

Augmented Reality Why the IETF Should Care



Perrey

Research & Consulting



This Session will

- Prepare the “ground” for discussion with some terminology and frameworks
 - Define AR
 - Use Case Categories
 - Standards activities
- Provide some parameters that could be relevant to IETF
- Recommend that AR use cases be part (or the focus of) future IETF work

Mont Blanc

Geneva



Lake Geneva

Arriving in
Montreux in
15 min



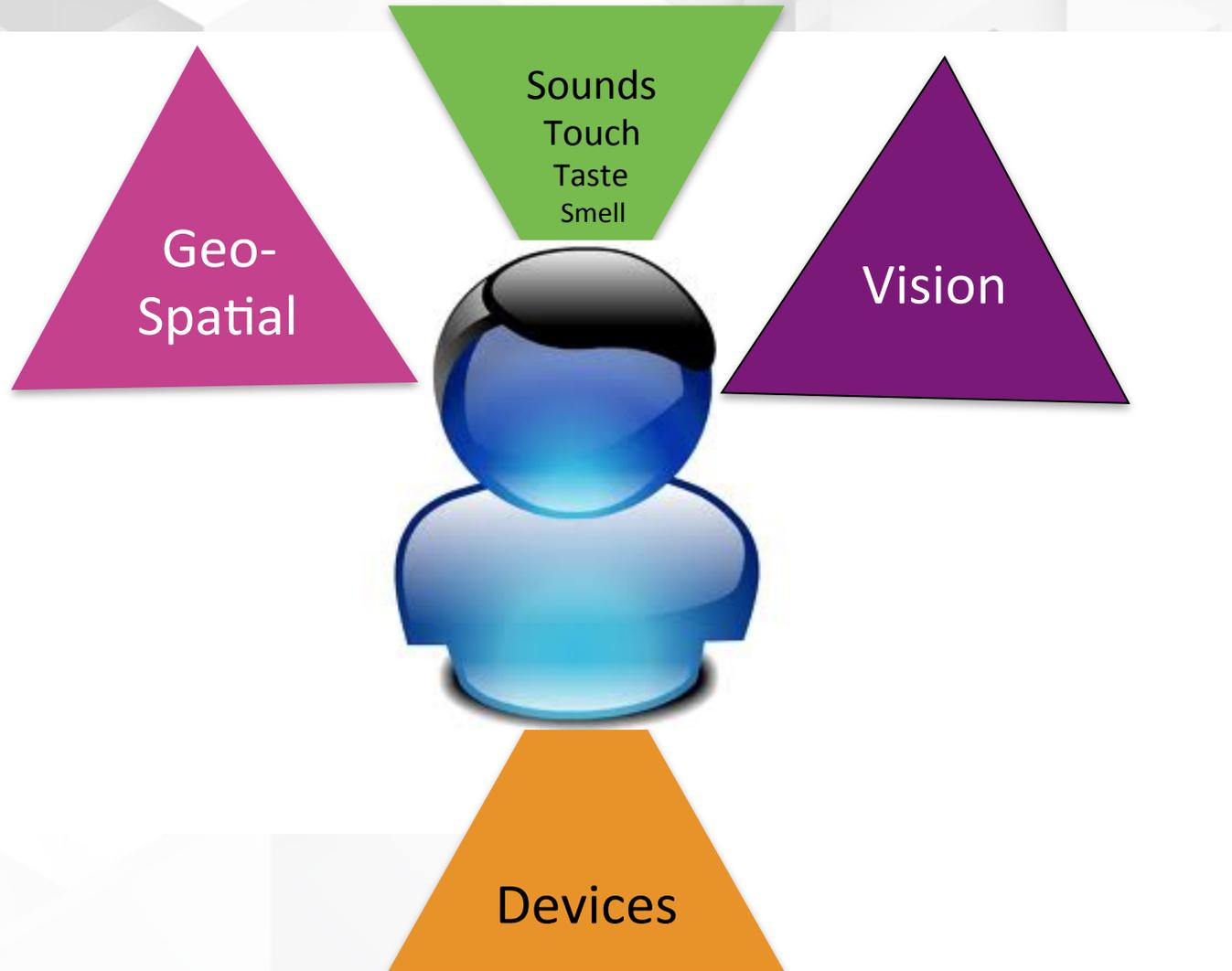
camera, GPS, compass,
accelerometer, microphone



