MMOS AND THE METAVERSE

TENERIFE.GG

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INTRODUCTION

- RECENTLY, THERE HAS BEEN A LOT OF EXCITEMENT AROUND THE CONCEPT OF THE **METAVERSE**
- THE METAVERSE IS CONCEIVED TO BE LIKE THE INTERNET BUT WITH A VIRTUAL REALITY ("EMBODIED") INTERFACE
 - SO AUGMENTED REALITY TOO, MAYBE
- MUCH HAS BEEN SAID ABOUT HOW THIS WILL IMPROVE MMORPGS
- THIS TALK WILL EXAMINE SOME OF THESE CLAIMS
- · FIRST, THOUGH, A LITTLE ABOUT WHO | AM ...

FFX/*V*

• FINAL FANTASY XIV, SQUARE ENIX, 2014



• I CURRENTLY HAVE A /PLAYTIME OF 101 DAYS

• SECRET WORLD LEGENDS, FUNCOM, 2017



• I HAD A /PLAYED OF 45 DAYS WHEN I QUIT - PLUS **150** DAYS ON *THE SECRET WORLD*...

SWL

SW:TOR

• STAR WARS: THE OLD REPUBLIC, BIOWARE, 2011



I PLAYED ~6H/DAY FOR 137 DAYS IN 2012
- 137 ELAPSED TIME, 33 DAYS (PU TIME

WORLD OF WARCRAFT

• WORLD OF WARCRAFT, BLIZZARD, 2004:



EVERQUEST

• EVERQUEST, SONY ONLINE ENTERTAINMENT, 1999



DIKUMUD

• DIKUMUD, COPENHAGEN UNIVERSITY, 1990

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[x2] A barrel has been left here.
An angry-looking statue of Hoturi is standing here.
An angry-looking statue of Priapus is standing here.
A statue of Odin is standing behind the altar.
A Sign for Newbies is here.
You are a guest here until you save yourself.
If vou need
to get to your guild, use the guild medallion in your inventory. If you lose
it, pray to the statue of Odin for another.
105m/202e/38hlook
   You are inside the small and humble village temple in Udgaard. A simple
stone altar, with strange stone carvings, is placed against the north wall.
                                                                                Ĥ
small humble donation room is to the east. The temple exit is south to the
Village Square.
[x2] A barrel has been left here.
An angry-looking statue of Hoturi is standing here.
An angry-looking statue of Priapus is standing here.
A statue of Odin is standing behind the altar.
 Sign for Newbies is here.
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105m/202e/38h

ABERMUD

• ABERMUD, ALAN COX, 1987

Your wimpy value is set to 15. See 'help change' to see what that means. The Temple Of Paradise You stand in the Temple of Paradise, a huge sandstone structure whose walls are decorated with ancient carvings and runes, some so old that even the priests no longer know their meanings. A single set of steps lead south, descending the huge mound upon which the temple is built and ending in the forests below. A roaring fire burns here. Its flames make the temple sparkle and glitter. At your feet a huge sacrificial pit allows you to give valuables to the gods in the hope of being rewarded. A furled umbrella lies here. Obvious exits are: North : Welcome Center South : Forest Track Down : Forest Track Last login: Wed Sep 7 17:43:26 2005

MUD

• MUD, ROY TRUBSHAW & RICHARD BARTLE, 1978

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Narrow road between lands.
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You are stood on a narrow road between The Land and whence you came. To the north and south are the small foothills of a pair of majestic mountains, with a large wall running round. To the west the road continues, where in the distance you can see a thatched cottage opposite an ancient cemetery. The way out is to the east, where a shroud of mist covers the secret pass by which you entered The Land. It is raining.

*₩

Narrow road.

You are on a narrow east-west road with a forest to the north and Gorse scrub to the south. It is raining. A splendid necklace lies on the ground.

- MUD DIDN'T COME FROM ANYTHING
- THIS EXPLAINS WHY THIS TALK IS BEING GIVEN BY AN OLD MAN

"THE"

- SO, LET'S BEGIN BY THINKING ABOUT WHAT WILL FORM THE **BASIS** OF THE METAVERSE
- THERE ARE A NUMBER OF **COMPETING** PLATFORMS
 - ROBLOX, FORTNITE, DECENTRALAND, SANDBOX, ... DOZENS MORE
 - META, MICROSOFT, GOOGLE, AMAZON, ...
- THE THING IS, IT'S **THE** METAVERSE, NOT **A** METAVERSE
 - IT WOULD BE LIKE CALLING FACEBOOK "THE INTERNET"
- IT TURNS OUT WE'VE BEEN HERE BEFORE ...

