

# HXRRC

## HELSINKI XR CENTER

Näkökulmia virtuaalitekniologioiden  
hyödyntämiseen nyt ja tulevaisuudessa

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# Who Am I?

- › Santeri Saarinen
- › R&D Lead @ **Helsinki XR Center**
- › Technology Expert @ **Metropolia UAS**
- › Expert Reviewer for Horizon Europe
- › MPhil (Interactive Technology)
- › 13 years of experience researching Metaverse technologies
  
- › Member of:
- › Board of Directors of **XR4Europe**
- › Advisory Board of **Finnish National Metaverse Strategy Group**
- › Academic Advisor Board of **FIVR**
- › **Future Media Hubs Network**
- › **Metaverse Standards Forum**
- › **Metaverse Competence Cluster**



# What is Extended Reality (XR)?

## Virtual Continuum

Mixed Reality (MR)



Reality



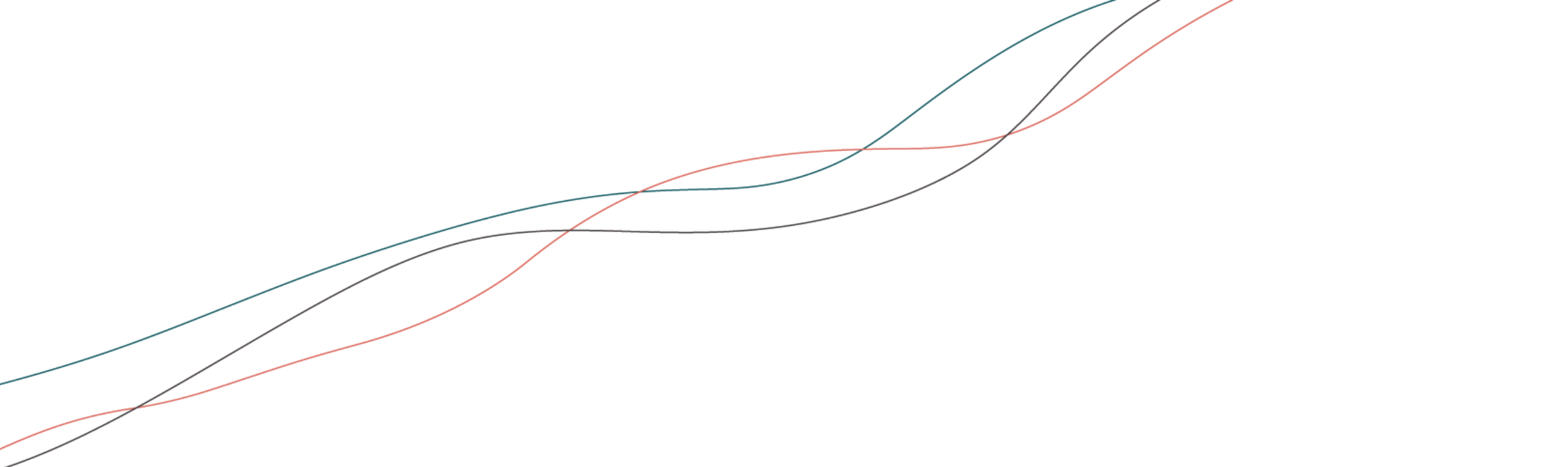
Augmented Reality (AR)



Augmented Virtuality (AV)



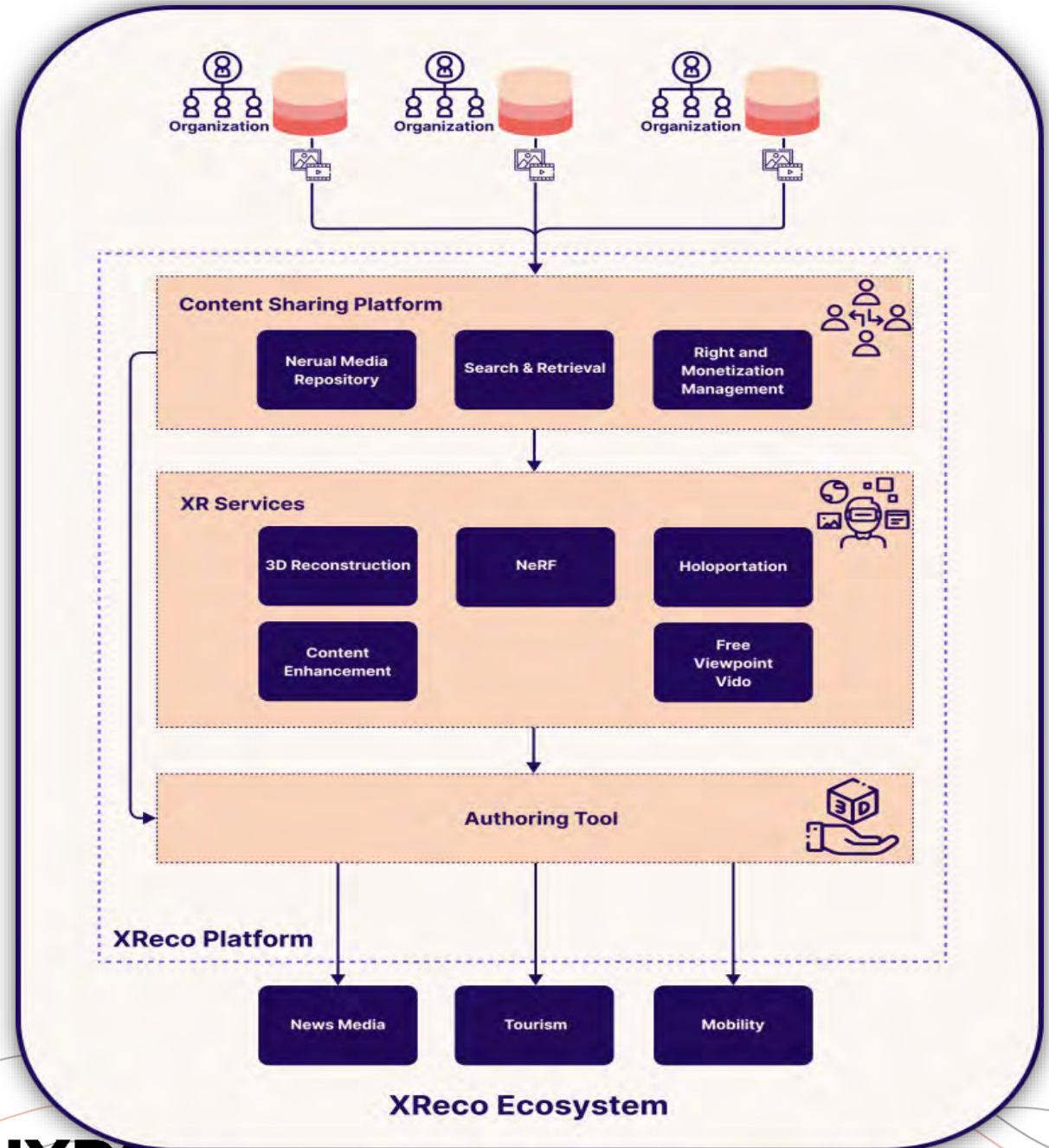
Virtual Reality (VR)



