SIGGRAPH 2014 BOF:
Cultural Heritage & Mixed Reality

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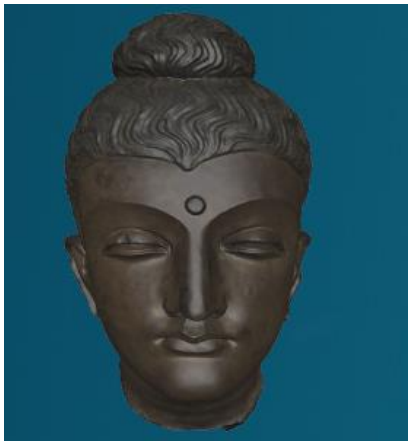
Vancouver, Canada 8 - 15 August 2014



Outline

- Introduction
- Opportunities
- Application Examples & Requirements
  - Cultural and Natural Heritage
    (see also Web3D 2014 Workshop)
  - Mixed and Augmented Reality
- Scoping the challenge for Web3D graphics community
- Call to Action

Steve Miller was Right!

- "Time keeps on slippin… slippin … slippin into the future"
  - Memories fade
  - Materials degrade
  - Political factors upheaval /access

- Preservation often comes at the expense of access

David Byrne was right!

"Same as it ever was...
Look where my hand was
Time isn't holding up
Time is an asterisk
Same as it ever was... "

Once in a Lifetime

… The time is now!

Heritage

Millions of cultural and natural heritage artifacts populate our museums and about 90% still await discovery in museum archives!

- Can digital archives help us with this problem?
- Can the web be used to multi-purpose these precious assets?

Web3D Heritage

3D Digital models can provide:

- Arbitrary availability and concurrent access to digital surrogates of cultural heritage artifacts for art historians and scientists:
  - Use of digital surrogates in cultural heritage institutions for exhibition planning, documentation and acquisition planning.
  - Virtual presentation (combined with new forms of presentation technologies, such as hybrid exhibitions) as a means to increase attractiveness
  - Possibility for new science and research!

Web3D Heritage

3D Digital models can provide:

- Physical surrogates based on digital 3D models:
  - Substitute loaning of cultural heritage artifacts by digital surrogates avoiding damage from transport, insurance fees and legal issues.
  - Reusability of historically correct 3D models in gaming and film industry as well as for architectural reconstruction.

www.Web3D.org

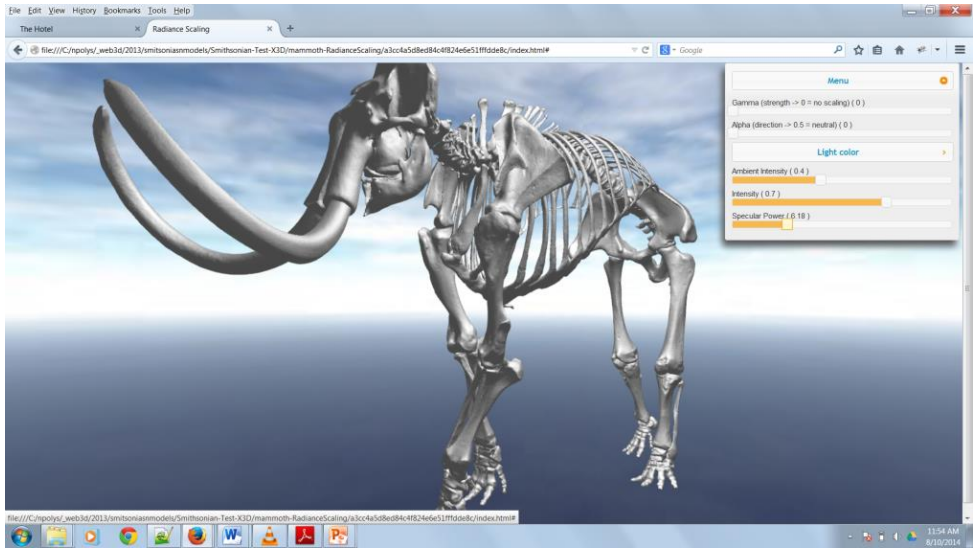
- *See Homepage Case Studies!*

Game Changers

- Scanning Technology – increase resolution, accuracy, coverage
- Processing Tools – Meshlab, Polytrans, 3DS exporters, Geomagik, Rawkee, … ?
- Publication platforms for industrial strength immersion (X3D) and/or web-wide interactive 3D (HTML5+X3DOM)
- 3D Printers increase in capability, decrease in cost

