Metaverse Standards Forum

Update and Transition to an Independent Consortium

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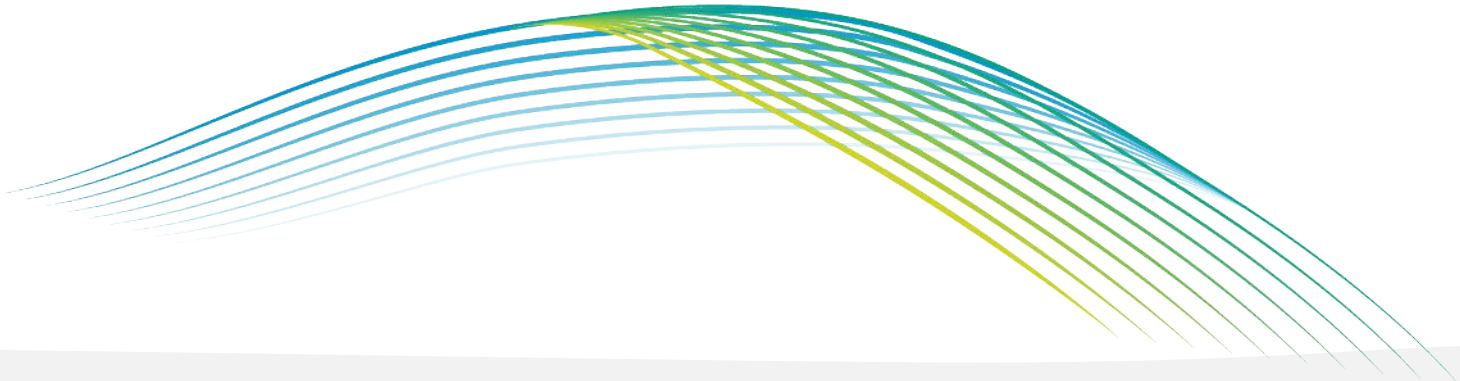
Embargoed until 18th April 2023, 6AM PT



The Metaverse Will be Built on Interoperability

Combining multiple disruptive technologies to work together (AI, GPU, XR, Web3)

Building bridges between applications to scale beyond a series of disconnected silos

Depends on
Interoperability

Evolving a platform that is open and inclusive for all – an immersive evolution of the web

Pervasive metaverse interoperability will need a constellation of open standards …
… involving 100s of standards organizations

KHRONOS GROUP

Khronos finds increasing interest in its standards for the metaverse…

… but discovers that there is nowhere to coordinate with other standards organizations

End 2021

Khronos funds launching the Forum in bootstrap mode to determine industry interest

A venue for cooperation between standards organizations and the wider industry

Straightforward participation agreements with Khronos to enable standardization cooperation and communication

June 2022

Metaverse STANDARDS FORUM™

The Forum grows to over 2400 Member organizations

Multiple Domain Working Groups working to improve interoperability one project at a time

End 2022

The Forum incorporates with unanimous agreement from its membership

Independent, self-funded, non-profit industry consortium

The Forum's mission is to create a wavefront of business opportunities through fostering interoperability 'brick-by-brick' on the road to the metaverse

Today

The Metaverse Brings Together Diverse Technologies

The Metaverse combines the connectivity of the Web with the immersiveness of Spatial Computing

Combining multiple disruptive technologies

Advances in GPU-driven real-time photorealistic graphics and simulation
Scenes, avatars and objects

Decentralized Trust and Storage
ID and Reputation
Economic transactions
Persistence

Artificial Intelligence (AI) a.k.a. Machine Learning
Natural user interfaces
Semantic scene understanding
User generated 3D content

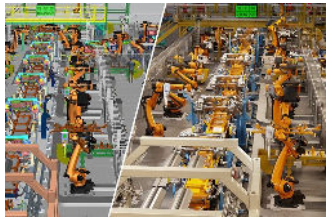
XR – Virtual Reality (VR) and Augmented Reality (AR)
VR for generated environments
AR to overlay the real world

Networking
Edge computing
5G, 6G, 10G

GPU-accelerated photorealistic rendering and simulation
E.g., Epic MetaHumans

Social gaming with end user-generated content
E.g., Roblox

Affordable and accessible XR Devices
E.g., Meta Quest Pro



Digital twins for modeling, monitoring and simulation
e.g., NVIDIA Omniverse

How Will the Metaverse Evolve?