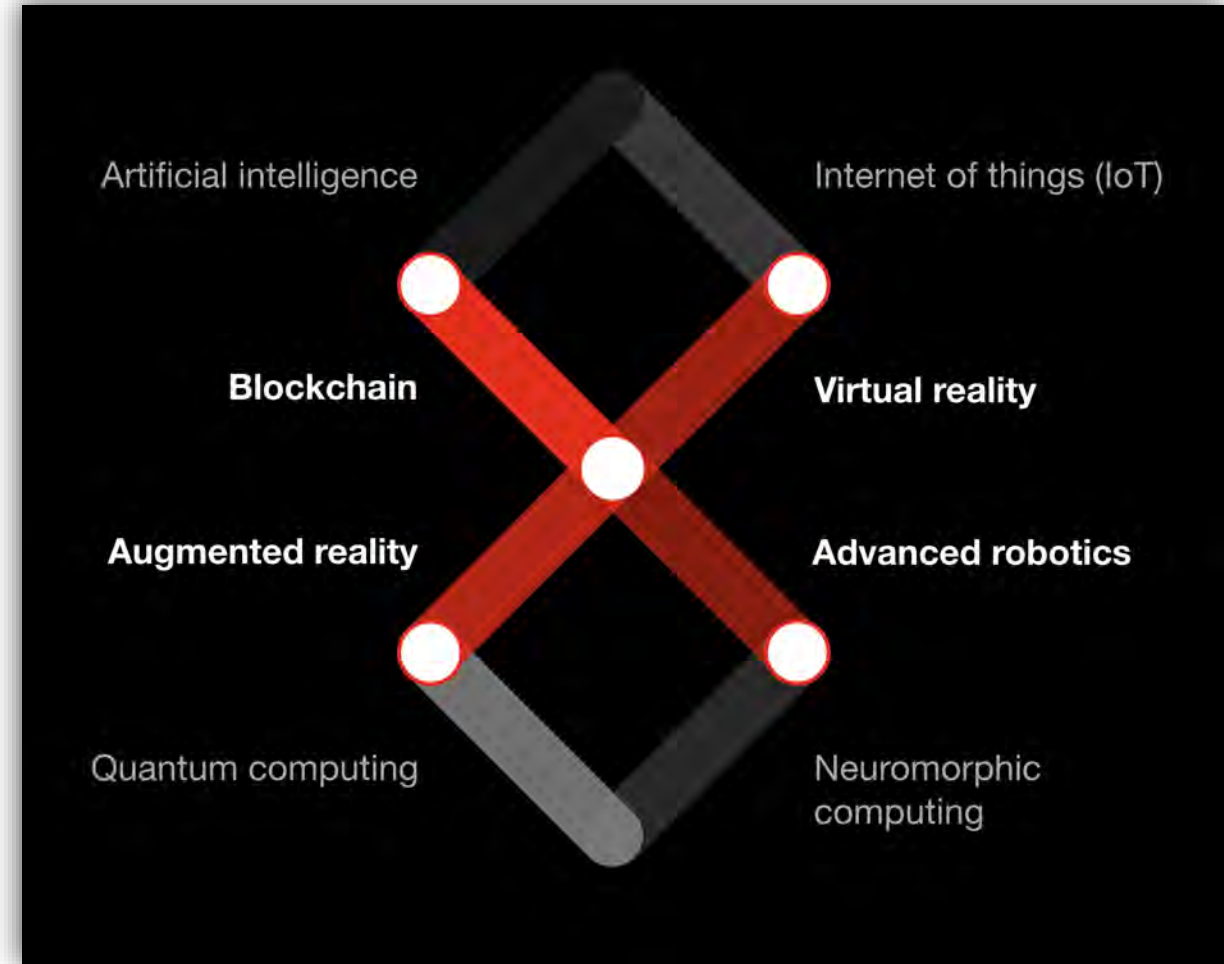
# What are we talking about?

Is it enough to talk about XR?

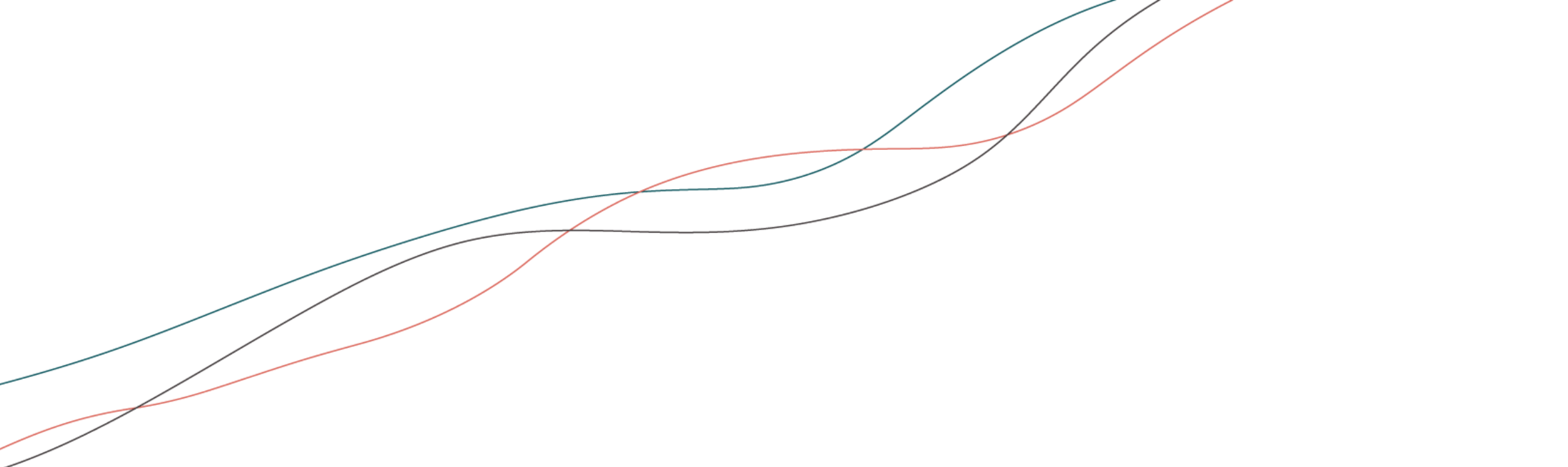
- › XR is just a medium for displaying information
- › We should include more essential technologies



- › XR is just a medium for displaying information
- › We should include more essential technologies
- › Can we do that without being too generic?
- › Is Metaverse the answer?



Essential Eight Emerging technologies for businesses.  
*PWC, 2023*



Why now?



METaverse  
DRIVERS



**Virtual and  
Augmented Reality,  
Cloud-based services  
became popular**

**METAVERSE  
DRIVERS**

**Advances in  
Network  
Infrastructure, IoT  
devices and Artificial  
Intelligence**

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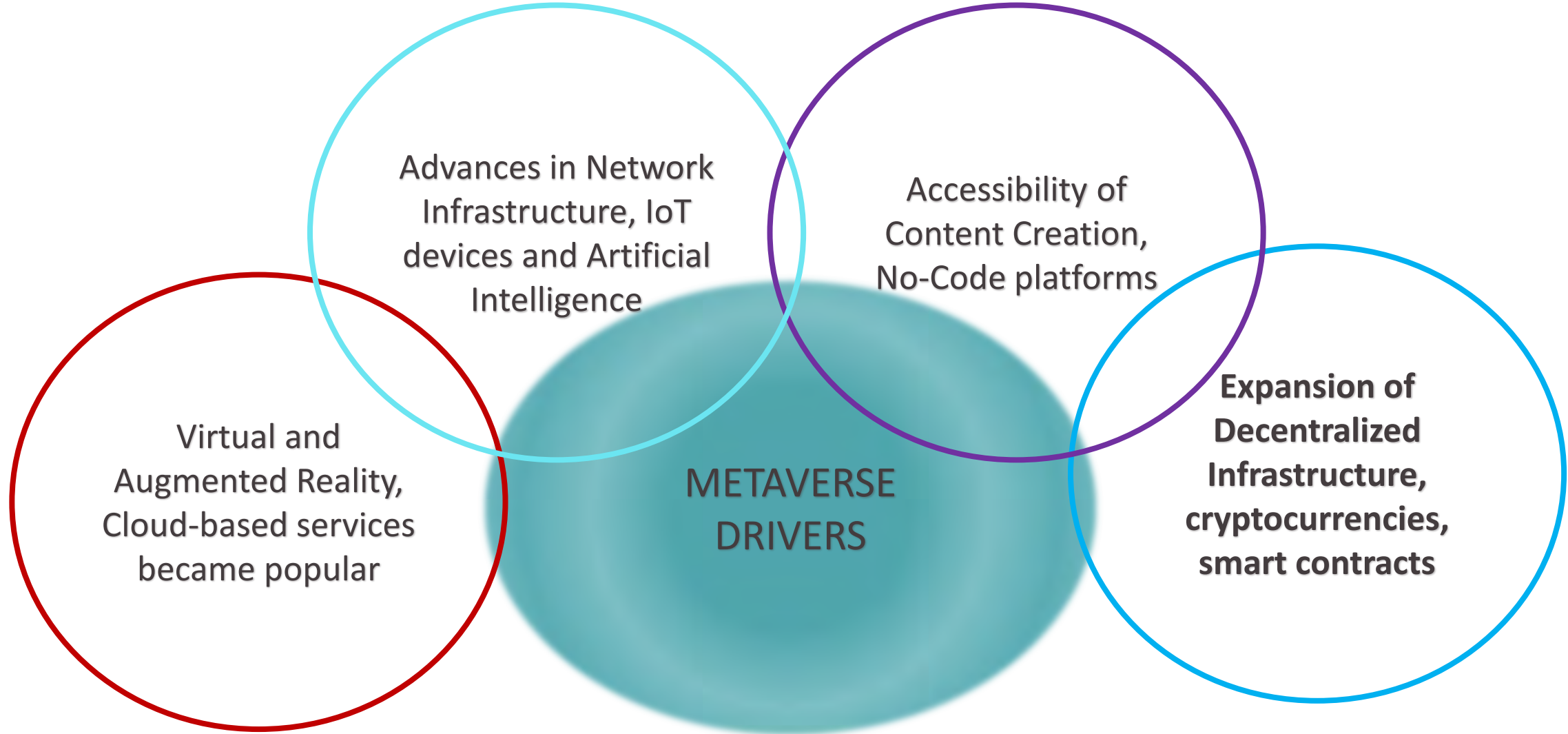
**METAVERSE  
DRIVERS**