19805

• BACK IN THE **1970S** AND **1980S**, THE ONLINE WORLD WAS DOMINATED BY 5 AMERICAN **"SERVICE PROVIDERS"**

- COMPUSERVE, PRODIGY, AMERICA ONLINE, DELPHI, GENIE

- THEY WERE WALLED GARDENS
 THEY DIDN'T TALK TO EACH OTHER OR TO ANYONE ELSE
- WHEN THE INTERNET WAS OPENED UP FOR COMMERCIAL USE IN **1993**, THEY THOUGHT IT WOULDN'T TAKE OFF

- THEY HAD ALL THE USERS AND ALL THE CONTENT

• THEY WERE WRONG

ONE

- WE DON'T HAVE **FIVE** INTERNETS, WE HAVE **ONE** INTERNET
- IT'S THE SAME THING FOR THE METAVERSE
- WE WON'T GET A PROPRIETARY METAVERSE UNLESS THE MULTINATIONAL TECH COMPANIES CREATE IT TOGETHER (CHINESE INCLUDED?)
 IT WOULD HAVE TO BE AN OPEN STANDARD, TOO
- A USEFUL WAY TO LOOK AT CLAIMS ABOUT THE METAVERSE IS MENTALLY TO CHANGE THE WORD "METAVERSE" TO "INTERNET"
- IF IT MAKES NO SENSE, BE WARY

UTILITY

- WHAT WILL PEOPLE DO IN THE METAVERSE?
- · MOST ANSWERS BEGIN WITH "THEY CAN..."
- THAT DOESN'T ANSWER THE QUESTION!
- WHAT THEY CAN DO ISN'T THE SAME AS WHAT THEY WILL DO
- IN SOME RESPECTS, THE METAVERSE IS A
 SOLUTION LOOKING FOR A PROBLEM
- YOU CAN BUY THINGS, WATCH MOVIES, CHAT WITH FRIENDS AND PLAY GAMES IN THE METAVERSE - BUT DO YOU NEED TO?
- WHAT DOES THE METAVERSE DELIVER?

lots

- JUST BECAUSE IT'S NOT OBVIOUS WHAT THE METAVERSE WILL DELIVER, THAT DOESN'T MEAN IT
 WON'T BE POPULAR OR UNIQUE
- THE VR INTERFACE MAY GIVE IT CRITICAL MASS
 - ALTHOUGH IT'S CLUNKY AT THE MOMENT, ESPECIALLY WITH INPUT
 - PEOPLE WON'T WEAR **3D GLASSES** TO PLAY MMOS, SO VR GOGGLES ARE A **HARD** SELL
- IT CERTAINLY HAS THE POTENTIAL FOR NEW APPLICATIONS OR IMPROVED OLD ONES

- ENOUGH TO SUPERSEDE THE INTERNET, THOUGH?

GAMES

- THIS IS WHERE GAMES COME IN
- MUCH OF THE TECHNOLOGY FOR THE METAVERSE
 HAS ALREADY BEEN DEVELOPED FOR GAMES
 SPECIFICALLY, VIRTUAL WORLDS MMORPGS
- METAVERSE EVANGELISTS ARE LOOKING FOR WAYS TO IMPROVE VIRTUAL WORLDS
- GAMERS ALREADY UNDERSTAND ALL THE IMPORTANT CONCEPTS
- INTEGRATING VIRTUAL WORLDS INTO THE METAVERSE WOULD UNLOCK ITS POTENTIAL AND PROVIDE COMPELLING INITIAL CONTENT

DESIGNERS

- SOME GAME DESIGNERS REALLY LIKE THIS
- THE METAVERSE WILL BRING **STANDARDS** - COMMON BUILDING BLOCKS AND FUNCTIONALITY
- THIS OUGHT TO MAKE CREATING GAMES MUCH
 FASTER AND LESS EXPENSIVE
- TECHNOLOGIES DEVELOPED FOR THE METAVERSE WILL INDEED BE VERY USEFUL FOR GAMES
 - THIS IS WHY I DON'T DISAPPROVE OF ATTEMPTS TO CREATE THE METAVERSE
- IT'S HOW METAVERSE ADVOCATES SEE THIS AFFECTING GAME **DESIGN** THAT'S PROBLEMATIC

INTEROPERABILITY

- · LET'S START WITH INTEROPERABILITY
- WOULDN'T IT BE GREAT IF YOU WERE PLAYING THE LATEST SILENT HILL AND SUDDENLY SAW A POKÉMON YOU COULD CAPTURE?