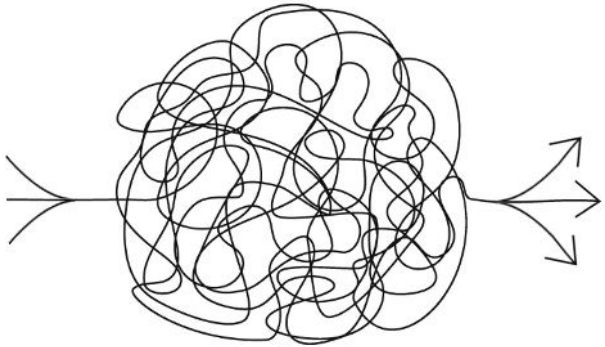
The World Wide Web changed the world

But in ways that were hard to predict when it was first invented

The development of the metaverse will be equally hard to forecast

Diverse emerging technologies are being brought together in novel ways

Synthesized visual reality
Universally portable 3D assets
Practical XR optics
Real-time environment scanning and semantics
End-user 3D content creation tooling
Accurate physical simulations
Realistic avatars
Online personas and social connections
Machine learning for semantic understanding and assisted content creation
User identity, security and privacy
Effective remote social interactions
Streaming of vast geospatial data sets
Real-world geo-anchoring with persistence
IOT sensor networks
Universal digital twins
Servers scaling to millions of simultaneous users
Interoperable run-times
Online economies and currencies
Pervasive low-latency wireless connectivity
and much more …



Darwinian Evolution

Elevates technologies and services that gain market success

Creating a wavefront of commercial opportunities as the metaverse emerges incrementally

Technologies working together at pervasive scale need interoperability standards!

Standards accelerate market opportunities and drive increased volume
Reduce consumer confusion
Increase product capabilities and usability
Enable focus on differentiated innovation
Reduce costs and speed time to market

Pervasive metaverse interoperability will need a constellation of open standards from 100s of standards bodies

Ubiquitous Standards for the Metaverse

Industry Standards

Standards are the basis for ubiquitous infrastructure

IEC 60038 Standard voltages
IEC 60228 Conductors of insulated cables
IEC 60269 Low-voltage power fuses
IEC 60320 C13 Connectors and C14 Inlets
IEC 60884 Household Plugs And Socket-Outlets
IEC 61970 APIs for energy management

Multiple Standards

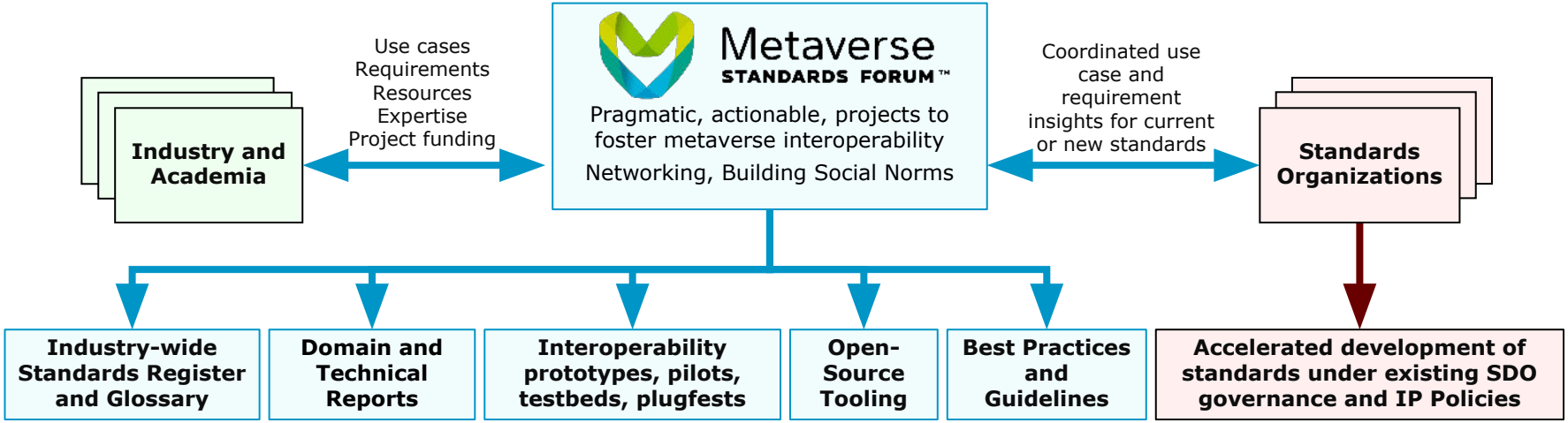
Widely adopted platforms require many hardware and software standards