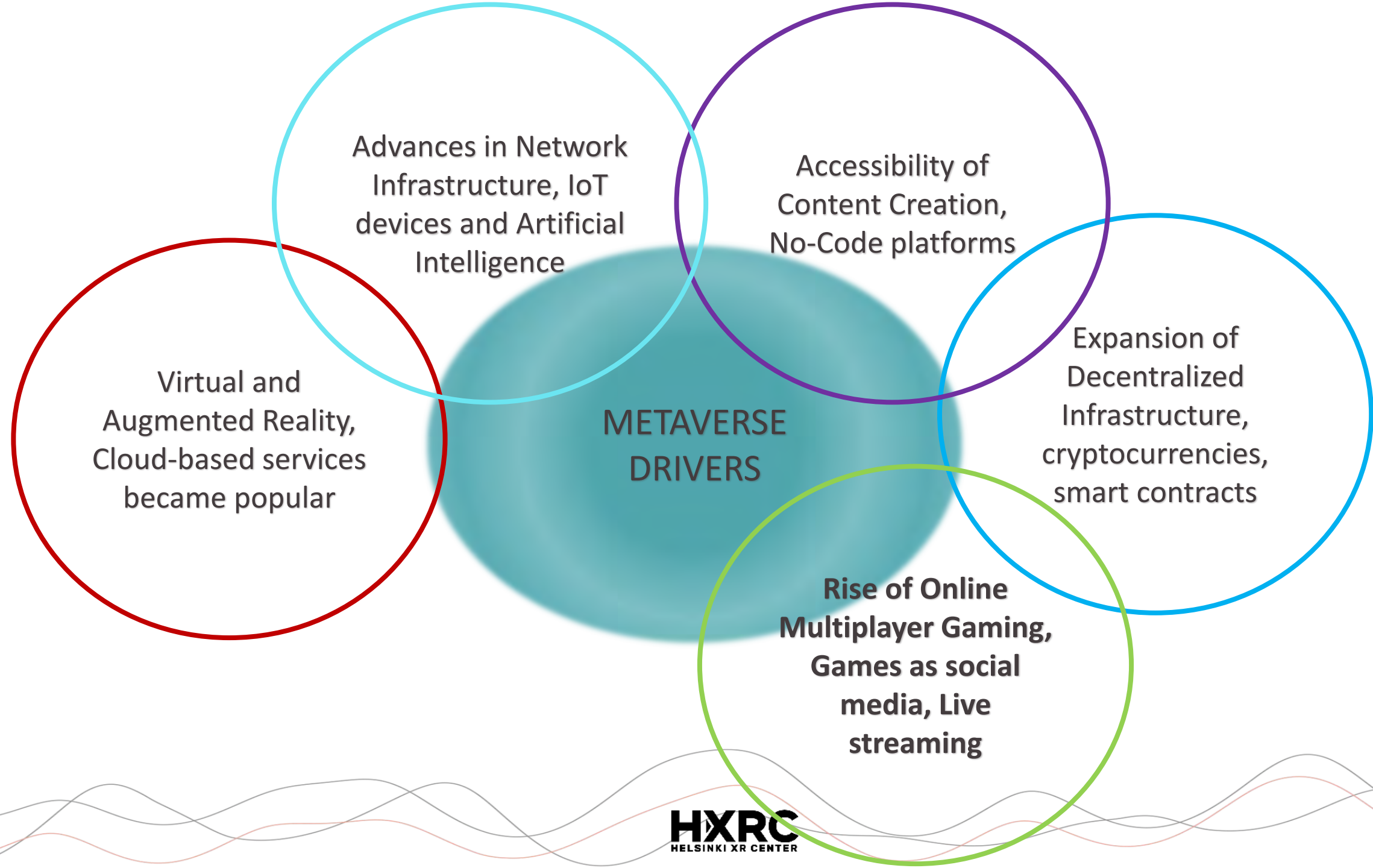
Advances in Network  
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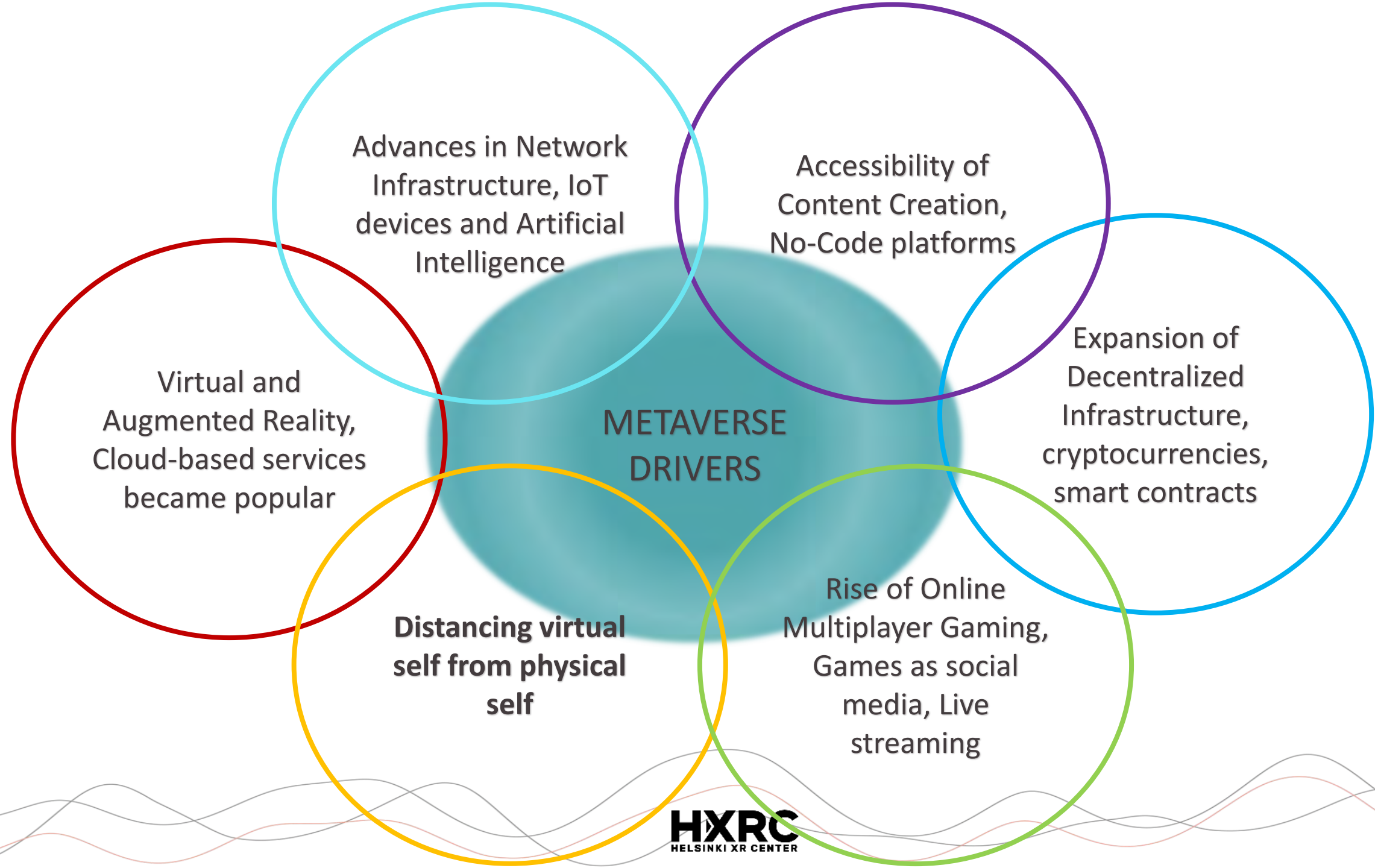
**Accessibility of  
Content Creation,  
No-Code platforms**