Challenges I

- Acquisition
  - Accuracy: e..g. physical sensors, occlusion
  - speed
- Scan data size
  - Meshes
  - Texture maps
  - Volumes
  - … other material descriptions



Challenges II

- Processing geometry and appearances
  - to polygon and low polygon models
  - Hole filling
  - Re-topologizing
  - … Many techniques (e.g. in Meshlab)

    Work better or worse depending on the data

Challenges III

- Durable collections
  - Asset formats built for long-term viability of content
  - Not subject to proprietary whims, royalties
  - Use ISO standards for international recognition
- Interoperable collections:
  - CIDOC ontologies, LIDO XML – populating and integrating metadata into the scene graph
  - Annotation / population of ontologies
  - Shape database Search

Challenges IV

- Accessible collections (portability)
  - Not bound to specific platforms
  - Reproducible visualizations

Can we find best practice?

- Workflows, portals
- Lossiness and processing ,
  Visual fidelity in delivery
- ***Open tools and reproducible presentations***

Good news:

We are working on it!

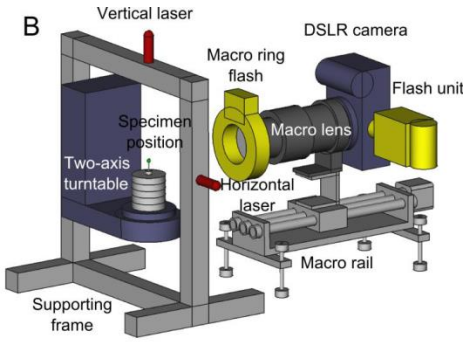
Pedro Santos, Fraunhofer IGD

EU and National initiatives:

- CoForm
- CultLab3D

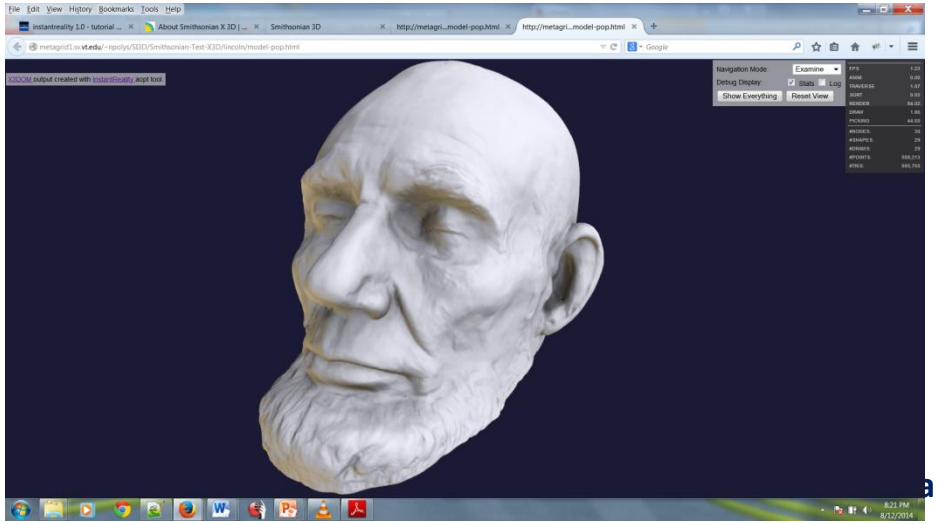
Cultural & Natural Heritage

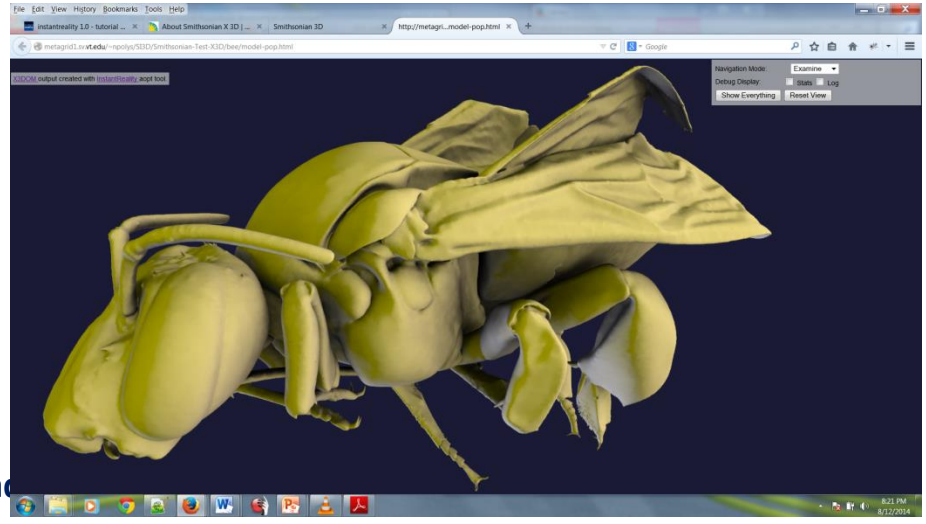
- What requirements are common here?
- What makes these applications or communities different?
  - See Matt Adcock' Web3D 2014 poster on digital entomology!



Smithsonian 3D

- Keynotes @ Web3D 2014:
  - Günter Waibel, Director of Digitization Smithsonian Inst. http://3d.si.edu/
  - http://metagrid1.sv.vt.edu/~npolys/SI3D/

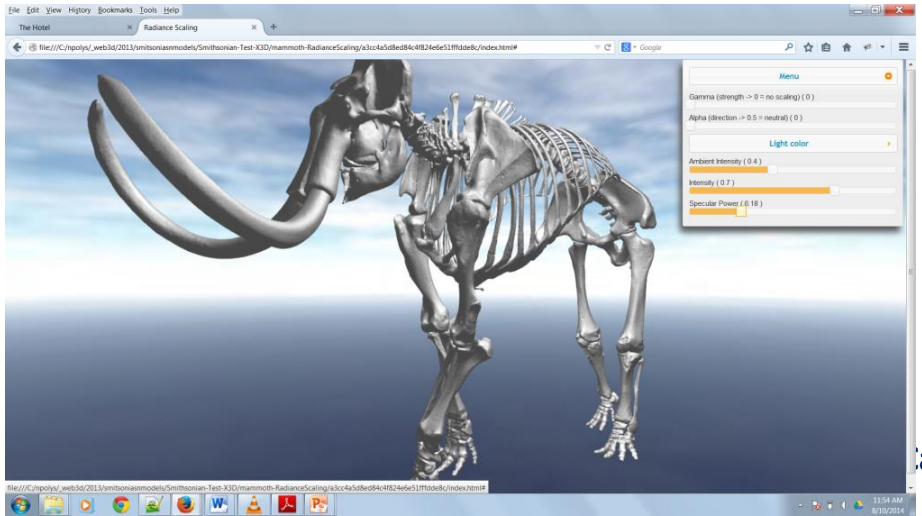


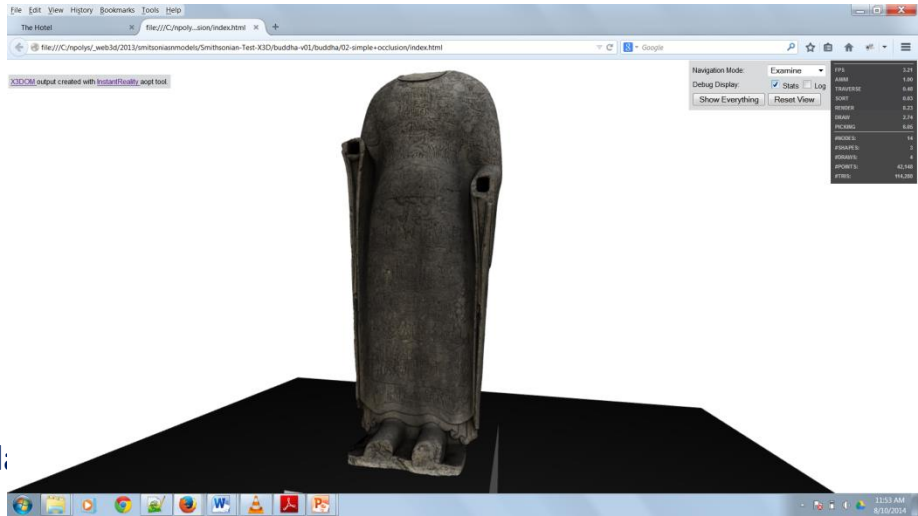


More Digital Heritage Examples

X3D from phones to CAVEs!