Constellation of Standards

An open and inclusive metaverse at pervasive scale will need the right standards at the right time – from MANY standards organizations!

Better Metaverse Standards – Sooner!

- Coordination and cooperation between Standards Developing Organizations (SDOs) and wider industry
- NOT another SDO! All standardization 'heavy-lifting' continues at existing SDOs
- Open to all, Member access with no participation dues, no NDA, no patent licensing
- The Forum exists to accelerate the mission of its members – including SDOs and advocacy organizations



June 2022 - 37 Founding Organizations

Today - Over 2400 Members and Counting

Wide diversity of organizations, including…

SDOs
Khronos, W3C, Open Geospatial Consortium, IEEE, OMI, ASWF, Spatial Web Foundation, VRM Consortium, XRSI, OMG, Open AR Cloud, OMA3 …

Platforms
Meta, Microsoft, Sony, Google, Baidu, Huawei, General Motors, RedHat, Siemens, Tencent, Mozilla, Paramount …

Tools and Engines
Epic, Unity, Adobe, Autodesk, Otoy, Maxon, Cesium, ESRI, Blackshark.ai, Croquet, Lamina1, Niantic, Ready Player Me, DGG, Manticore …

XR
HTC, Magic Leap, Nreal, Panasonic, Tobii, zSpace …

Hardware
NVIDIA, Intel, AMD, HP, Acer, Dell, Qualcomm, Samsung, Sony, MediaTek, Oppo, Lenovo, ZTE, LG …

Wireless and Networking
China Telecom, Deutsche Telekom, T-Mobile, Verizon, NTT, AT&T, Telefónica, Juniper, Comcast …

3D Commerce
Alibaba, Alvanon, Avataar, CLO, Browzwear, IKEA, VNTANA, Metaverse Fashion Council, Target, Wayfair …

Universities and Institutes
Stanford, John Hopkins, Yale (XRP), Queens University Belfast, University Salford, New York Institute Technology, APMG …

Advocacy
XRSI, AREA, XR Association, VRAR Association, XR Guild, Web3 Marketing Association, International Virtual Reality Healthcare, Swiss Institute for Disruptive Innovation, IOT Consortium, Metaverse Japan, RIAA …

Organizing for Effective Forum Action

1. Gather interoperability Topics from all members

Online input from all members on actionable topics that need improvement today!

Over 200 topics suggested and counting, for example..

Database of metaverse standards
Taking 3D assets between worlds
Asset LODs
glTF / USD interoperability
Avatar customization / animation
3D Apparel and Fashion
Cloth Simulation
Metaverse traversal
Geospatial ontologies
Geospatial streaming
Decentralized User ID
Ethical framework
User privacy
Child safety
Payment frameworks
Etc. etc..

2. Organize Topics into Domains

Consensus on member interest AND where the Forum can add industry value

Topics naturally falling into Domains

Privacy, Safety, Security, Inclusion
Interoperable 3D Assets
Real/Virtual World Integration
Identity (was User Identity)
Avatars and Apparel
Teaching, Education, Certification
Metaverse Standards Register
XR and UI
Metaverse Definition
Networking
Geospatial
Payments and Economy
Runtimes and Object Model
Governance and Advocacy
Video Broadcasting and Meetings
Forum Outreach
Tooling and Creators
Gaming
Health and Medical
Performance and Scalability
Business Analytics

3. Create Domain Working Groups

Make recommendations and work products publicly available

Any Forum member can propose and participate in a Domain Working Group

Forum Working Groups focus on short-term pragmatic projects to create a wavefront of business opportunities

Domain and technical reports

Use case and requirements recommendations

Pilots, testbeds and plugfests

Open-source tooling

Best practices and guidelines

Other interoperability data, insights and visibility

Etc.