Virtual and  
Augmented Reality,  
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**METAVERSE  
DRIVERS**









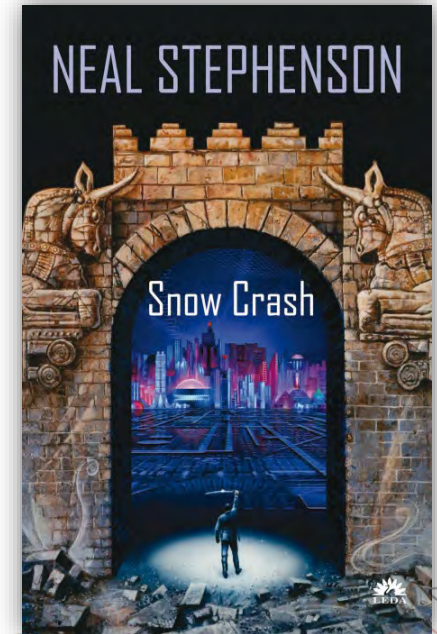
# What is Metaverse?



Metaverse is the convergence of physical, augmented and virtual reality in a shared online space.

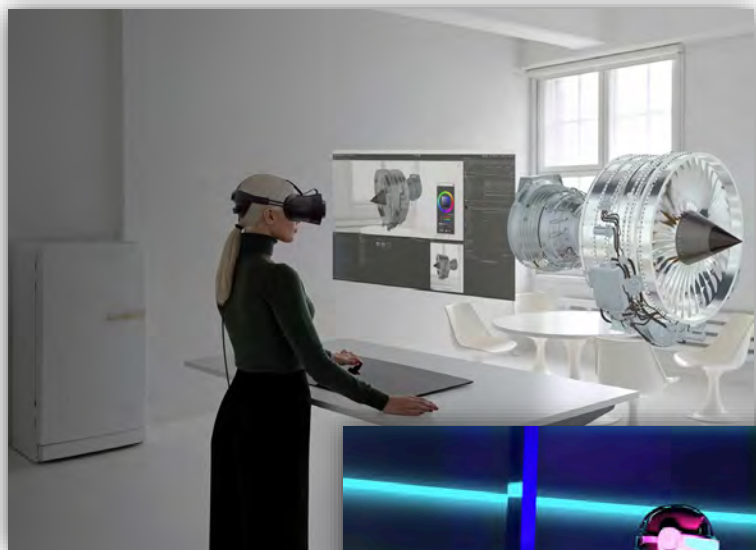


Neal Stephenson, *Snow Crash*, 1992





# Definition?



- › **Metaverse** is a set of virtual spaces where you can create and explore with other people who aren't in the same physical space as you. Meta
- › **Metaverse** is the convergence of virtually enhanced physical reality and physically persistent virtual space. It is a fusion of both, while allowing users to experience it as either. Metaverse Roadmap Summit '06
- › **Metaverse** is a collection of interconnected virtual collaboration spaces that people can use regardless of physical location to access and interact with environments, digital twins, digital models and information visualized in the space. VTT Technical Research Centre of Finland
- › **Metaverse** is the free and interconnected experience of things across physical and digital spaces. Ben Grossman
- › **Metaverse** is an integrated network of 3D virtual worlds which constitute a compelling alternative realm for human sociocultural interaction. J.D.N. Dionisio et al.

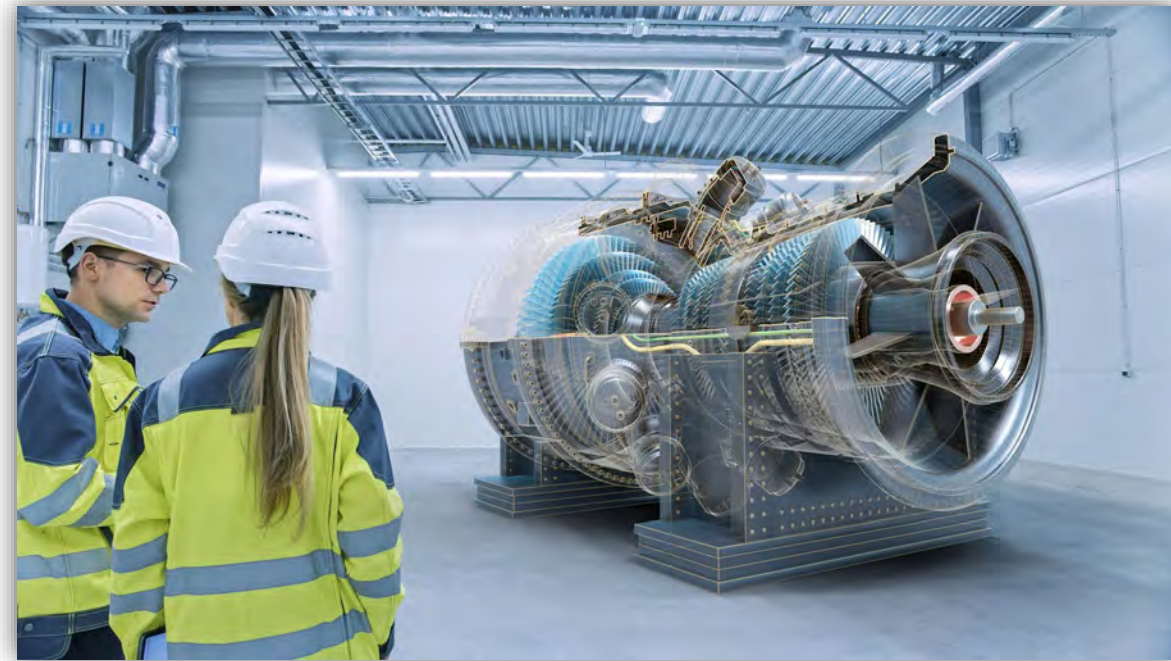
# Definition?



- › **Metaverse** is a massively scaled and interoperable network of real-time rendered 3D virtual worlds that can be experienced synchronously and persistently by an effectively unlimited number of users with an individual sense of presence, and with continuity of data, such as identity, history, entitlement, objects, communications, and payments. Matthew Ball
- › **Metaverse** is a network of interconnected virtual worlds with the following key characteristics: Presence, Persistence, Immersion and Interoperability. It is the next iteration of the internet enabled several converging technologies. XR Safety Initiative
- › **Metaverse** is a hypothetical iteration of the Internet as a single, universal, and immersive virtual world that is facilitated by the use of virtual reality (VR) and augmented reality (AR) headsets. Wikipedia
- › **Metaverse** will be an embodied internet operated by different players in a decentralized way. Mark Zuckerberg