- Cosmic Buddha
- Mammoth w/ interactive multi-texture control
- Using models to test new X3D compression methods and metadata schemes





X3DOM.org


File Edit View History Bookmarks Tools Help
X3DOM - home
www.x3dom.org/?page_id=2429
Google
x3dom
Instant 3D the HTML way!
home about showcases examples browser support documentation get it profile get involved legals
Fork me on GitHub
NIST/DLMF uses X3DOM
March 24th, 2014
The American National Institute of Standards and Technology (NIST) has just made public an X3DOM version of the Digital Library of Mathematical Functions (DLMF). VRML content has been successfully migrated to X3DOM, so that every WebGL-capable browser can now be used to inspect high-quality visualizations of mathematical functions from the DLMF.
Figure 21.4.1 (See in context.)
Colormap
Modulus Phase Quadrant
Viewpoint
Scale Figure
Cutting Control
github.com/x3dom/x3dom
11:31 PM
8/11/2014

Fraunhofer IGD

- Liberal Open Source WebGL library for X3D and HTML5 integration – *Git it!*
- X3DOM volume rendering component

… **X3DOM.ORG …**

- Other strong contributors around the world include VicomTech (Web3D Members)

See Also: the industrial strength *InstantReality.org*

Web3D

The open, not-for-profit vehicle for the community to develop and drive international standards and recommendations

- Special Interest Groups
- Working Groups

Experiment: Mixed and Augmented Reality

- VT

CONDITIONS		Zoom	
		Physical Device Proximity	Finger Pinch Manipulation
Rotation	Physical Device Orientation	None	Pinch
	Finger Glide Manipulation	Touch	Both

Interface	Interface Type	Techniques	Accuracy Ranking	Speed Ranking	Ease of Use Ranking	Intuitiveness Ranking	Favorite Interface	Favorite Rotation	Favorite Zoom
Both	Non-mixed	Pinch Zoom Touch Rotation	1	2	3	2	Tied	Yes	Tied
None	Non-mixed	Physical Zoom Physical Rotation	2	1	1	1			Tied
Pinch	Mixed	Pinch Zoom Physical Rotation	3	4	4	3			Tied
Touch	Mixed	Physical Zoom Touch Rotation	4	3	2	4	Tied	Yes	Tied

3DUI 2013 Poster: A Comparative Study of Metaphors for Investigating Augmented Reality Artifacts