Forum Domain Group Pipeline

Metaverse Standards Register
Publicly available database mapping the landscape of metaverse-relevant standardization activities

glTF/USD 3D Asset Interoperability (visuals, behaviors)
Cooperation between USD and glTF to increase synergy
and reduce duplication of effort, gaps, fragmentation and industry confusion

Real/Virtual World Integration (Digital twins, IOT)
Constructs to describe and integrate the physical world and created representations

Asset Management (web3, protection, digital rights)
Digital rights, protection, portability, access, availability

Interoperable Avatars
Cross-platform avatars and characters for film, gaming, fashion and social platforms

Digital Fashion/Wearables
Clothing (including layering), shoes, hats, accessories

Network Requirements and Capabilities to Support Metaverse Applications
Industry requirements for seamlessly transitioning traffic on multiple wireline and wireless
technologies for deploying metaverse applications at scale

Privacy, Cybersecurity & Identity
Recommendations for responsible innovation that mitigates human and societal harm from
objective and subjective privacy risks – including cybersecurity and identity risk management

Technical Interoperability and End-User Troubleshooting
Enabling end-users to ensure reliable metaverse experiences

3D Web Interoperability
Enable the broadest possible interoperability of Metaverse Content using the Web

Ownership and Identity
Accessibility
Best Practices for Living and Working in the Metaverse

Metaverse STANDARDS FORUM™

https://metaverse-standards.org/domain-groups/

Key
Working Groups
Exploratory Groups
Exploratory Group Proposals

Typical Domain Group Activities

Awareness
Understand the standardization landscape in this Domain

Create a Group-maintained list of key players: companies, organizations

Invite key players to join the Forum

Invite key players to present to the Domain Group on their activities – as members or guests

Analysis
Identify where there are interoperability gaps or misalignments

What are the clearest problems or opportunities where communication and cooperation can make a difference today?

Are there standardization organizations working and willing to fill standardization gaps?

Are industry players willing to cooperate on better alignment on creation and use of best practices or standards?

Action
Initiate Projects to generate and publish work products that foster interoperability

Publish 'Domain Interoperability Reports' to build industry understanding and consensus on the need and benefit of increased interoperability

Establish subgroups to deep dive and generate and publish use cases and requirements for needed standardization work

Initiate testbed/plugfest projects to encourage real-world testing, and publicly release assets and tools for ongoing compatibility

Promote and publish Domain Group results

Charter Approved and Working Group Formed

Exploratory Group

Ongoing blend of Awareness, Analysis, and Action as the group transitions and grows

Working Group

Example Asset Interoperability Testbed Project

- Goals
  - Confirm asset behaviours and attributes satisfy use cases
  - Test publishing and transmission pipeline
  - Exercise interoperable behaviours in multiple runtimes
- All engine and platform vendors invited to participate
- Cooperative shared open-source and assets

AUTODESK
blackshark.ai
CESIUM
Adobe
MAXON
A NEMETSCHEK COMPANY
otoy

Tools create assets using open standards

FORTNITE
ROBLOX
UNREAL ENGINE
Unity
three.js
babylon.js
PLAYCANVAS
GODOT
Game engine
O3DE
OPEN 3D ENGINE
NVIDIA OMNIVERSE