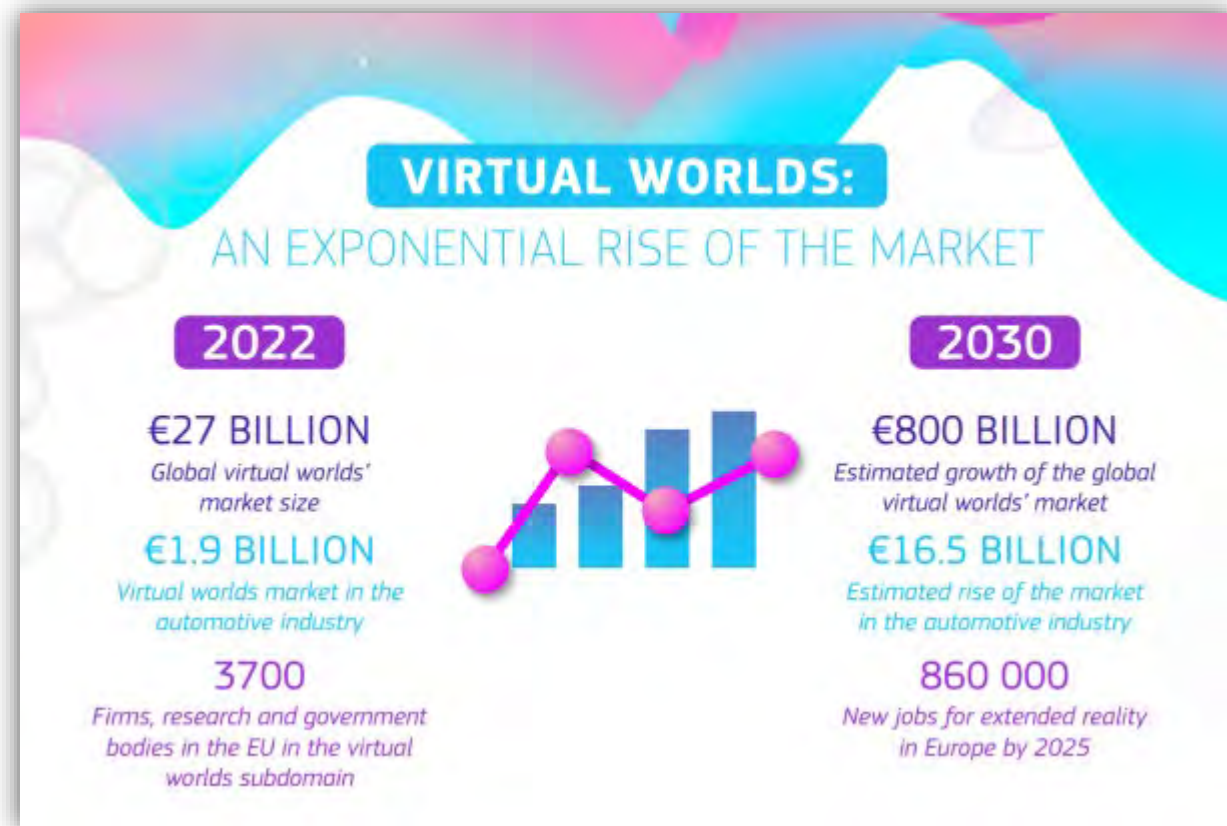
# Definition

- › The ideal Metaverse is an **open, interoperable network of ecosystems of spatial immersive environments** which connect **people, devices and data**



# Same things, different terms

- › EU Initiative on Virtual Worlds and Web 4.0
- › Virtual Worlds
  - › Persistent, 3D, real-time, immersive environments, blurring the line between real and virtual, for socializing, working, learning, making transactions, playing and creating.
- › Web 4.0
  - › Seamless blending of real and virtual worlds, enabled by natural user interfaces, real-time sensor data, generalized AI, ubiquitous computing and distributed control.
- › Apple and Spatial Computing
  - › Eliminate boundaries between the physical and digital realms, allowing for more natural and immersive interactions with digital technology.



# Problems with terminology

- › Hype cycle needs to have new terms every few years.
- › We go from VR -> NFT -> Metaverse -> AI -> Spatial Computing -> ???
- › Continuous rebranding makes it really difficult for the consumer
- › Still, a catch-all term might be useful sometimes
- › But in design, development and purchases, we need to be specific!

## Technology terms used in startup descriptions and tech articles

2020	2021
Multiplayer game	<u>Metaverse</u>
Virtual Reality <u>experience</u>	<u>Metaverse</u>
<u>Augmented Reality filter</u>	<u>Metaverse</u>
5G Connection	<u>Metaverse</u>
AR <u>Cloud</u>	<u>Metaverse</u>
Digital Avatar	<u>Metaverse</u>
Digital <u>Event</u>	<u>Metaverse</u>
ML <u>classifier</u>	<u>Metaverse</u>
E-commerce	<u>Metaverse</u>
<u>Blockchain</u>	<u>Metaverse</u>
Internet	<u>Metaverse</u>
Social Media	<u>Metaverse</u>
<u>Videocall</u>	<u>Metaverse</u>
<u>Porn</u>	<u>Metaverse</u>
Potato	<u>Metaverse</u>



# Technologies of Metaverse

# Key Technologies of the Future

- › How are the solutions of the future built?



# Key Technologies of the Future



- › Extended Reality & other display technologies
  - › AR, VR & MR to visualize and use data in 3D





# Extended Reality



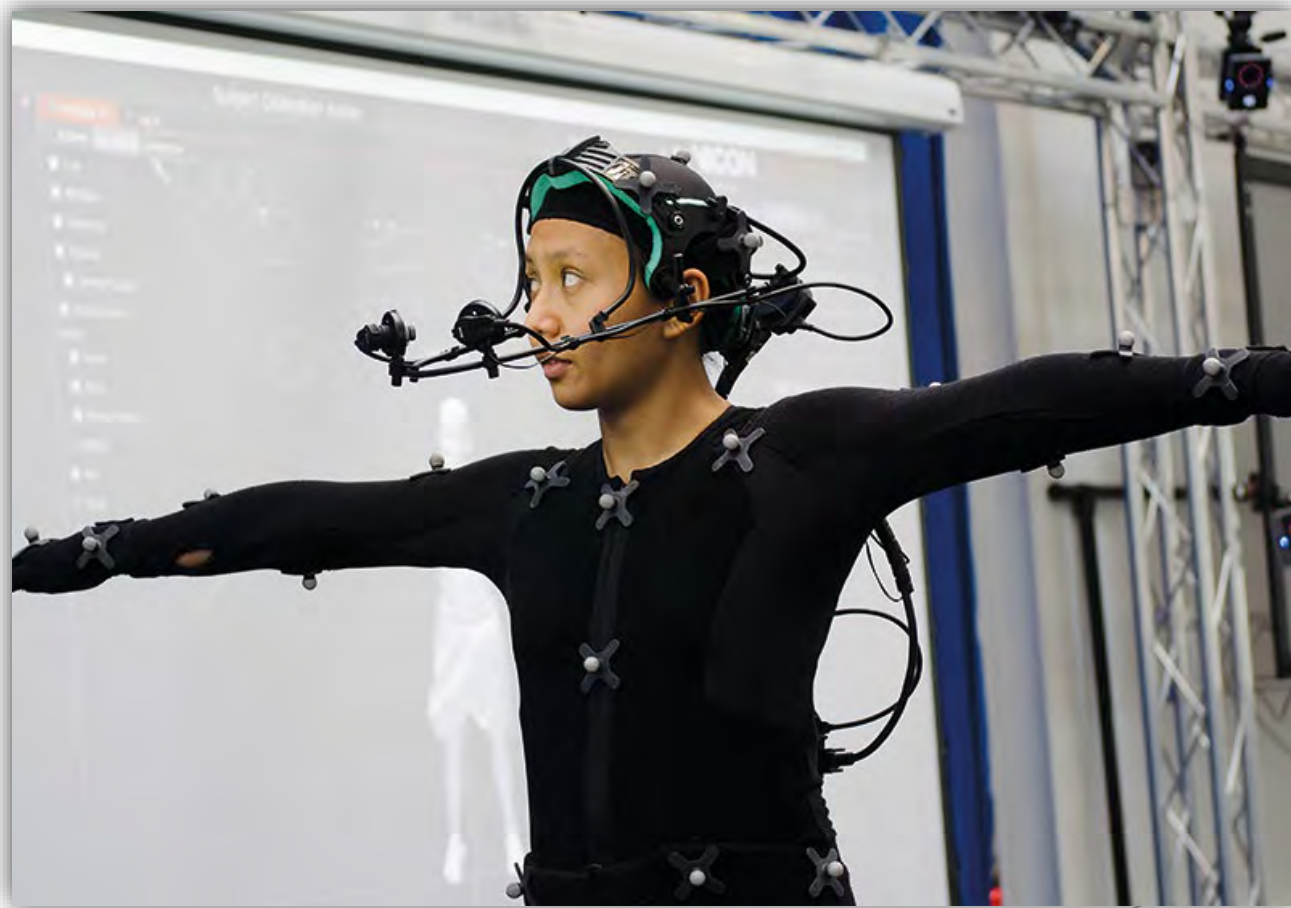
- › Mixed Reality in Design
- › See real objects in real environment
- › Real-time changes to virtual objects
  