The User is the Point

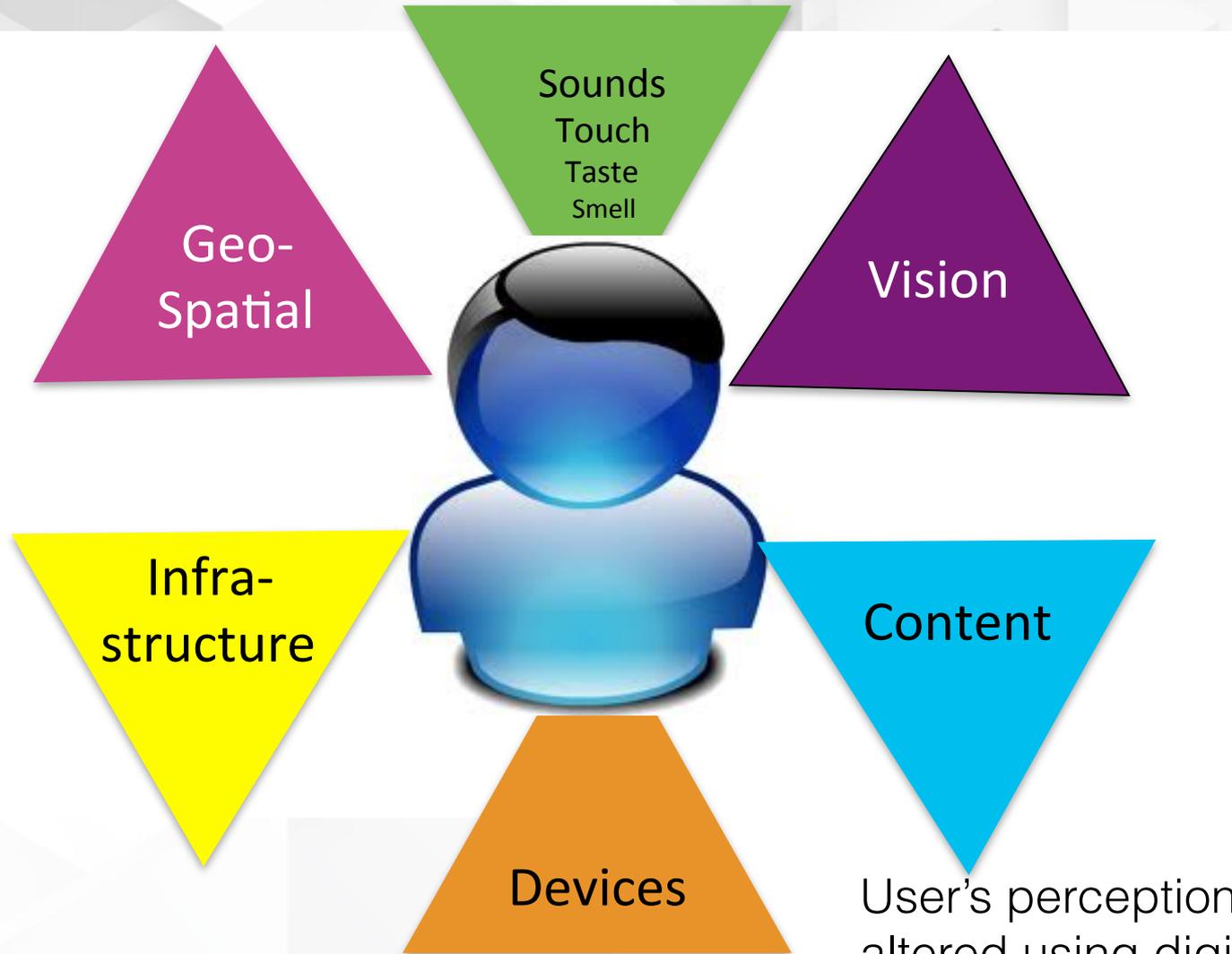


User's Multi-Modal Context





AR Enhances User Experiences



User's perception of reality altered using digital assets *synchronized* with reality