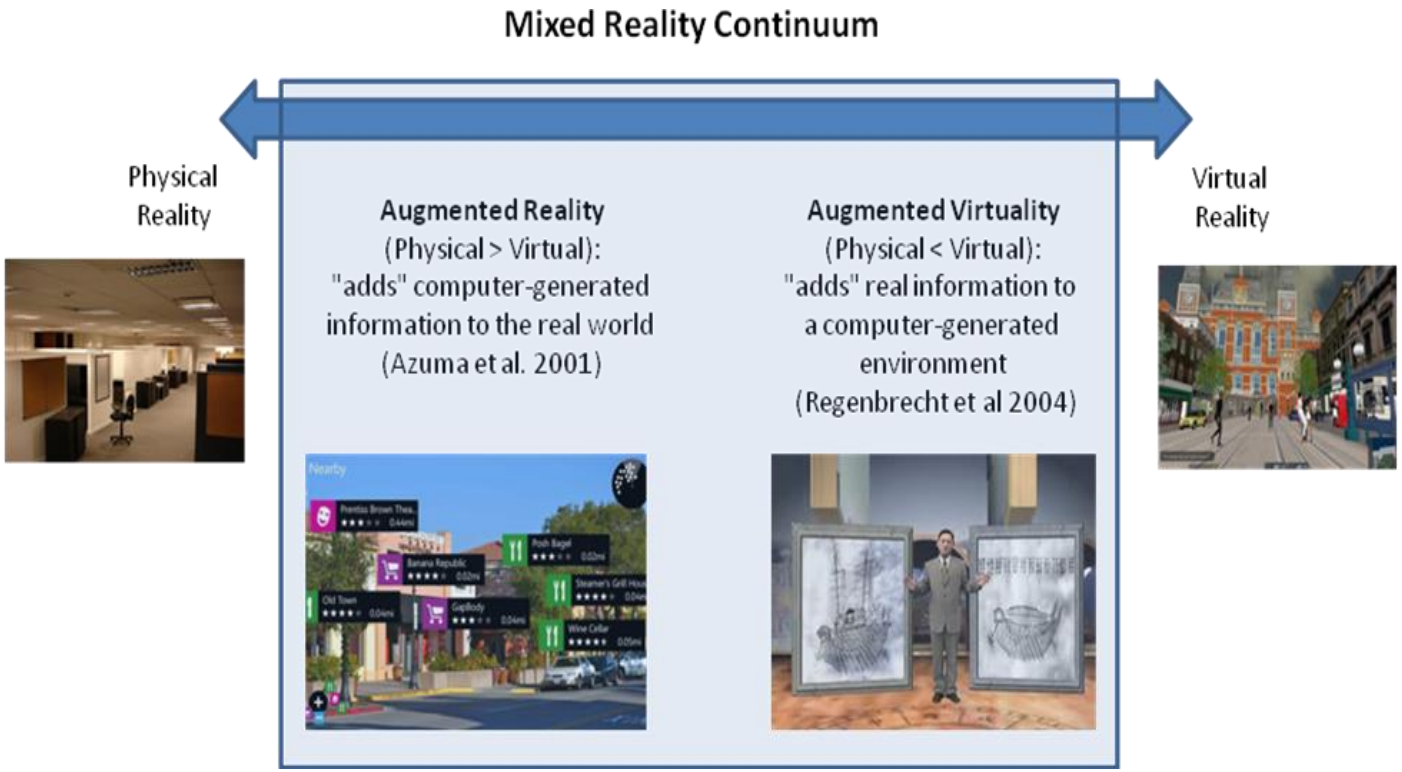
Kimberly Zeitz, Rebecca Zeitz, Congwu Tao, and Nicholas Polys

Exciting Times!

- A lot of ‘Wild West’ innovation and compelling applications
- A growing concern for longevity and interoperability of MAR content: deliberate design for long term success
- Between 2011 and 2013, several SDOs took on the problem

Mixed and Augmented Reality

MAR focus


Mixed Reality Continuum
Physical Reality
Augmented Reality
(Physical > Virtual):
"adds" computer-generated information to the real world
(Azuma et al. 2001)
Augmented Virtuality
(Physical < Virtual):
"adds" real information to a computer-generated environment
(Regenbrecht et al 2004)
Virtual Reality

Hard Problem for 1 SDO!

- Web3D Consortium
  - http://www.web3d.org/realtime-3d/working-groups/augmented-reality-ar
- Open Geospatial Consortium
  - http://www.opengeospatial.org/projects/groups/arml2.0swg
- Khronos
  - Web/OpenGL, OpenMax AL/SL, StreamInput
- MPEG
  - ARAF: http://wg11.sc29.org/augmentedReality/

=====➔ ISO SC 24 + SC 29: Joint (ad-hoc) Working Group

ISO MAR Reference Model

- **In development**
- **Uses a component-based classification system**
- **Covers terminology**
- **Demonstrates models with local and remote resources for processing and presentation**
  - 6 state-of-the-art use cases
  - 2 Point Of Interest (POI) use cases
  - Using 3D video
  - Using 3D audio

Views

Viewpoint	Viewpoint Definition	Topics in RM-MAR
Computational	• Outer specification of a generic system/module /component • Interconnection	• MAR component functionalities and interconnections • Input / output specification
Information	• Information requirement • Semantics • Data/information model	• Generic MAR Content • Inter-module data model • MAR context/event model
Enterprise	• Business model • Actors	• Potential business model for each actor • Actors and their role for MAR