- › Personnel from different production teams can interact with the same models
- › Production cycle becomes more efficient when there's no need for physical prototypes

# Key Technologies of the Future

- › Extended Reality & display technologies
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- › Spatial computing
  - › To quickly respond to user actions that mimic reality

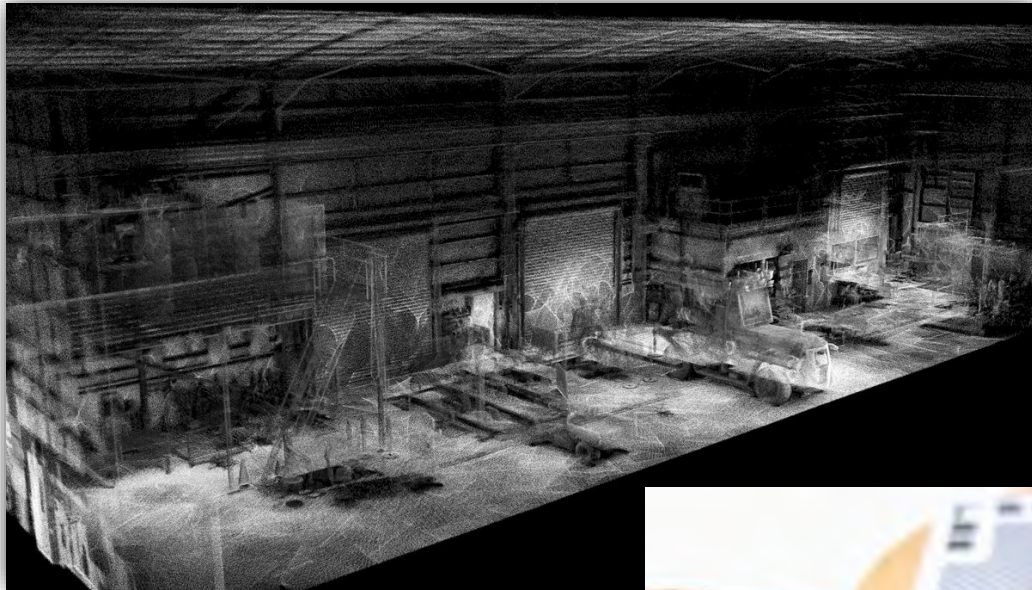


# Spatial Computing



- › Motion Capture for virtual productions
- › Quickly animate characters based on actors, including face
- › More realistic animation, more accurate training examples
- › Faster production cycle for new content

# Key Technologies of the Future



- › Extended Reality & display technologies
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- › 3D reconstruction
  - › To capture and model real objects



# 3D Reconstruction



- › Laserscanning & photogrammetry to digitize and save historical sites and objects
- › Laserscanners (such as Leica BLK360) provide accurate surface quality
- › Photogrammetry provides textures and easy access to all angles
  
- › Create digital copies of any real site
- › Excellent environments for further content

# Key Technologies of the Future



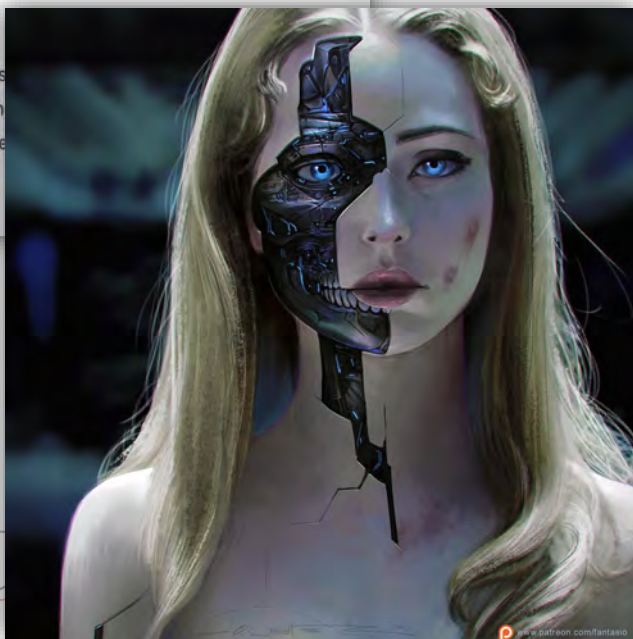
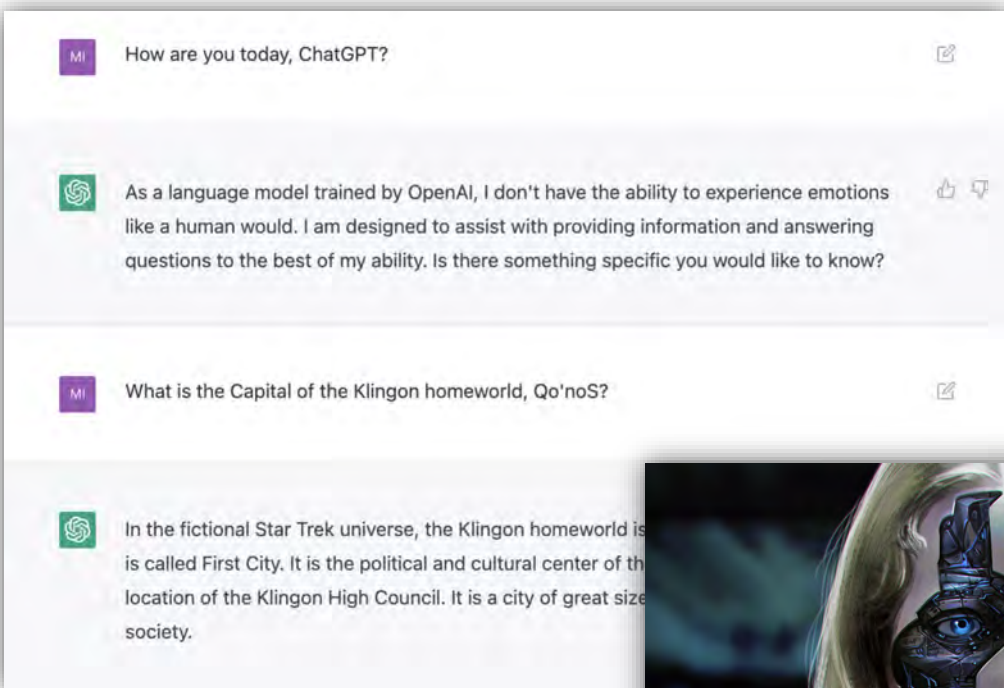
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- › Internet of Things
  - › To seamlessly connect 3D virtual spaces with the real world through data and digital twins

# Internet of Things



- › Combining real-time IoT data from city's data sources with XR city planning software
- › Simulate electricity, weather, traffic or noise pollution
- › Collaborate effectively with a larger team
- › Visualize information that would be difficult to understand for general populace

# Key Technologies of the Future



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- › Artificial Intelligence
  - › To create conversational agents, intelligent, automatic data analysis and generative tools



# Artificial Intelligence



- › Use AI in combination with in-car AR view
- › Recognize the environment and objects
- › Offer guidance to user
  
- › Better visualized navigational aids, in the environment instead of a map
- › Automatically react to danger if driver does not notice