Retail Shopper



Tissot Watch
campaign on High Street in GQ and T3
<http://www.youtube.com/watch?v=sM70yME1OLk&>



Hostage Wear
<http://site.layar.com/company/blog/layer-of-the-week-shop-till-you-drop-in-the-new-hostage-virtual-shopping-layer>



Adidas Neighborhood
http://www.adidas.com/campaigns/originals_ss10/content/microsites/neighborhood/default.aspx

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Entertainment/Game Applications



Sosro (Indonesia)



DNP Japan

<http://augmentedblog.wordpress.com/2010/04/09/metaio-and-dnp-japan-develop-first-augmented-reality-iphone-app-for-the-collectible-card-market/>



Acrossair Virus killer 360

<http://www.youtube.com/watch?v=qssUKAVN2ki>



Coke Zero and Avatar

<http://www.youtube.com/watch?v=APQ2OxgCNzE>

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Overcoming barriers due to vision or language



Colorblind Vision

- Normal Vision**
Regular color vision
92% male - 99.5% female
- Deuteranopia**
Green weakness
5% male - 0.38% female
- Protanopia**
Red weakness
2.5% male - 0.02% female
- Tritanopia**
Blue weakness
0.5% male - 0.002% female
- Achromatopsia**
Inability to see color
0.005% of the population



<http://opcoders.com/#colorblind-vision>

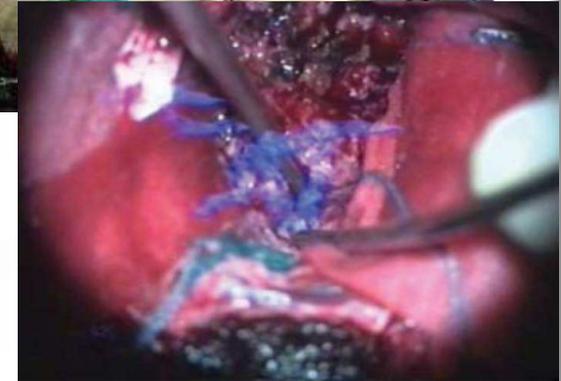


<http://www.questvisual.com/us>





Medical/Healthcare



Above, operating room with the MAGI system. Below, enhanced view perceived by the surgeon with overlaid virtual anatomical structure in blue.

Source: Edwards et al. Guy's Hospital, London

http://www.readwriteweb.com/archives/how_augmented_reality_helps_doctors_save_lives.php

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Design/Architecture



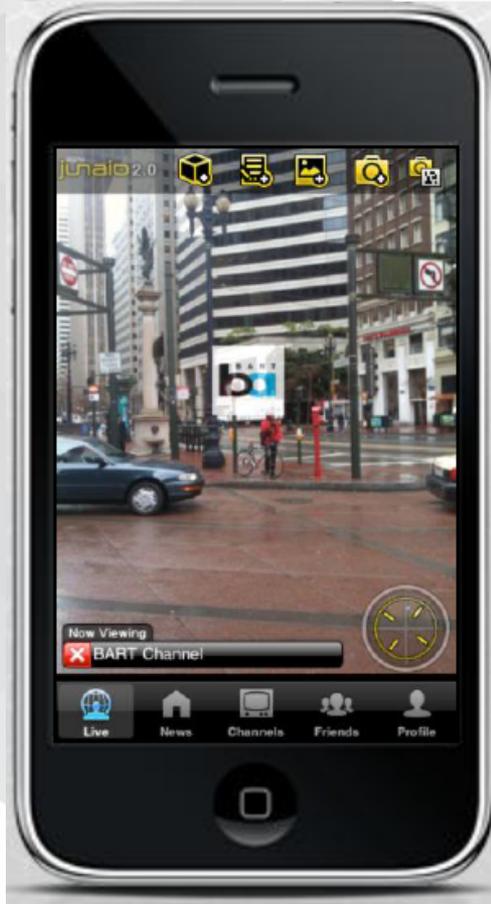
Novartis campus and the river
Urban Design and Planning Department
of Basel-Stadt and LifeClipper project
<http://www.lifeclipper.net/EN/general2.html>



iLiving application for furniture
<http://www.metaio.com/iliving/>
http://www.youtube.com/watch?v=pM_tXqH-vVM