- "PLAYERS CAN CREATE THEIR OWN EXPERIENCES!"

- IT BREAKS THE FICTION AND AESTHETICS
 - IT WOULD BE LIKE WATCHING A **STAR TREK** MOVIE IN WHICH **GANDALF** SHOWED UP
- IF IT'S OPT-IN ONLY AND PLAYERS CAN DECLINE
 TO GROUP WITH PEOPLE WHO DO OPT-IN,
 WELL I GUESS IT'S HARMLESS

TRANSFORMATION

- WHAT ABOUT TAKING OBJECTS FROM ONE GAME TO ANOTHER?
 - COULD YOU SET CHARIZARD ON PYRAMID HEAD?
- TO AVOID SPOILING THE FICTION, WE CAN TRANSFORM OBJECTS' LOOK & FEEL
- ASSAULT RIFLES IN SURVIVAL GAMES ARE EPIC, BUT DON'T FIT IN FANTASY WORLDS

- SO TRANSFORM THEM INTO WANDS OR BOWS?

• BY HAVING **STANDARD** (ATEGORIES OF OBJECTS AND LOCAL **EQUIVALENCES**, CAN'T MOVEMENT BETWEEN WORLDS **WORK**?

YES AND NO

- IT CAN, BUT IT'S UNACCEPTABLE TO DEVELOPERS
- THE 1992 INTERMUD PROTOCOL TRIED IT, BUT FAILED BECAUSE OF TRUST ISSUES
- · ANYONE CAN MAKE THEIR OWN OBJECTS IN THEIR OWN WORLDS
 - THIS MEANS THAT EVERYONE HAS AN ASSAULT RIFLE EQUIVALENT
- · GAMES COMPLETELY LOSE BALANCE THIS WAY
- BESIDES, WHAT'S EPIC IN ONE GAME MAY BE STANDARD ISSUE IN ANOTHER

- ASSAULT RIFLES IN WAR GAMES AREN'T EPIC

FORM

- EVEN MOVING IDENTICAL OBJECTS FROM ONE GAME TO ANOTHER IS PROBLEMATIC
- THEIR IMPORTANCE VARIES GAME-TO-GAME
 - APPLES IN A SURVIVAL GAME
 - APPLES IN A COOKING GAME
- IF YOU **REALLY** WANT TO DO IT, GO THROUGH AN **INTERMEDIATE** FORM:
 - CONVERT THE ITEM INTO THIS INTERMEDIATE FORM
 - CONVERT FROM THE INTERMEDIATE FORM INTO SOMETHING IN THE TARGET GAME
- WE HAVE A NAME FOR THIS FORM: MONEY

- ASSUMING THEY TRUST EACH OTHER'S CONTENT

- IF TWO GAMES ACCEPT THE SAME BLOCKCHAINS, THEN THE OWNERSHIP AND STATUS OF OBJECTS CAN BE VERIFIED
- NFTS ARE STORED ON BLOCKCHAINS
- THIS IS WHERE NON-FUNGIBLE TOKENS COME IN
- HOW TO DO THAT?
- LIKEWISE IF YOU SELL IT
- IF YOUR EPIC ITEM IS DESTROYED IN ONE GAME, IT SHOULD BE DESTROYED IN ALL GAMES
- INTEROPERABILITY REQUIRES TRACKING

TRUST

- HOLD ON ... IF THEY DO TRUST EACH OTHER'S CONTENT, WHY BOTHER WITH NFTS?
 YOU DON'T NEED A DISTRIBUTED DATABASE, JUST A SHARED ONE
- IT'S ESPECIALLY WEIRD WHEN THE NFT ONLY WORK'S IN ONE GAME
 - IT DOESN'T TRUST ITSELF?
- WHAT DOES OWNERSHIP OF THE NFT ACTUALLY GIVE YOU ANYWAY?
 - "THE PRISON GUARDS **CAN'T** CONFISCATE MY WIRECUTTERS BECAUSE I OWN THE NFT!"?