Run time engines ingest and process assets

USD

USD-based tools
Author assets and publish into glTF

DISTILL

glTF

Web-based Configurator
Material variants

TRANSMIT

Runtime Demos
Open door, start engine
Drive course with physics simulation

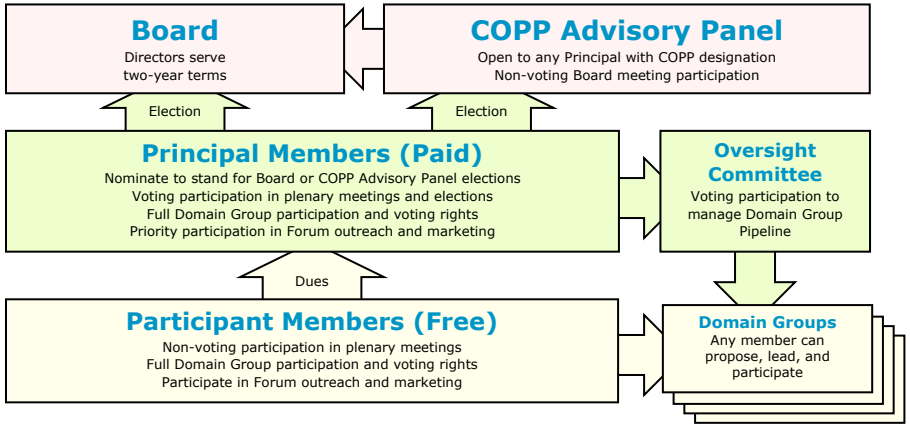
Metaverse Standards Forum Inc.

- The Forum is now incorporated as an independent non-profit industry consortium!
  - Delaware 501(c)(6) non-profit, non-stock corporation bylaws
- The goals and daily operation of the Forum are unchanged for a seamless transition
  - We are STILL not an SDO, there is no NDA for Forum activities, consensus-based with one vote per organization
- Still two membership levels 'Participants' and 'Principals' plus and now and elected Board
  - Participant membership remains free and provides access to all Domain Group activities
  - Principals continue to be key to Forum oversight: participation in Oversight Committee and Board Elections

To encourage participation by a broad diversity of standardization organizations the Forum designates some members as 'COPP's with reduced or waived fees

'Collaborative Organization with Public Products' produce publicly available, specifications, policies, recommendations, or open-source software through a collaborative member-driven process.

A COPP may stand for election to the COPP Advisory Panel for non-voting Board meeting participation



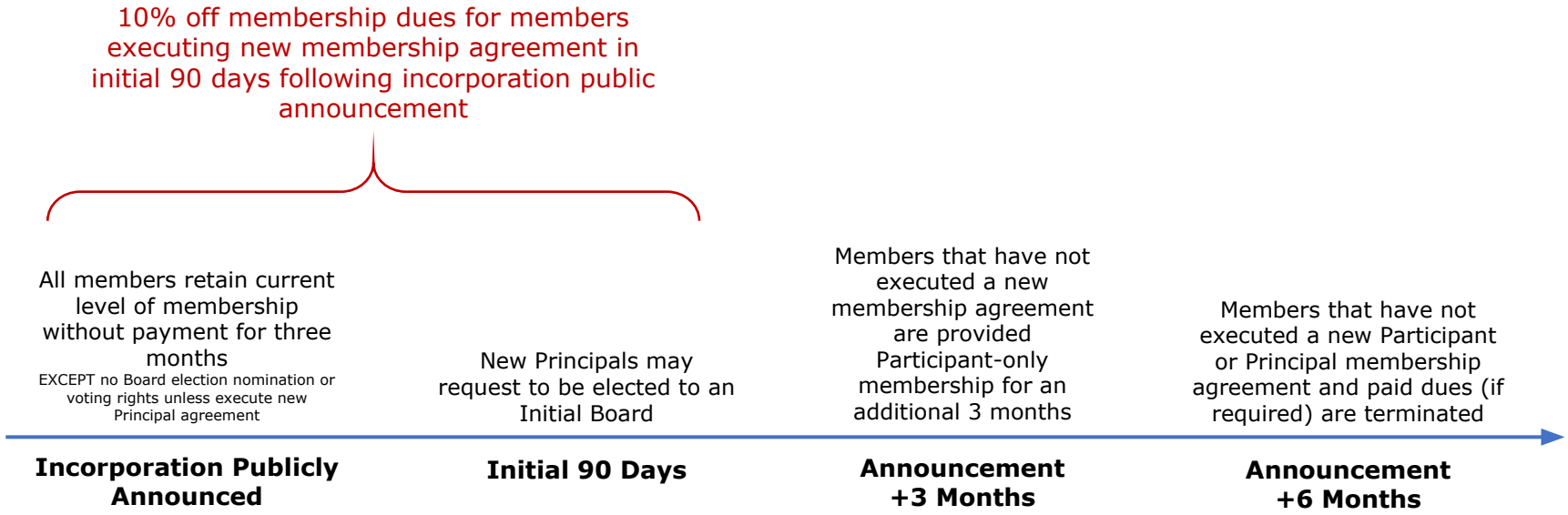
Principal Dues

- Principal Annual Membership dues introduced to Fund Forum Operations and Projects
  - Principal fees tiered on member size to enable participation by organizations of all sizes and geographies
- All Principals can cast one vote in decisions and elections, regardless of dues paid
  - Avoid any concerns over inappropriate 'buying of influence'
- Principal dues capped at $999 for COPPs and accredited academic institutions
  - COPPs and non-profits may apply for a due waiver to $0