Public Sector



Bay Area Rapid Transit and metaio
Many others (e.g., Tokyo, Portland's Transit Agency)



- Emergency response systems:
- fire fighting
 - police
 - natural disaster recovery

Public utilities (energy, water) using AR to aid with infrastructure deployment and maintenance



AR-assisted Service



Mitsubishi Electric MeView
<https://www.youtube.com/watch?v=iz4yKMn3UR4>

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Three Categories of AR Use Cases

Guide

- Simplest
- Largest

Publish

- AR married with Web 2.0 tools
- aka “Social AR”

Collaborate

- Complex
- Future of games



The “Guide” Use Cases

- System leads the user through a path or process in step-by-step (sequential) manner

1.9L Engine

See Figures 2 through 12

1. Disconnect the negative battery cable.
2. Remove the accessory drive belt.
3. Remove the alternator.
4. Remove the radiator cooling fan motor and the shroud assembly.
5. On 1991-93 models, remove the exhaust manifold heat shield.

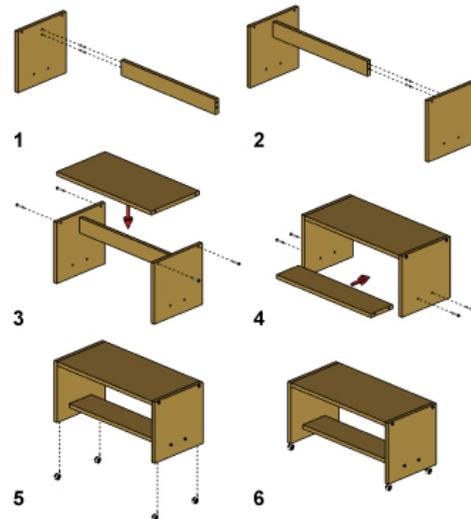
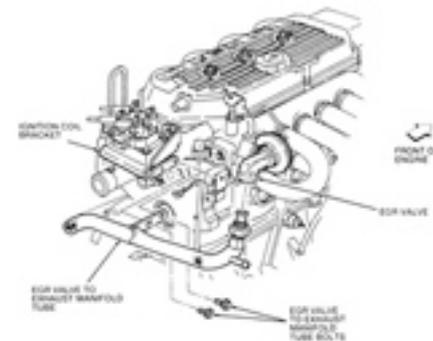


Fig. 2: EGR valve tube-to-exhaust manifold routing-1994-96 1.9L engine





The “Publish” Use Cases

- System furnishes the user the ability to attach or introduce (annotate) personal digital data in association with people, places and things in the real world





The “Collaborate” Use Cases

- System permits two or more people to interact with one another at a distance and some digital data in the real world in real time



https://www.youtube.com/watch?v=X-GXO_urMow (6min 30 sec)

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Key Mobile AR Enablers

- Low cost, high performance, low power
 - Sensors
 - Compute power (devices)
 - High speed networks
- Cloud and content management systems
- Personal and shared display technology
- Mobile application distribution platform (aka “the AppStore”)



Mobile Handsets for AR

- Multi-core CPU smartphones with GPU acceleration are capable of
 - Tracking physical world in 3D
 - Rendering 3D digital assets in real time
- Problems remain with
 - Sensor quality, stability, reliability
 - Interference of natural world with sensors
 - User interaction
 - Power consumption (battery life)
 - Thermal threshold