SCARCITY

- NFTS ARE POPULAR AMONG METAVERSE FANS
- THEY INTRODUCE SCARCITY AND THEREFORE VALUE
 - BASICALLY, YOU CAN SELL THEM TO SUCKERS
- THEY HAVE SOME ISSUES, THOUGH ...
- FIRST OF ALL, DUPE BUGS
- IN RUNESCAPE, 2,000,000 EXTREMELY RARE
 PURPLE PARTY HATS WERE DUPED IN ONE DAY
 - ROLLING BACK A DATABASE EASY BUT PAINFUL
 - ROLLING BACK A **DISTRIBUTED** (BLOCKCHAIN) DATABASE – **FORGET** IT

INVENTORY

- IT'S ALSO HARD TO KEEP TRACK OF
 INVENTORY IN A BLOCKCHAIN DATABASE
- "TELL ME EVERYTHING IN THIS GAME THAT THIS PLAYER OWNS"
 - YOU HAVE TO GO THROUGH **ALL** THE OBJECTS IN THE GAME SEEING IF THE PLAYER OWNS THEM
 - YOU CAN'T INDEX BY PLAYER
- AS FOR **REAL ESTATE**, OWNERSHIP MAY MAKE SENSE IN **GAMES** BUT NOT IN GENERAL
 - IMAGINE THE INTERNET IF THERE WAS A HARD LIMIT ON THE NUMBER OF WEB PAGES IN EXISTENCE

TELEPORTATION

- REAL ESTATE IS VALUELESS IF YOU CAN TELEPORT
 - IT DOESN'T MATTER WHERE IT IS
- IF YOU **CAN'T** TELEPORT, WHO'S GOING TO WANT TO WALK PAST 20 **Deliver** BUILDINGS TO GET WHERE THEY WANT TO GO?
 - IT WOULD BE LIKE A WEB SITE YOU COULD ONLY ACCESS BY SCROLLING PAST 20 OTHER WEB SITES
- THIS IS ALL WELL-UNDERSTOOD (SECOND LIFE)
- METAVERSE LAND IS IN EFFECTIVELY INFINITE SUPPLY, YOU JUST NEED A HOSTING SERVICE

IP

- INTELLECTUAL PROPERTY IS GOING TO BE A MESS IN THE METAVERSE
 - AT LEAST UNTIL LAW-MAKERS SORT IT OUT
- IF A TEAM OF AAA ARTISTS CREATES AAA ART, THEY'LL WANT ROYALTIES IF YOU USE IT
 - OR IF SOMEONE VISITING YOUR GAME USES IT
- THEY MAY WISH TO **PROHIBIT** THE USE OF THEIR ART IN **COMPETITORS'** GAMES
 - PLAYERS MAY GET LOW-RES LOOKS FOR FREE
- ITS NOT JUST VISUAL ART, EITHER
 ITS SOUNDS, MUSIC, ANIMATION, FUNCTIONALITY, ...

CREATIVITY

- ONE OF THE **BIG** METAVERSE FEATURES THAT FANS PUSH IS **CREATIVITY**
 - YOU CAN CREATE CONTENT!
 - YOU CAN SELL CONTENT!
 - YOU CAN MAKE A LIVING OFF THE METAVERSE!
- YOU CAN DO THE SAME OFF THE APP STORE, SPOTIFY, KINDLE STORE, ETSY ETC.

- BUT ONLY PEOPLE WITH LUCK OR CONNECTIONS DO

- 95% OF CREATIVE WORK IS RUBBISH
 - UNFORTUNATELY, MOST PEOPLE THINK THEIRS IS IN THE 5% THAT ISN'T

PLAY TO EARN

- OR "WORK", AS IT'S CALLED ELSEWHERE
- THIS IS NOT LIKE PROFESSIONAL ESPORTS
- THIS IS 15 GUYS IN INDONESIA PLAYING FOR LESS THAN MINIMUM WAGE TO MINT NFTS AND CRYPTOCOINS YOU'LL BUY OFF THEM
 THAT THE DEVELOPER COULD GIVE YOU FOR FREE
- PZE WILL BE **DOMINATED** BY ORGANISED GROUPS (AS IN SECOND LIFE AND EVE ONLINE)
- PAID PLAY LOSES ITS INTRINSIC VALUE - GOOGLE "OVERJUSTIFICATION EFFECT"

ALS0

- · SOME OTHER QUICK POINTS
- TOXICITY IS LIKELY TO BE WORSE IN THE METAVERSE THAN IN MMOS
 - CO-ORDINATED GUILDS OF MILLIONS OF JERKS
- CLIENT SOFTWARE CAN RENDER PEOPLE DIFFERENTLY TO HOW THEY SEE THEMSELVES
 - EVERYONE'S ANIME! EVERYONE'S A CAT PERSON!
- CAN AI NPCS MOVE BETWEEN WORLDS OF THEIR OWN VOLITION?
 - THIS IS A **50-SLIDE** TALK ON ITS OWN!

- <u>WWW.HOWTOBEAGOD.COM</u> - FREE BOOK!