Global Architecture

Sensors / Actuators

AVH Display / UI

MAR Engine

MAR Scene Descriptions

Services

Additional Media

Computational Viewpoint

Real World AVH Capture

Actuator Device

AVH Display / UI

Rec/Tracker

Spatial Mapper

Context Mapper

Scene Graph Engine

AVH Renderer

MAR Engine

MAR Scene Descriptions

Services

Additional Media

Get involved in MAR Reference Model

1. Stakeholders and participants
   - MAR Reference Model is intended to become an ISO standard
   - Animated by SC24/WG9 and SC29/WG11
   - Contributions from Web3D, ARS, OGC
   - Open to all interested in developing an open and free standard
2. ISO Intellectual property rights policy
   - MAR Reference model will be published by ISO under the royalty free policy
3. How to get involved
   - Participate to meetings of any standard organization involved (ISO, Web3D, OGC)
   - Direct contributions on http://wg11.sc29.org/trac/augmentedreality
4. Contact information
   - Marius Preda (marius.preda@it-sudparis.eu)
   - Gerry Kim (gjkim@korea.ac.kr)

X3D AR

- **X3D version 3.4 and 4.0 will support the MAR Reference model (4.0 = HTML5/DOM/X3DOM)**
  - Much work is complete already
- **X3D AR working group cochairs:**
  - ar_chairs@web3d.org
  - Gun Lee, University of New Zealand
  - Timo Engelke, Fraunhofer IGD
- **X3D working group cochair:**
  - Don Brutzman, Naval Postgraduate School
  - brutzman@nps.edu cell +1.831.402.4809

Web3D Consortium

- Members from Korea, Germany, France actively working:
  - Rationalized X3D node proposal to support the MAR Reference Model
  - Ongoing design discussions on mailing list, phone calls, wiki:
    - http://www.web3d.org/wiki/index.php/X3D_and_Augmented_Reality
    - http://www.web3d.org/wiki/index.php?title=AR_Proposal_Public_Review