Size and Type of Organization	Principal Dues (US$)
COPPs and Non-profits approved for Principal Fee Waiver Invited Industry Experts (individuals) and Liaison Orgs	$0
Micro Enterprises (< 10 emp. AND <$2M revenue/assets)	$50 per employee
Small Enterprises (< 50 emp. AND <$10M revenue/assets) Accredited Academic Institutions COPPs without fee waiver	$999
Medium Enterprises (< 250 emp. AND <$50M revenue/assets)	$4,999
Large Enterprises (>250 emp. OR > $50M revenue/assets)	$9,999

Membership Transition

- Six-month transition period for all members to execute updated membership agreement
  - For agreement terms consistency between all members



Post-Incorporation Board Timeline

- Board processes for quorum and actions as per bylaws

Initial Board Consent

Khronos President and Managing Director elected as Directors
Terms through to Interim Board Election

Officers Elections
Khronos President as President and Secretary
Khronos Managing Director as Executive Director and Treasurer

Forum President and Executive Director Officer terms through to Full Board Election
for continuity

Incorporation Publicly Announced
April 18th, 2023

Board may elect up to 5 additional Directors At least one seat reserved for non-Large Enterprises.
Terms through to Interim Board Election

Board may elect Secretary and Treasurer Officers from Directors
Terms through to Interim Board Election

Initial Board

Initial Board

Officers serving until first AGM after 9 months
Neil Trevett: President and Secretary
Emily Stearns: Executive Director and Treasurer

Directors serving for 90 days until first Board Elections
Ulrich Dropmann, Nokia
Paul Higgs, Huawei
Yu Yuan, Versemaker (IEEE SA President)
Matt White, Berkeley Synthetic Inc.
Aditya Mani, YOLOgram

Interim Board Election

Up to total 11 Directors elected by and from Principals
Up to 3 seats reserved for non-Large Enterprises.
Terms through to Full Board Election

Announcement +3 Months

Board elects Secretary and Treasurer Officers
Terms through to Full Board Election

Interim Board

Full Board Election AGM

Up to total 19 Directors elected by and from Principals
5 seats reserved for non-Large Enterprises.
Staggered two year terms

Announcement +9 Months

Board elects all Officers
Terms through to upcoming AGMs

Full Board

Post Incorporation FAQ

- Is the Forum now going to try to 'define and solve the metaverse'?
  - No! The focus remains on practical, actionable interoperability projects that can create a wavefront of short-term opportunity. We are 'baking the open standard bricks' for the metaverse, not trying to 'build the whole cathedral'
- Is the Forum now a new standards organization?
  - No, the Forum remains a unique venue to coordinate requirements and support for existing SDOs developing standards relevant to the metaverse, complementing existing standards bodies
- Is the Forum competing with other metaverse-related organizations?
  - No! We welcome other organizations to join the Forum, and we hope that the opportunity for wider visibility and cooperation can help them further their mission
- Why did Khronos acting as host and bootstrap the Forum?
  - Promoting industry cooperation is part of Khronos' non-profit mission, our membership requested we help create an open, neutral forum for the benefit of all. Khronos is delighted to see the ongoing success for the Forum and for it to become an independent incorporated consortium
- Now Principals pay dues, will larger companies be able to 'buy outsized influence'?
  - No, Forum processes mandate on vote per organization, regardless of the size of paid dues to encourage decisions to continue to be made by consensus

Metaverse STANDARDS FORUM™

Call for Participation in Unique Cooperative Opportunity

Broad global participation in the Forum enables a unique opportunity for metaverse standards cooperation, coordination and leadership for Forum members to accelerate *their* organizations objectives
https://metaverse-standards.org/