GITF

THIS IS THE GITF FILE FORMAT FOR 3D OBJECTS •

gITF - what the 😕?	Concepts The conceptual relationships between the ton-level	scenes, nodes The gITE ISON may contain scenes (with an optional	meshes The meshes may contain multiple mesh primitives	buffers, bufferViews, accessors	Sparse accessors
	elements of a gITF asset are shown here:	default scene). Each scene can contain an array of indices of nodes.	These refer to the geometry data that is required for rendering the mesh.	geometry of 3D models, animations, and skinning. The bufferViews add structural information to this	When only few elements of an accessor differ from a default value (which is often the case for morph
An overview of the basics of the GL Transmission Format	scene	"scene": 0, Each of the nodes can "scenes": I contain an array of indices	"meshes": [Each mesh primitive has a rendering mode, which is	data. The accessors define the exact type and layout of the data	targets), then the data can be given in a very compact form using a sparse data description:
gITF was designed and specified by the Khronos	node	of its children. This allows modeling a simple scene		Buffers' I Each of the buffers refers to a binary data file, using	"accessors": 1 The accessor defines the type of the data (here,
Group, for the efficient transfer of 3D content over networks.	camera mesh skin	hierarchy:	"indices": 0, POINTS, LINES, or TRIANGLES. "attributes": (The primitive also refers to	"bytelength": 35. "url": "buffer01.bin" a URI. It is the source of one block of raw data with the given byteLength.	"type": "SCALAR", "componentType": 5126, "count": 10, "the total element count.
The core of gITF is a JSON file that describes the structure and composition of a scene containing	material accessor + animation	("children": [3, 4],	"ROBITION": 1. "ROBAL": 2 of the vertices, using the indices of the accessors for	Each of the bufferViews	"aparao": (contains the count of
3D models. The top-level elements of this file are: scenes, nodes	material accessor - animation		i this data. The material that i should be used for rendering	"butter": 0." has a byteOffset and a "byteOffset": 4. byteLength, defining the	sparse data elements.
Basic structure of the scene	texture bufferView		is also given, by the index of the material.	"butter": 0 has a byteOffset and a byteLogft, defining the byteLogft, defining the bytestride": 12. "bytestride": 12. butfer that belongs to the buffer that belongs to the buffer there.), bufferView that contains the soarse data values.
cameras View configurations for the scene	sampler image buffer). "nodes": [A node may contain a local	Each attribute is defined by mapping the attribute name to the index of the accessor that contains the	and an optional OpenGL buffer target.	"bufferView": 1. The target indices for "componentType": 5123 the sparse data values
meshes Geometry of 3D objects	Binary data references	transform. This can be given as	attribute data. This data will be used as the vertex attributes when rendering the mesh. The attributes	"accessors": [The accessors define how the data of a bufferView is	are defined with a reference to a
buffers, bufferViews, accessors	The images and buffers of a gITF asset may refer to external files that contain the data that are required	1.0.0.0 0.1.0.0 0.0.1.0.0 rotation and scale properties.	may, for example, define the POSITION and the NORMAL of the vertices:		bufferView and the componentType.
Data references and data layout descriptions	for rendering the 3D content:	5,6,7,1 where the rotation is given as a quaternion. The local transform	POSITION 1.2 -2.6 4.3 2.7 -1.8 6.2	"byteoffset": 4. interpreted. iney may define an additional "compositive": 5126, byeOffset referring to the start of the bufferView,	The values are written into the final accessor data, at the positions that are given by the indices:
materials Definitions of how objects should be rendered	The buffers refer to binary files (.BIN) that contain	matrix is then computed as M = T * R * S "translation": where T, R and S are the matrices	NORMAL 0.0 2.0 0.0 0.71 0.71 0.0	"min" : [0.1, 0.2] "max" : [0.9, 0.8] and contain information about the type and layout of the buffer/view data:	(sparse (countré)
textures, images, samplers Surface appearance of objects	"byteLength": 102040, }	1 9.0.0 1. that are created from the	A 10-10-10 10	The data may, for example, be defined as 2D vectors of floating point values when the type is "VEC2"	4.3 9.1 5.2 2.7 values
skins	The images refer to image (files (PNG, IPG) that	" the global transform of a node is given by the product of all local	Position: (1.2, -2.6, 4.3) Normal: (0.0, 1.0, 0.0)	and the componentType is GL_FLOAT (5126). The range of all values is stored in the min and max	THE
Information for vertex skinning animations	"uri": "image01.pmg" contain texture data for the models.	transforms on the path from the root to the respective node.	A mesh may define multiple morph targets. Such	property. The data of multiple accessors may be interleaved	* ** *