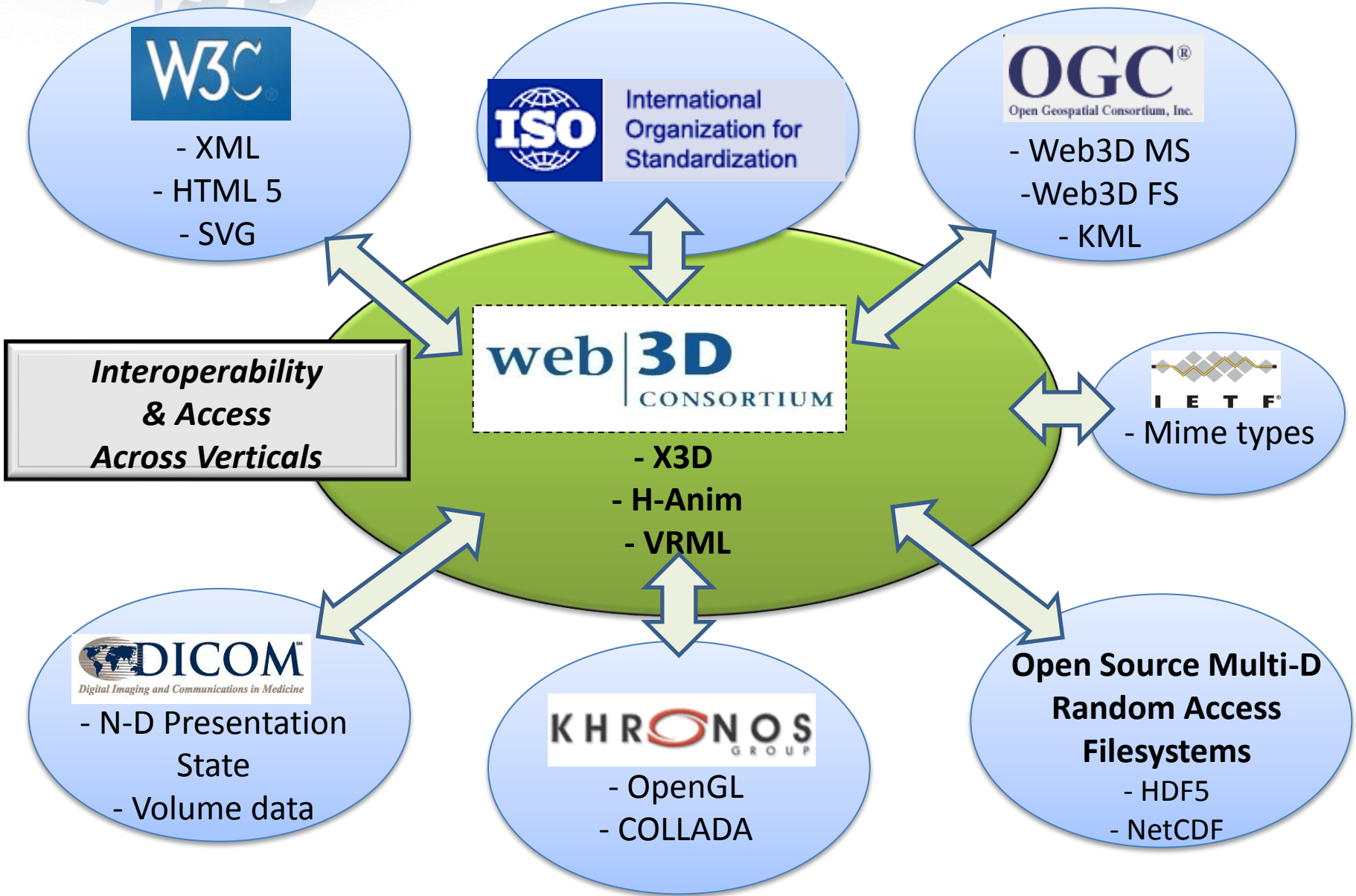
Open Standards

www.web3d.org

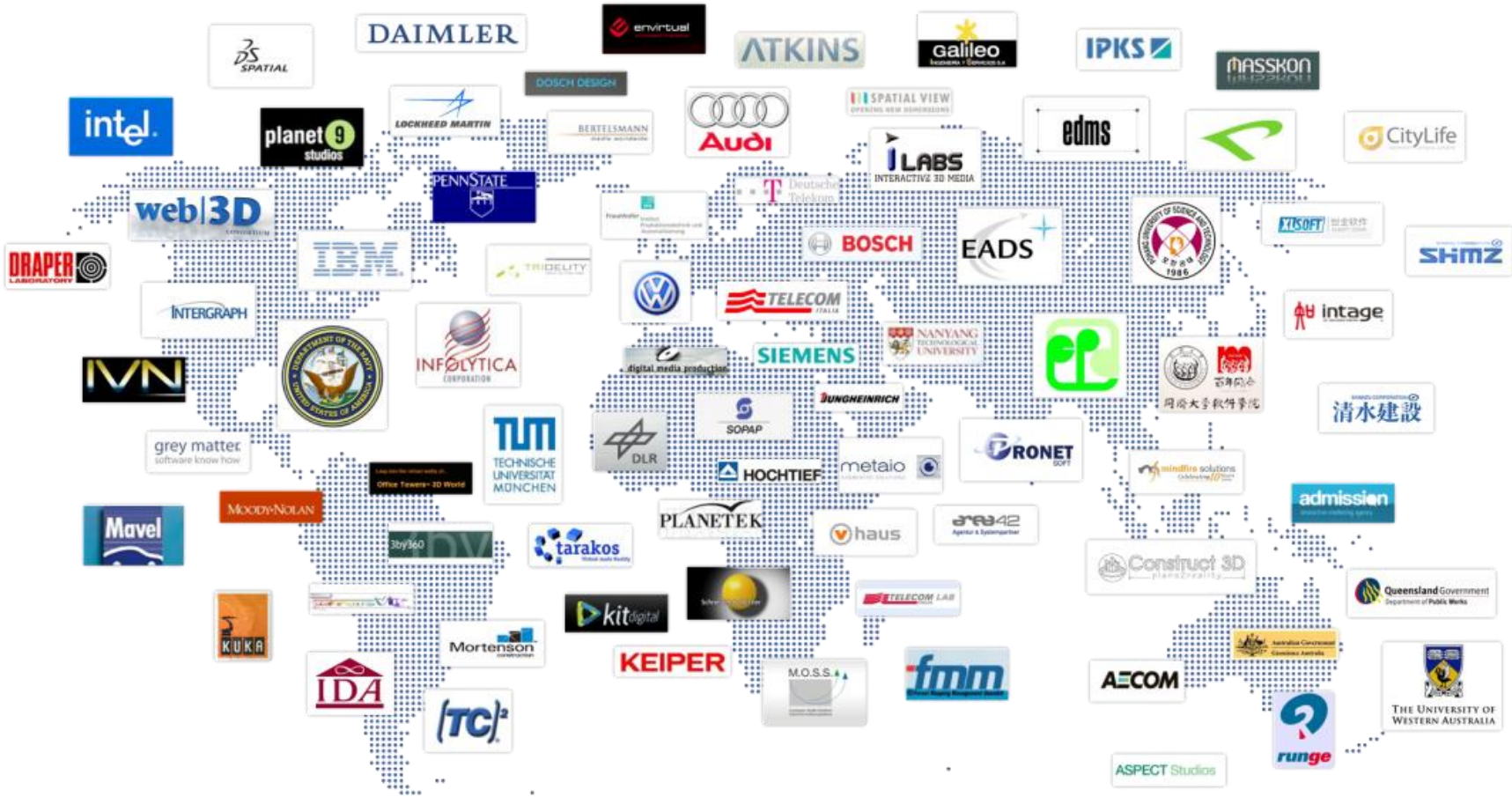
- Portability
- Durability
- IP independence
- International recognition and support