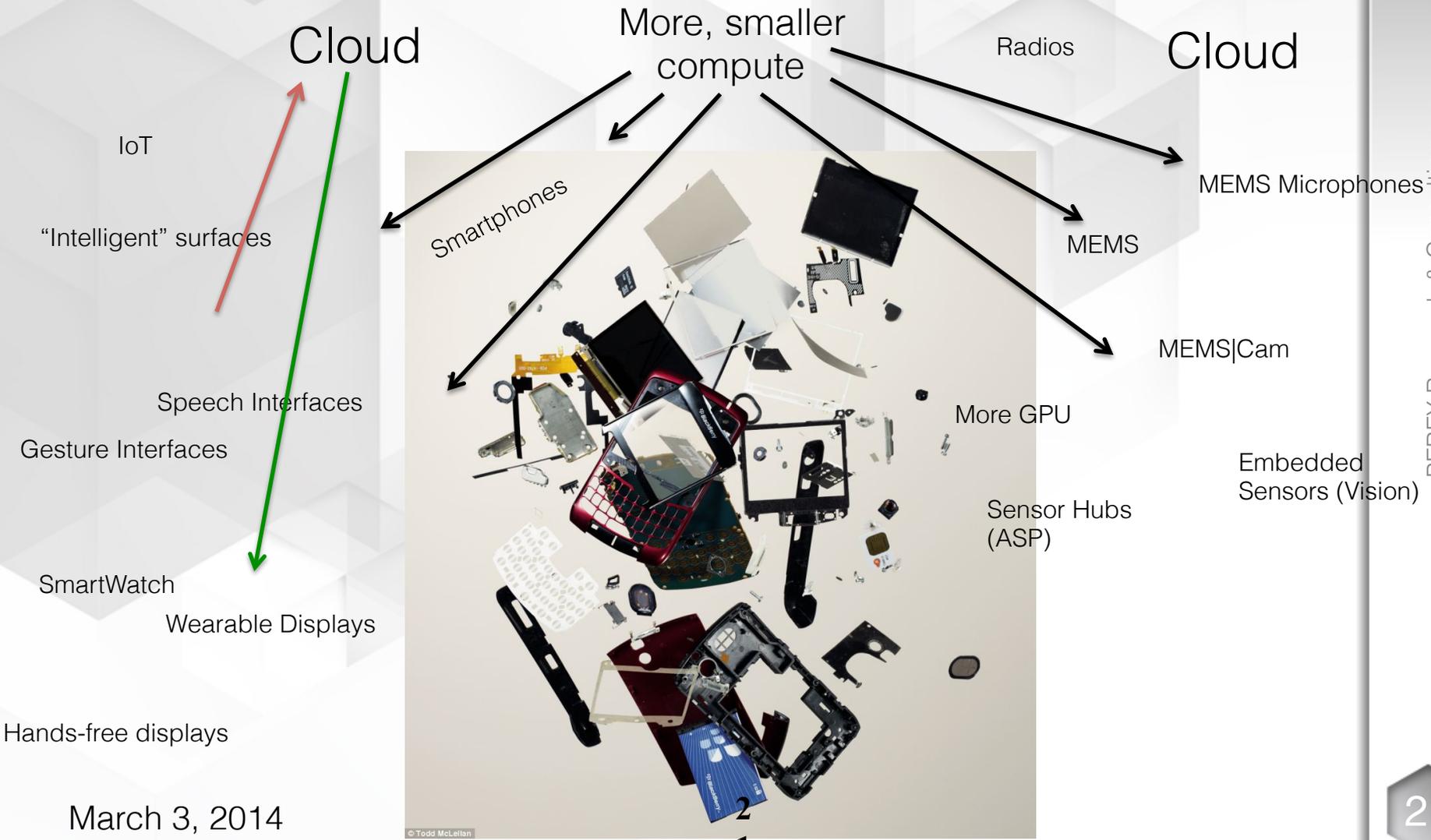


Device + Network Requirement: Capture the Physical World

- Sensors (observation streams)
 - <400 ms latency (depends on the sensor)
 - In 3D (where possible)
 - More than just position (e.g., lighting)
- Leverage what is available from IoT



Mobile Computing is Fragmenting





Networks Services for AR

- Many AR platforms use cloud-based processing and data, via wireless networks
 - Mobile AR can also be developed for use “off line”
- Lack of value-added role for network operator reduces their motivation and does not address the user needs



Network Requirement: Deliver and Render Digital Assets

- Lowest latency
- In 3D (if available)
- Progressive (Adaptive)
- Caching likely



Displays for Mobile AR

- Personal
 - Wearable computing/technology
- Shared
 - Windows (car windshields, buildings)
 - Digital signage
 - Anything on which we can project digital assets (requires projector)



