turner/629023ee698f5683ba9b02e30d3f2811/>

premise, making good governance by standards unlikely" (McStay, 2022, p. 15). McStay ends his article by considering specific governance proposals for the Metaverse that align with data stewardship and the dictates of virtual realist governance. His primary focus is on interoperability in the Metaverse, which involves the ability to seamlessly transfer one's personal data, virtual avatar, and other virtual possessions across different virtual worlds and applications. McStay proposes personal...

S2 — Life, the Metaverse and Everything: An Overview of Privacy, Ethics, and Governance in Metaverse (pp. 3–4)

DOI: 10.1109/icdsw56584.2022.00058

<https://consensus.app/papers/life-the-metaverse-and-everything-an-overview-of-privacy-ethics-and-governance-in-the-metaverse-c.444545f943b253f80a642342908464d/>

the metaverse. C. Modular governance Governance in online platforms is a high-stakes challenge that yet has few basic features of offline (physical) governance legacies [17]. The authors [17] propose a modular



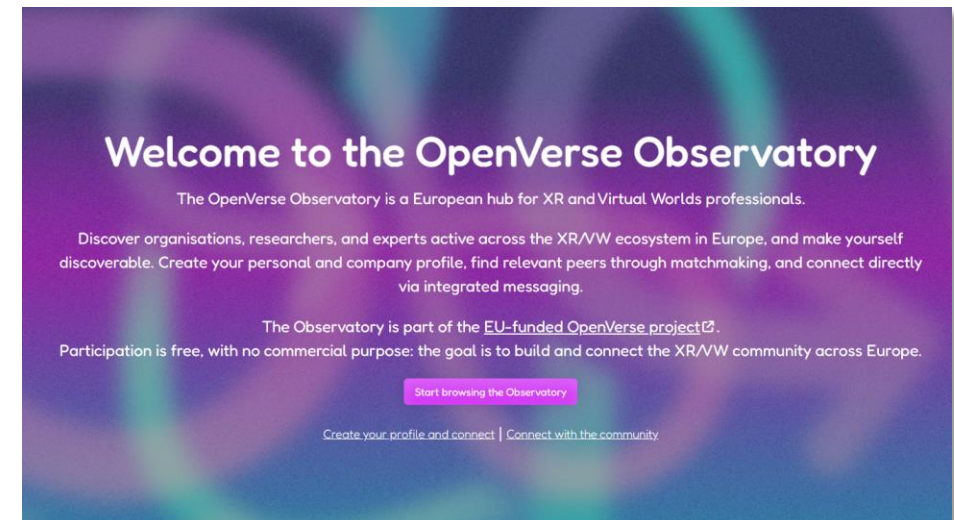
# OpenVerse Observatory Collection of XR Regulatory Sandbox Use Cases

*John Favaro – Trust-IT*

# Support for Regulatory Sandbox Initiatives



- OpenVerse Partner Lisbon Council is elaborating an approach to regulatory sandboxes for virtual worlds innovation
  - Includes a structured methodological process
- The OpenVerse Observatory is supporting the initiative
  - The collection of international sandbox case studies underpinning the Lisbon Council research has been implemented in searchable form in the Observatory
- **Live Demo**





# A Roadmap for Open and Co-created Virtual Worlds

# A Roadmap for Open and Co-created Virtual Worlds



Building upon the July 2023 initial EU strategy message on virtual worlds and the Web 4.0 and in collaboration with all OPENVERSE partners, Inspiring Futures undertook a foresight exercise, leading to the co-development of a [Roadmap for Open and Co-created Virtual Worlds, including Five Pillars and Ten Key Strategic Actions](#). The Roadmap is still open for contributions through an [Expert & Stakeholders Survey](#) and a dedicated Workshop that will be held on July 2, 2026.

## The five pillars

- Trust and Safety by Design
- Interoperability and Data-Readiness
- Skills, Financing Tools and SME Scale-up
- Science–Industry Testbeds and Sector Adoption
- Foresight-in-the-Loop

## Immediate & Urgent Priorities (2026–2028)

- Promote guiding ethical and health principles for well-being in virtual worlds
- Promote inspiring partnerships across sectors and borders
- Promote AI integration and the corresponding skill building for VW creativity
- Support, refurbish and inaugurate new forms of financing for VW creators

## Medium-Term Deployments (2026–2032)

- Build skills for virtual worlds; make the EU a talent magnet
- Help the Cultural & Creative Industries (CCI) and media test new business models
- Develop standards for open/interoperable virtual worlds, with sandbox options
- Boost professional virtual worlds across sectors of excellence

## Long-Term Scale-Out (2026–2035)

- Address sovereignty: promote champions; fight IPR theft, manipulation and misinformation
- Reduce the environmental footprint of XR/VW deployments

# Q&A



# Thanks for your attention



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