Web3D 2015

- **June 18-20, Heraklion, Crete (Greece)!**


W3C
- XML
- HTML 5
- SVG
ISO
International Organization for Standardization
OGC
Open Geospatial Consortium, Inc.
- Web3D MS
-Web3D FS
- KML
Interoperability & Access Across Verticals
web3D CONSORTIUM
- X3D
- H-Anim
- VRML
IETF
- Mime types
DICOM
Digital Imaging and Communications in Medicine
- N-D Presentation State
- Volume data
KHRONOS GROUP
- OpenGL
- COLLADA
Open Source Multi-D Random Access Filesystems
- HDF5
- NetCDF

Adoption



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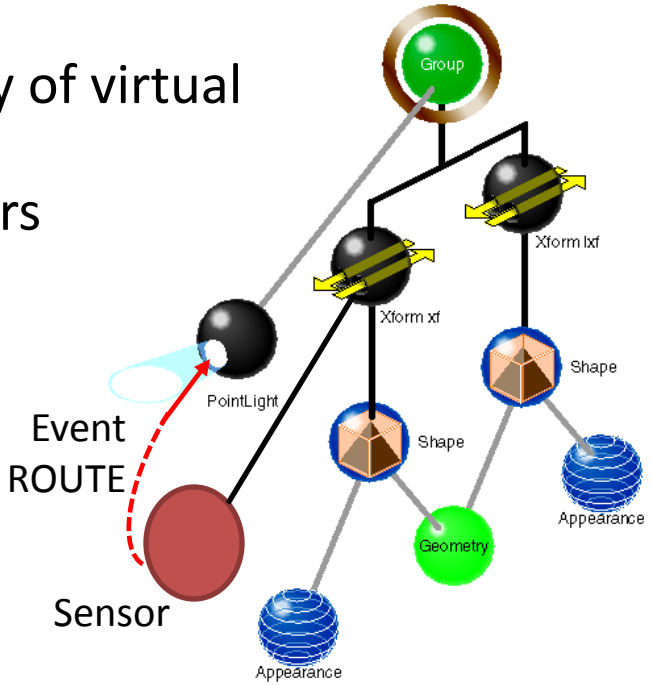
Standard Scope

Scene graph for real-time interactive delivery of virtual environments over the web:

- Meshes, lights, materials, textures, shaders
- Integrated video, audio
- Animation
- Interaction
- Behaviors
- Scripts
- Application Programming Interfaces



- 3.3 examples for Medical Imaging, CAD and Geospatial support!

X3D Book & Online Resources

- http://www.x3dgraphics.com/

Extensible
3D Graphics
For Web Authors

From NPS grad class – slides, videos, examples all online!!!

Source of Specs, Models, Links, Bulleting boards, Blogs, Mailing lists,

http://www.web3d.org

Charter and Scoping Discussion

- Gather Critical mass:
  - Listerve
  - Wiki
- Reflect
- Participate in setting our direction:
  - All comments welcome!

Contact:

npolys@vt.edu