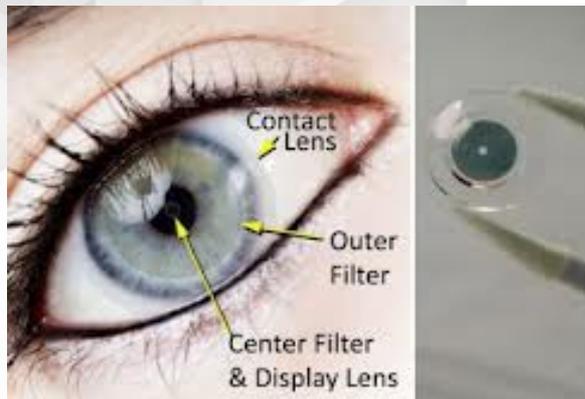
Known Smart Glasses Manufacturers

Defense Markets

- LiteEYE
- Lockheed Martin
- SBG Labs
- Rockwell Collins
- Osterhout Design Group
- Trex Enterprises
- MicroVision
- Six-15 Technologies
- Physical Optics Corp
- Innovega
- ARA
- Silicon Micro Display
- Thales Visionix

Commercial Markets

- Optinvent
- Kopin
- Epson
- Silicon Micro Display
- Google
- Microsoft
- Recon Instruments
- Scalar
- Brother
- Sony
- Oakley
- Laster Technologies
- EyeTap
- Canon
- Olympus
- eMagine
- Samsung
- MetaView
- Vuzix
- Innovega
- CastAR
- Lumus Vision
- GlassUp



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PEREY Res



High Diversity

Hardware

- Field of View
- Camera
- Adjustability of position (hinge)
- Gyro
- Brightness, transparency
- Focal plane
- Weight
- Industrial design
- Battery life

Software

- Each has unique SDK
- Very rudimentary
 - Not well integrated with AR authoring and SDKs
- Some companies are developing middleware and publishing platforms
 - Interface with radios and other shared resources
 - Generic control



User Control Interface Technologies

Software

- Gesture tracking
- Speech recognition
- Eye gaze

Hardware

- Tactile (“pad”)
- IR Pointer
- Depth sensing camera
- Video camera
- Microphone
- User focus (gaze)



What is Open and Interoperable AR?

Complete end-to-end system in which **modular components** can be supplied by **multiple vendors** and still have the **same workflow** and **experience quality**

(Hint: think of the Web)



In an ideal world AR Systems...

- Consistently receive reliable data (correct observations and/or calibrate sensors) about
 - User context and status
 - Focus of attention in the physical world
 - Position and orientation in the physical world
 - Other relevant physical world landmarks
 - Resources for producing/enhancing experiences
 - Data objects
 - Computational resources
 - Communication resources
 - Storage resources
 - Display/ presentation resources



Open and Interoperable AR



Faster and
Lower cost



**Existing
Proven
Standards**



AR Standards Community

- Identify open interfaces and existing standards
- Assist, where standards are missing and needed, in their development
 - Collect and communicate AR developer and user requirements
 - Define industry- and technology-neutral use cases
- Foster and support the coordination of efforts across multiple Standards Development Organizations
- Detect the emergence of and provide a centralized place/forum for the expression of needs from the community including obstacles to the growth of AR