# Key Technologies of the Future

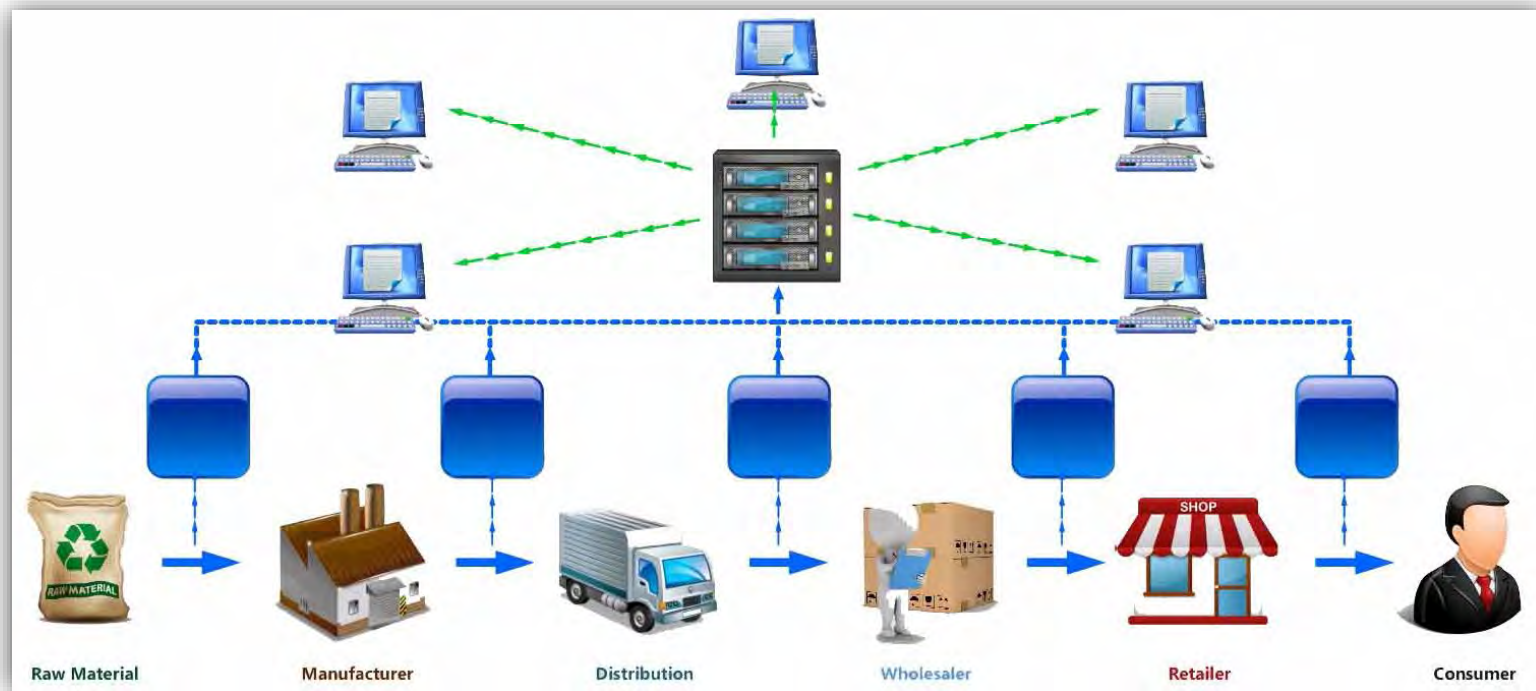


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- › Web3 Technologies
  - › To decentralize and secure digital content

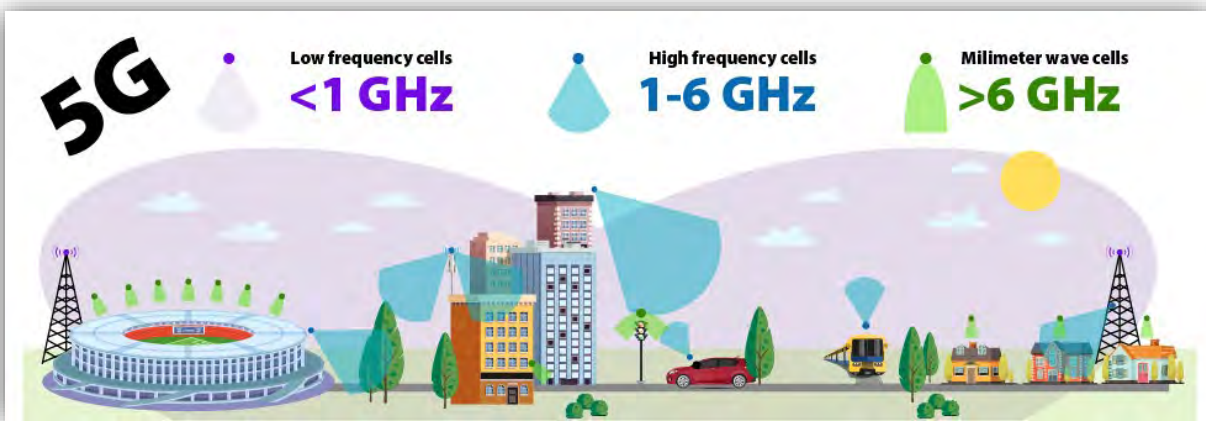


# Web3 Tech

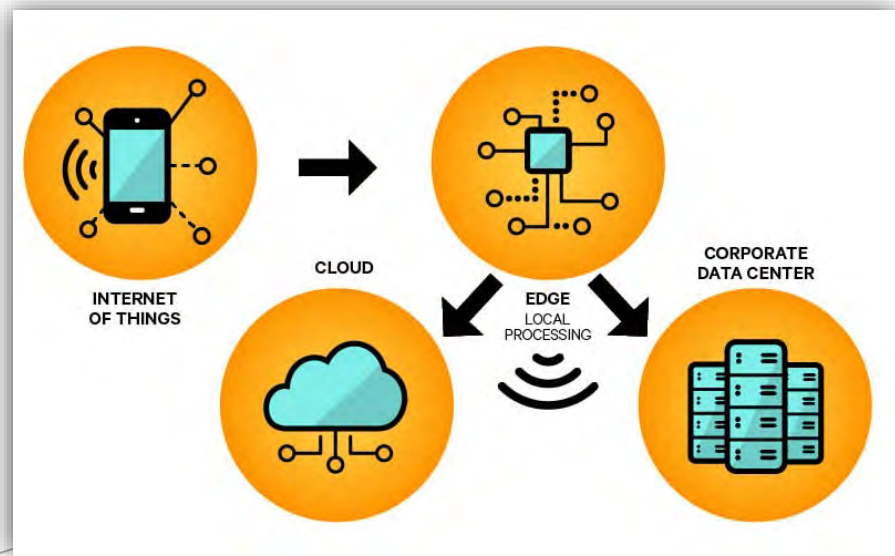
- › Blockchain supported supply chain
- › Product information saved to distributed ledger at every stage
- › Verifiable source of product
- › Transparent and secure information on the product
- › Increased trust between consumer and retailer



# Key Technologies of the Future



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- › Network Technologies
  - › To provide bandwidth and connectivity for all the data



# Network Tech

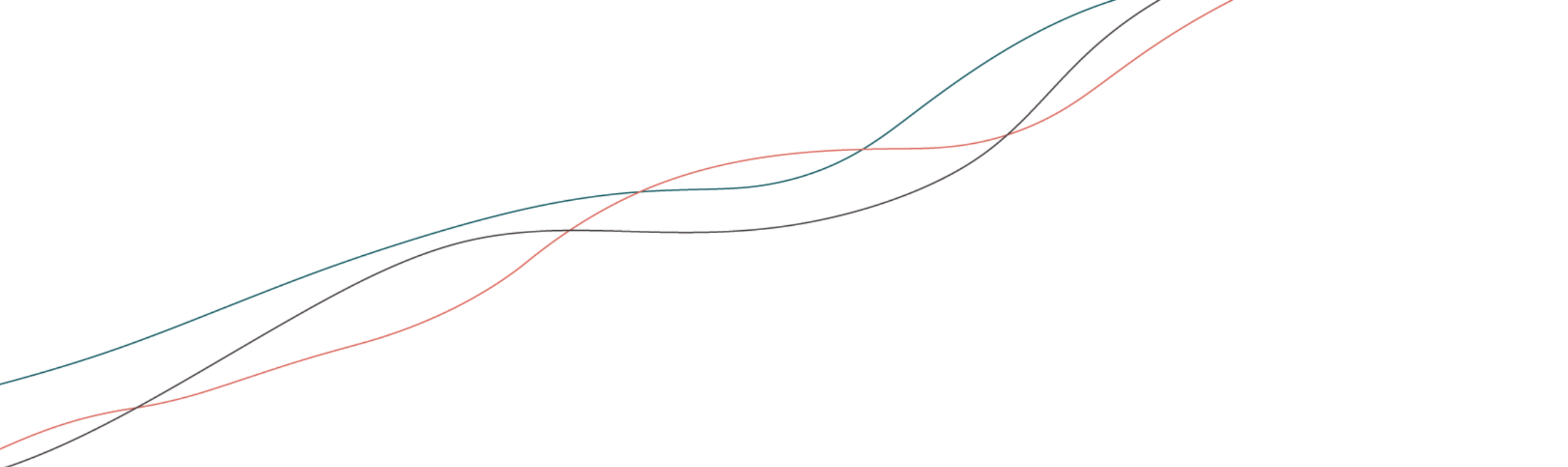


- › 5G mmWave enabled live replays on stadiums
- › Instant replay from several angles to users' smartphones in the stadium
- › No delay on transferring huge amount of video data
- › Improved viewer experience in the stadium