Changes of properties over time	The data is referred to via URIs, but can also be	Each node may refer to a mesh or a camera, using indices that point	a morph target describes a deformation of the original mesh.	inside a bufferView. In this case, the bufferView will have a byteStride property that says how many	0 1 2 3 4 5 6 7 8 9 0.0 4.3 0.0 0.0 9.1 5.2 0.0 2.7 0.0 0.0
These elements are contained in arrays. References between the objects are established by using their indices to look up the objects in the arrays.	included directly in the JSON using data URIs. The data URI defines the MIME type, and contains the data as a base64 encoded string:	into the meshes and cameras arrays. "mesh": 4, These elements are then attached	for the second s	bytes are between the start of one element of an accessor, and the start of the next.	Final accessor data with 10 float values
It is also possible to store the whole asset in a single	Buffer data:	to these nodes. During rendering, instances of these elements are	"targets": 1 can contain an array of targets. These are dictionaries	The buffer data is read from a file:	24 28 32
binary gITF file. In this case, the JSON data is stored as a string, followed by the binary data of buffers	"data:application/gitf-buffer:base64,AAABAATAAgA" Image data (PNG):	created and transformed with the global transform of the node.	*postrzion*; 11, that map hames of attributes *postal_1 to the indices of accessors that contain the displacements of	buffer bytelength = 35	be used by a mesh primitive,
or images.	"data: inage/prg:base64,17008x0X"	The translation, rotation and scale properties of a node may also be the target of an animation: The	the geometry for the target.	bufferView 4 8 12 16 20	to access 2D texture 24 28 32 coordinates: The data of the bufferView may be bound
Further resources	Version 2.0a	animation then describes how one property changes over time. The attached objects will move	The mesh may also contain an array of weights that define the contribution of each morph	The accessor defines an additional offset:	as an OpenGL buffer, using glBindBuffer. Then, the
The Khronos gITF landing page: The Khronos https://www.khronos.org/gitf https://git	gITF GitHub repository: gITF version 2.0 This overview is hub.com/KhronosGroup/gITF non-normative!	accordingly, allowing to model moving objects or camera flights.	target to the final, rendered weights": [0, 0.5] state of the mesh.	accessor 8 12 16 20 byteOffset = 4 IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	24 28 32 properties of the accessor may be used to define this
	Feedback: gitf@marco-hutter.de	Nodes are also used in vertex skinning: A node hierarchy can define the skeleton of an animated	Combining multiple morph targets with different	The bufferView defines a stride between the element 8 12 16 20 by estimate = 12	ts: buffer as vertex attribute 24 28 data, by passing them to alVertexAttribPointer
	gITF and the gITF logo are trademarks of the	character. The node then refers to a mesh and to a skin. The skin contains further information about how the mesh is deformed based on the current	weights allows, for example, modeling different facial expressions of a character: The weights can	byteStride = 12	the start have been a start and the start of
CONNECTING SERTINANE TO BLICON	Khronos Group Inc. 02016-2017 Marco Hutter www.marco-hutter.de	skeleton pose.	be modified with an animation, to interpolate between different states of the geometry.		x ₁ y ₁
cameras	skins	Computing the skinning matrix		animations	
Each of the nodes may refer to one of the cameras that are defined in the gITF asset.	A gITF asset may contain the information that is pecessary to perform vertex skinning. With vertex	Computing the skinning matrix The skinning matrix describes how the vertices of a n skeleton. The skinning matrix is a weighted combinat	nesh are transformed based on the current pose of a ion of joint matrices.	A gITF asset can contain animations . An animation can the local transform of the node, or to the weights for the	he morph targets.
Each of the nodes may refer to one of the cameras that are defined in the gITF asset.	A gITF asset may contain the information that is necessary to perform vertex skinning. With vertex skinning, it is possible to let the vertices of a mesh be influenced by the bones of a skeleton, based on its current pose.	The skinning matrix describes how the vertices of a m skeleton. The skinning matrix is a weighted combinat Computing the joint matrices	ion of joint matrices.	A gITF asset can contain animations. An animation of the local transform of the node, or to the weights for ti "asimations": [Each animation com (array of samplers.	he morph targets. sists of two elements: An array of channels and an