AR Standards Community

The numbers

4 years

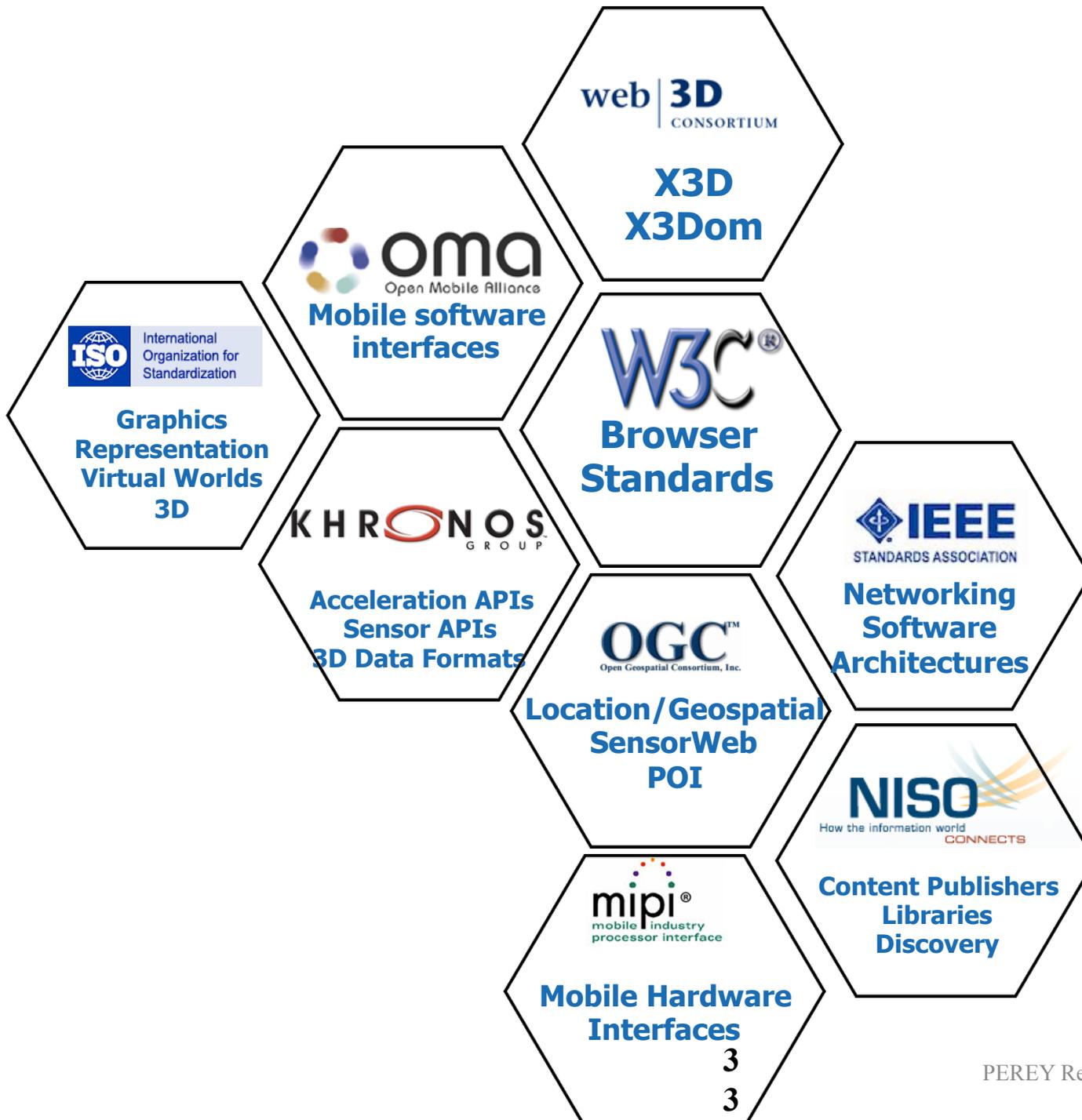
6 archived mailing lists

9 in-person meetings (next meeting in 3 weeks)

>10 Standards Development Organizations
participating

>250 people

All resources are on the portal
<http://www.arstandards.org>





**Embedded
Vision
Algorithms**

web | **3D**
CONSORTIUM

**X3D
X3Dom**



I E T F
**Network
Protocols**



**Mobile software
interfaces**



**Automotive
Aviation**



**Graphics
Representation
Virtual Worlds
3D**

W3C
**Browser
Standards**

HITSP
Healthcare



**Acceleration APIs
Sensor APIs
3D Data Formats**



**Networking
Software
Architectures**



**Display
Technologies**



**Location/Geospatial
SensorWeb
POI**

Construction



**Building
Management**



**Metadata
for Digital
Objects**



**Content Publishers
Libraries
Discovery**

**National
Standards
Organizations**



**Mobile Device
Radios and Com**



**Mobile Hardware
Interfaces**



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IEEE SA Role in Augmented Reality

- IEEE SA is developing assets for market education and awareness programs
- IEEE SA seeks, where applicable, to engage with IETF to increase the support for AR in existing and future standards
- IEEE SA is leading AR awareness across IEEE societies and members



IEEE SA Emerging Technologies

- Will publish
 - Information about how IEEE specifications can advance AR
 - Domain specific uses for AR
- Organize
 - Information and demonstration events
 - Community and expert discussions



Proposals

- Explore
 - Evaluate where IETF may add value
 - Mobile AR use cases in future work
- Collaborate with the AR Community and AREA
 - Obtain and develop specifications that will meet mobile AR requirements

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