# Key Technologies of the Future



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- › Web3 Technologies
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- › Network Technologies
  - › To provide bandwidth and connectivity for all the data
- › + microelectronics, photonics, batteries, neuro-tech, robotics, wearables, semiconductors



# Current themes and challenges

What should be taken into account when developing solutions?

# Key Themes in Current Metaverse Experiences



## Games-as-a-Platform

- Increasing amount of non-game social activities happening in games: community events such as weddings, graduations, and birthday parties, but also official brand-driven events such as virtual concerts, activations, and fashion shows.
- Games replacing social media for casual connection, enabled by the enrichment of in-game social engagement features.

## User-Generated Content

- The metaverse requires community-sourced creation to scale effectively. Game platforms such as Roblox, Crayta, and Core lead the trend of user-created experiences, games, mods, and worlds.
- Growth of in-game creator tools and no-code development to simplify the creation process.
- AI-assisted UGC.

## Merging of Virtual & Physical Worlds

- Real places, cities, and objects that are mapped digitally 1:1 (e.g. NVIDIA Omniverse, Digital Twins).
- Virtual fashion that can be “tried on” using AR.
- Improving augmented reality lenses / glasses.
- Growth of immersion tech for virtual reality such as haptics.

## Persistent Avatar & Identity

- Concept of a persistent digital identity that accumulates unique digital assets (fashion, land, art) which can be used or interacted with in various games / metaverse gateways.
- Increasing importance and complexity of digital avatars as representation in virtual worlds, with associated digital assets to match, such as pets, land, or vehicles.



# Key Themes in Current Metaverse Experiences

## Cloud & Scalability

- Large-scale persistent simulations.
- Increasing mass concurrency from 100 participants per shard/instance to 10,000+.
- Expanding accessibility and entry into the metaverse through instant-join experiences that don't require download or installation.
- Games designed without processing power limits in mind.

## AI & Procedurally-Generated Content

- Rich and dynamic AI avatars/NPCs (Non-Player Characters), enabling interactivity & influencing behavior via community input (e.g., Rival Peak).
- Rapid auto-generation of maps, worlds, and other elements, especially in open worlds.
- Real-time creation and simulation/visualization.
- Hyper-realistic digital humans adapting to real-time situations and able to read emotional states.

## Decentralized P2P Economy & NFTs

- Player-to-player economy and new types of virtual jobs.
- True, persistent ownership of unique digital items that can exist (and be bought/sold/traded) outside of the game (NFTs); grey markets may be replaced by official NFT marketplaces.
- Play-to-earn games and modes which enable a new earning economy.

## Interoperability & Standards

- Technical standards, interfaces, and protocols that enable cross-application interoperability and make it easy to bring an item from Fortnite into Roblox, for example.
- Examples: Pixar's [USD](#) (Universal Scene Description), NVIDIA's [MDL](#) (Material Definition Language).
- Khronos Group's [glTF](#) (3D file format standard).

# Key Challenges Limiting Growth



## Politics & Regulations

Governments will want to control virtual worlds, and regulations may create new barriers between worlds.

E.g., in April 2020, China banned **Animal Crossing: New Horizons** after the platform was used to stage digital protests about Hong Kong.



## Moderation & IP Rights

UGC spaces require strong safety and content moderation processes in place, supported by **machine learning** and **trust/safety agents**.

Furthermore, IP and copyright management will need radical modernizations to account for a myriad of new situations.



## Privacy & Ethics

Metaverse activity-tracking has the potential to become far more powerful than web-tracking.

There already are certain organizations working toward an open metaverse rather than a closed one controlled by a few entities.



## Accessibility & Scale

The metaverse is not yet accessible or interoperable at scale. New standards and protocols are needed.

Mass concurrency on a global scale is still a challenge, though one that increasingly more companies are trying to solve.

# To wrap up



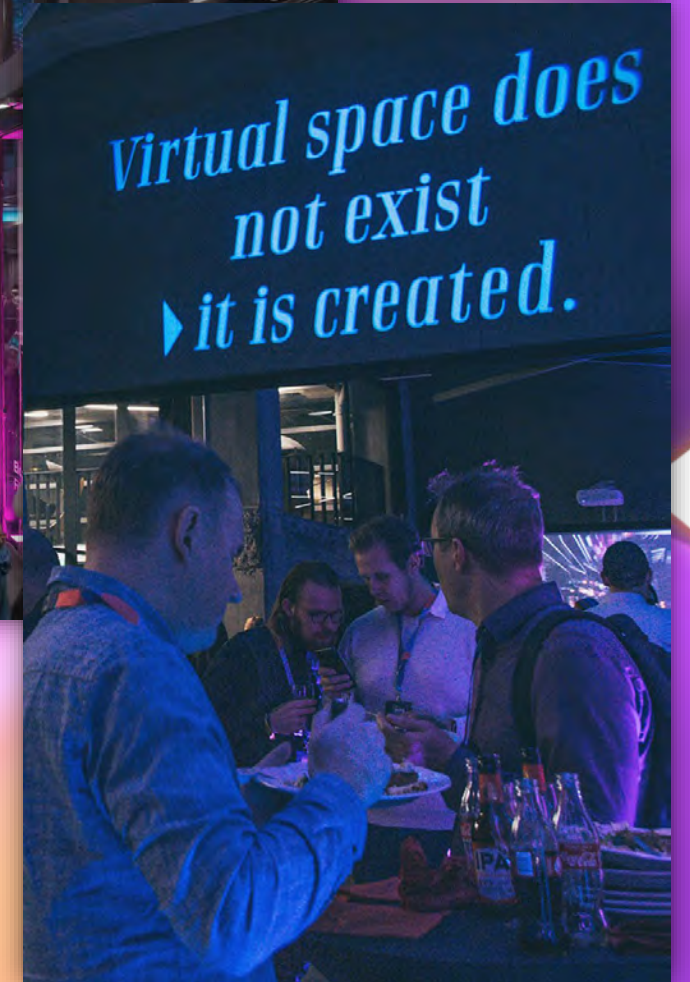
- › We should always be considering a larger variety of technologies that can be utilized, not just the display medium (XR)
- › We can use **Metaverse Technologies** as the all-encompassing terminology
- › **Metaverse** is a theoretical model, not current reality or a single application
- › When starting to use these technologies, **content** and **use cases** are always first. Based on them we can select the correct technologies and devices
- › Don't use hype tech just because, always evaluate the actual current benefit





# MatchXR '23

- › 29<sup>th</sup> November, 4-8PM, Arabianranta, Helsinki
- › The biggest XR & Metaverse technology event in the Nordics
- › Finnish Metaverse Strategy reveal
- › Pre-booked 1on1 matchmaking by Enterprise Europe Network
- › [www.matchxrhelsinki.com](http://www.matchxrhelsinki.com)
- › 65 organisations, i.e. Varjo, Nokia, Immersal, 3D Talo, Stereoscape, Twinverse, Dispelix, Arilyn, Glue and many more...



# HXRRC

## HELSINKI XR CENTER

Thank you!

Questions?

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