Comprehensive, international gathering of industry requirements and expertise in Forum Working Groups

Any Forum member can propose, lead, contribute to, participate in, or monitor Domain Working Groups

Metaverse STANDARDS FORUM™

Wide visibility and adoption of Forum initiatives

Metaverse
STANDARDS FORUM™

Background Materials

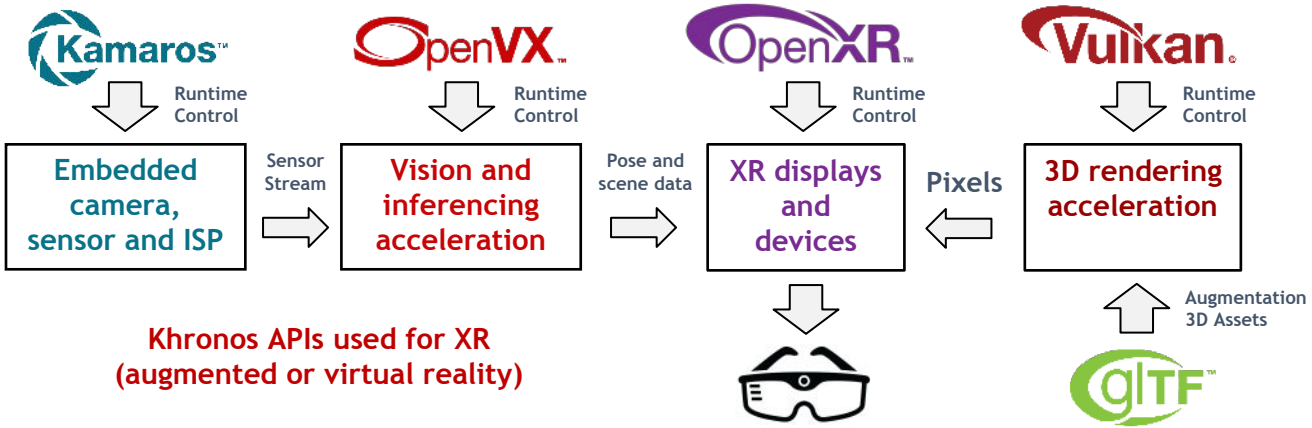
Khronos "Connects Software to Silicon"

KHRONOS GROUP

Standards Organization founded in 2000
~200 Members ~ 40% US, 30% Europe, 30% Asia

Non-profit, member-driven, open to any company
Well-defined multi-company governance and IP Framework

Open, royalty-free interoperability standards to harness the power of GPUs, multiprocessors and XR hardware
3D graphics, augmented and virtual reality, parallel programming, inferencing and vision acceleration



Proto-Metaverse Consumer Use Cases

Forbes, iLRN, Virbela

Enhanced student learning and engagement by transforming how educational content is delivered

Open AR Cloud, Niantic

Augmenting Reality with persistent geo-locking, linking, occlusion and realistic scene illumination

Microsoft Flight Simulator

Realistic environments where users can import their own authored assets

Roblox, Minecraft, Manticore

Virtual spaces where gamers create their own content

Fortnight, PUBG, Valheim

Realtime, multi-user gaming and socialization

Enterprise Proto-Metaverse Use Cases

PTC, AREA

Augmented Reality used in guided tasks and remote assistance are proven to boost productivity

Algorand, Sports Tomorrow

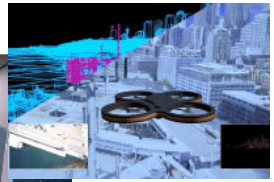
Virtual Sports Leagues and immersive viewing of sports events

GE, Siemens, Bentley, NVIDIA

Digital twins - virtual representation of a product, process, or place that measures mirrors and its physical counterpart - for monitoring, optimizing and prediction

OGC, Cesium, NVIDIA

Spatially indexing and streaming the digitized world for planning, visualization and simulation



Microsoft, Google

Immersive Training significantly increases understanding and retention

NVIDIA Omniverse

3D application interoperability for real-time immersive collaborative simulation and design

The Promise of Metaverse Interoperability

Interoperability is the key to the metaverse scaling beyond a series of disconnected silos

Decentralized trust and storage
Enable any service to access and confirm ID, reputation, payments, and ownership with a persistent history

Interoperable 3D objects and avatars
Take your personal avatar and objects you have earned, built or purchased seamlessly across multiple services

Travel between different spaces
With minimal friction and consistent user interface but with agreed 'border customs' to respect IP ownership, business models, age appropriateness, gameplay, rendering style etc.

and much more…..