Each of the nodes may refer to one of the cameras that are defined in the gITF asset.	A gITF asset may contain the information that is necessary to perform vertex skinning. It's possible to let the vertices of a mesh be influenced by the bones of a skeleton, based on it's current pose. "nodes": [A node that refers to a mesh	The skinning matrix describes how the vertices of a m skeleton. The skinning matrix is a weighted combinat Computing the joint matrices	for of joint matrices. For each node whose index appears in the joints of the skin, a global transform matrix can be computed. It transforms the mesh from the local space of the	A gITF asset can contain animations. An animation co the local transform of the node, or to the weights for the "animations": { { { bachanimation core array of samplers. { bachanimation core array of samplers. Each animation core array of samplers. Each channel define	he morph targets. sists of two elements: An array of channels and an is the target of the animation. This target usually ion the lote of this node, and to a nath , which
Each of the nodes may refer to one of the cameras that are defined in the gITF asset.	A giff asset may contain the information that is necessary to perform vertex skinning. With vertex skinning, it is possible to let the vertices of a mesh influence of by the bones of a skeleton, based on its current pose. A node that refers to a mesh maker : i "skine" is not refer to a skin.	The skinning matrix describes how the vertices of a n skeleton. The skinning matrix is a weighted combinat Computing the joint matrices The skin refers to the inverseBindMatrices . This is an accessor which contains one inverse bind	ion of joint matrices. For each node whose index appears in the joints of the skin, a global transform matrix can be computed.	A giff asset can contain animations. An animation can be be local transform of the node, or to the weights for the local transform of the node, or to the weights for the distribution of the node of the distribution of the dist	he morph targets. sists of two elements: An array of channels and an its the target of the animation. This target usually ing the index of this node, and to a path , which nimated property. The path may be "translation". Le", affecting the local transform of the node, or
Each of the nodes may refer to one of the cameras that are defined in the gITE asset.	A giff asset may contain the information that is necessary to perform vertex skinning. With vertex skinning, it is possible to let the vertices of a mesh influenced by the bones of a skeleton, based on its current pose. A node that refers to a mesh may also refer to a skin .	The skinning matrix describes how the vertices of a resolution of the solution matrix is a weighted combined to the solution of the solution o	ion of joint matrices. For each node whose index appears in the joints of the skin, a global transform matrix can be computed it tensions the mesh from the local space of the joint, and is called globalJointTransform.	A giff sest can cordain aminations An animation of the incide, route the incide route of the incide, route in the incide route of the incide route	he morph targets. sists of two elements: An array of channels and an is the target of the animation. This target usually ing the index of this node, and to a path , which immated property. The path may be 'translation '. to animate the weights of the morph targets of referred to by the node. The channel also refers
Each of the nodes may refer to one of the cameras that are defined in the gITE asset.	A giff asset may contain the information that is necessary to perform write kinning, with writek abring, it is possible to kit the writekes of a meth Science pose.	The skinning matrix describes how the vertices of a residence. The skinning matrix is a weighted combined to the single state of the skinning to the inverse bind matrix for each bink. Each of these matrices randoms the mesh into the local space of the local sp	Ion of joint matrices. For each node whose index appears in the joints of the skin, a global transform matrix can be computed, joint, based on the current global burnsform of the joint, and is called globalJointTransform.	A giff asst can contan animations. An animation of the local transform the mode, not be weights for the local transform to the mode, not be weights for the local transform to the loca	he morph targets. Sists of two elements: An array of channels and an sist of two elements: An array of channels and an is the target of the animation. This target usually imple induces of this node, and to a path , which mininted property. The path may be r translateLace ¹ . Las ² , affecting the local transform of the node, or referred to by the node. The channel also refers a summatives the actual animation data. the input and outbut data, using the indices of
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 "texCoord": 1

"emissiveTexture": {
 "index": 3,
 "texCoord": 1

[0.4, 0.8, 0.6]

contained in a giff sease. The materials to should be rendered, based on physical material propertie allows to apply **Physically Based Rendering (PBR)** tect to make sure that the appearance of the rendered object i consistent among all renderers. The defamily Fach mesh primitive m refer to one of the materials that are cribe how an object rial properties. This Consider a minor an endotres a The default material model is the **Metallic-Roughness-Model**. Values between 0.0 and 1.0 are used to describe how much the material characteristics resemble that of a metal, and how rough the surface of the object is. These properties may either be given as individual values that apply to the whole object, or be read from textures.



The properties that define a material in the Metallic-Roughness Model are summarized in the pbrHealtIcRoughness biological the baseLederFormers is the main texture that will be applied to the the baseLederFormers is the main texture that will be applied to the bius and apha component of the color. If no texture is used, these values will define to color of the whole object. The metallicRoughness Texture collars the metaleness value in defined. The color of the whole object. },
"baseColorFactor":
 [1.0, 0.75, 0.35, 1.0],
"metallicRoughnessTexture": [

occursion strength is a scaing factor to be applied to these values. • The emissiveTaxture refers to a texture that may be used to illuminate parts of the object surface: It defines the color of the light that is emitted from the surface. The emissiveFactor contains scaling factors for the red, green and blue components of this texture

Material properties in textures meshes": ["materials": [ALLIVE': [Tassel: 1 art Tassel: 1 etallicFactor": 1.0, suphressFactor": 1.0

Binary gITF files

12-byte header

> weights= •

WebGL Rendering Techniques: Why State Conference of the State State

In addition to the properties that are defined via the Metallic-Roughness Model, the material may contain other properties that affect the object appearance: The normalTexture refers to a texture that contains tangent-space normal information, and a scale factor that will be applied to these normals. • The occlusionTexture refers to a texture that defines areas of the surface that are occluded from light, and thus rendered darker. This information is contained in the "red" channel of the texture. The occlusion strength is a scaling factor to be applied to these values.

The texture references in a material always contain the **index** of the texture. They may contain the index of the texture. They may also contain the textured set index. This is the number that determines the TEXCOORD_cap. attribute of the rendered mesh primitive that contains the texture coordinates for this texture, with 0 being the default. "textures": (1 "source") 4, "sampler": 2],

Binary gITF files to even the set drawbacks, there is the option for including setemations in year research in the standard gIT for the set of the gIT pilot and the strawg data are the option for including setemation are set of the gIT pilot and the strawg data are set of the gIT pilot and the strawg data are set of the gIT pilot and the strawg data are set of the gIT pilot and the strawg data are set of the gIT pilot and the strawg data are set of the gIT pilot and the strawg data are set of the gIT pilot and the set of the gIT pilot are set of the gIT pilot and the set of the gIT pilot are set of the gIT pilot and the set of the gIT pilot are set of

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Extensions



"textures" : [Extensions allow adding arbitrary objects in the extensions property Tablesters" : term. Termer extensions and it may contain for the extension, and it may contain property extension-specifi properties.

Existing extensions

For following extensions are developed and maintained on the Khronos GitHub repository:
 Specular-Glossiness Materials

https://github.com/direnons/scrupt/IT/Tirreemaster/setensions/thronos/ORR_materials_ptrSpecularGossiness This extension is an alternative to the default Metallic-Roughness material model: It allows to define the material properties based on specular and glossiness values.

the material properties based on specular and glossiness values. • Common Materials Mitry/Applications/Common/Comm Common/Com

a diffuse, specurar, and emissive Color, and a summers value. • Common Lights https://pitha.com/brows/forest/file/interfised



PRACTICALITIES

- THERE ARE OUTSTANDING TECHNICAL PROBLEMS THAT HAVE YET TO BE SOLVED
- WE'VE HAD ALL THE FUNCTIONALITY THE METAVERSE NEEDS FOR MANY YEARS

- JUST NOT ALL INTEGRATED TOGETHER

- EVEN AFTER ALL THIS TIME, THOUGH, CREATING SIMPLE WORKING OBJECTS SUCH AS DOORS IS NOT TRIVIAL
- THERE ARE **DOZENS** OF INTERACTIONS BETWEEN DIFFERENT **DATA** SETS

- SHARING THOSE NEEDS STANDARDS WE DON'T HAVE

STANDARDS

- STANDARDS ARE GENERALLY A GOOD THING, BUT THEY CAN STIFLE INNOVATION
- TEXT MUDS ALL USED TO BE **DIFFERENT** UNTIL PEOPLE CREATED **ENGINES**
- THEN, WE GOT STOCK MUD SYNDROME
- · SIMILAR THINGS ARE HAPPENING WITH UNITY
 - PEOPLE WRITE ORIGINAL GAMES THAT ARE JUST LIKE ALL THE OTHER ORIGINAL GAMES THAT USE THE SAME TOOLS AND ASSETS
- STOCK UNITY SYNDROME?
- STOCK METAVERSE SYNDROME?

SUMMARY

- ALL THE COMPONENTS OF THE METAVERSE HAVE ALREADY BEEN DONE IN MMOS
 - MORE WORK IS STILL NEEDED, THOUGH
 - SOME OF THIS WILL HELP MMOS
- NOT ALL OF THESE COMPONENTS ARE POPULAR AMONG GAMERS
- HOWEVER, IF THE PEOPLE WHO LIKE RMT, NFTS,
 CRYPTO AND BEING JERK'S MIGRATE TO THE METAVERSE, THAT WOULD BE WONDERFUL!
- GAMERS WOULD FINALLY GET THEIR GAMES BACK!