If achieved, this level of interoperability would escalate the economy and utility of the metaverse beyond any single space or service

Metaverse Reality vs. Hype

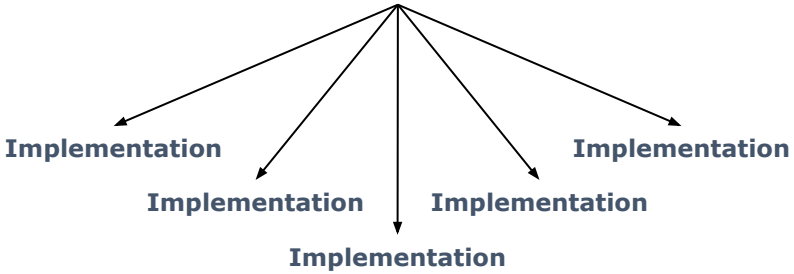
There is only one Metaverse
The metaverse is a platform - just as there is only one Web
The metaverse will enable diverse 'worlds', spaces' and 'experiences' etc.
Just as the Web enables 'pages' and 'apps' etc.

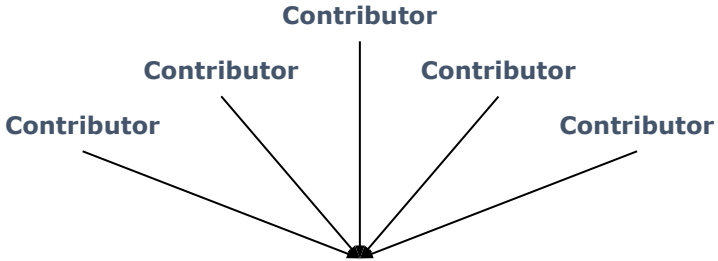
The Hype	The Reality
We will live our lives in the metaverse!	**We will choose to use the metaverse when and if it is engaging, insightful and educational – and perhaps more productively than the average of 3 hours a day we on average spend watching TV today**
You will need to plug into a VR headset to access the metaverse	**Although VR will deliver some of the most immersive and AR could *eventually* replace mobile phones, there will be many ways to use Metaverse applications - including phones, tablets and PCs**
The Metaverse will be a wild west of crypto currencies and NFTs	**Web3 is a young area of innovation – and is still evolving how to enable systems of decentralized trust for ID, reputation and economic transactions that will be essential to the metaverse**
The Metaverse market will be worth *Trillions* of dollars $ in the next few years	**As with many transformative technologies, its evolution will take longer than we think, but its impact will likely be larger than we first imagined**

Open Standards Make Technology Pervasive

INTEROPERABILITY standards define precise COMMUNICATION
E.g., software to hardware, client to server, organization to organization

Open Standard =
Shared Specification





Open Source =
Shared Implementation

Open standards with rigorous conformance testing enable consistency across multiple implementations that can meet the needs of diverse markets, price points, and use cases

Open standards often use open source to spread the implementation effort for sample implementations, tools, samples, conformance tests, validators etc...

Open Standard Why's, When's and How's

Why	
Grow Markets By reducing consumer confusion and increasing capabilities and usability	**Reduce Costs** By sharing ecosystem development between many companies and driving volume
Speed Time to Market With well-proven functionality, testing and interoperability	**Enable Innovation** Free companies compete on value differentiators: quality, performance, power etc.
When	
Proven Technologies Don't do R&D by standards committee	**Consensus Need** The downside of not having a standard is clear to all
How	
Multi-company governance Avoid single-company control or dependency	**Well-defined IPR Policy** Royalty-free standards have clearer path to wide adoption
With Extensibility Enable a responsive innovation pipeline to meet customer and market needs	**Thoughtful Abstraction** Focus on interoperability and avoid over specifying implementation which stifles innovation