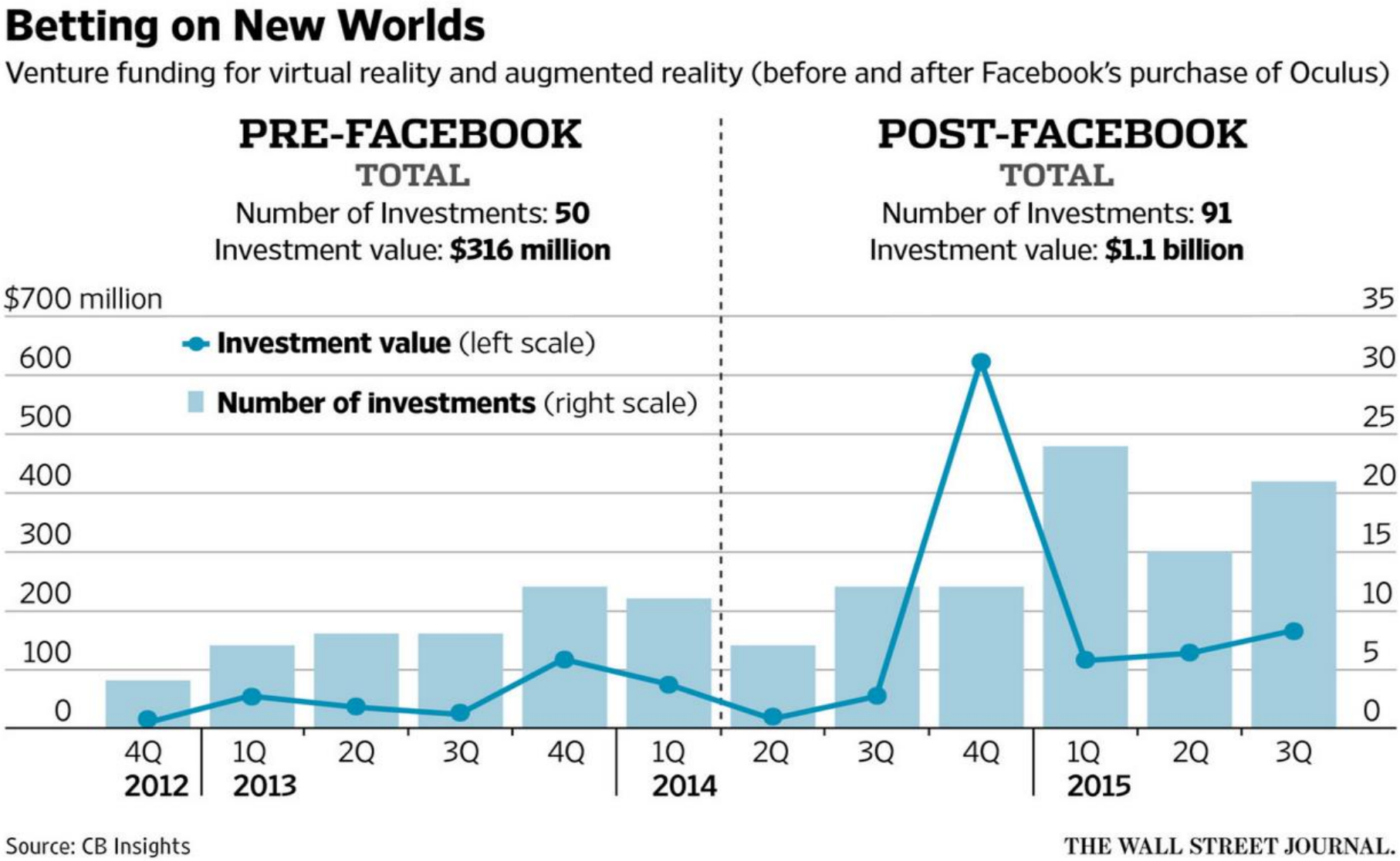
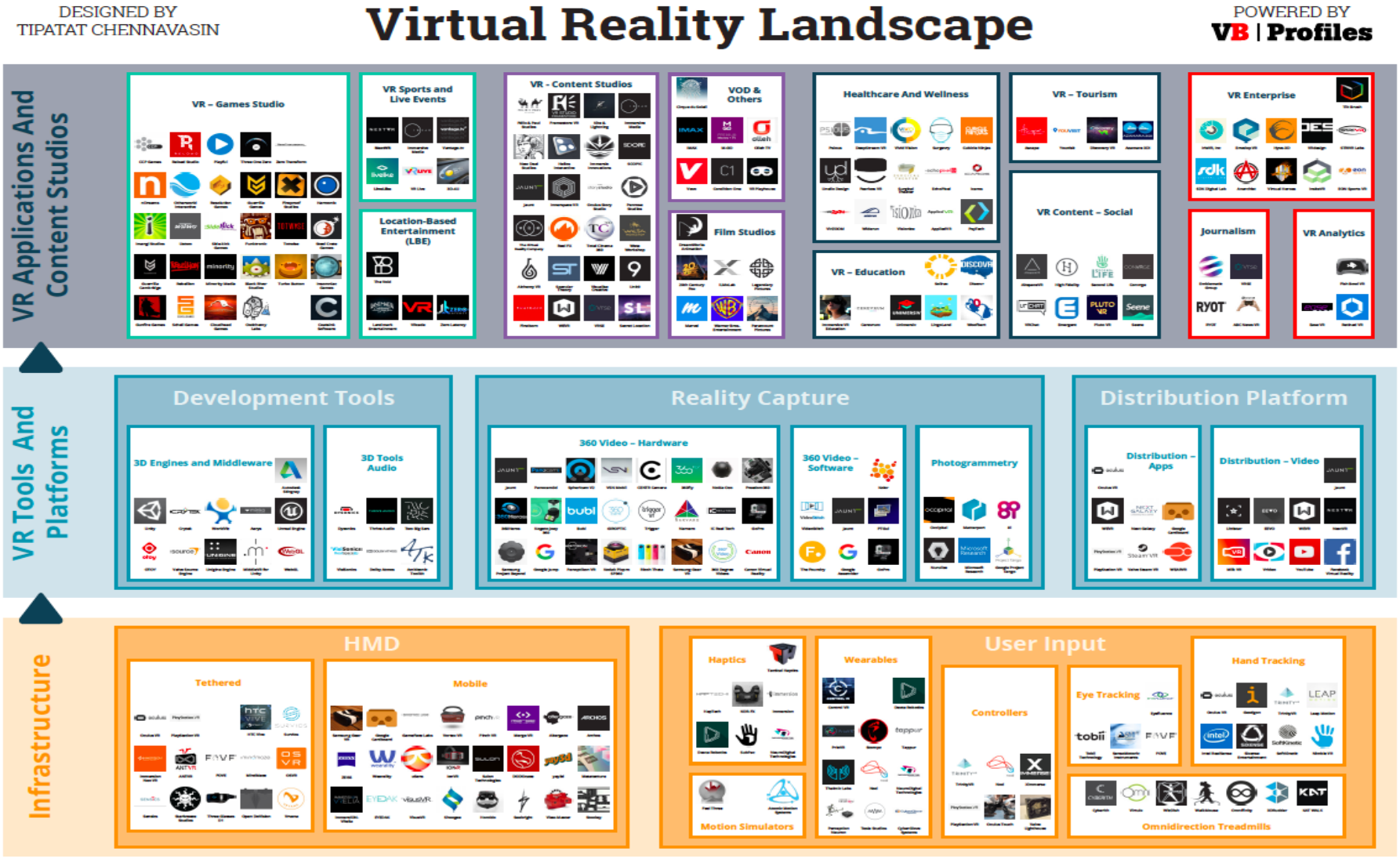
VR 산업 발전을 위한 투자 및 확산에 필요한 기술표준화 선점 전쟁

서동일
CEO, VoleR Creative

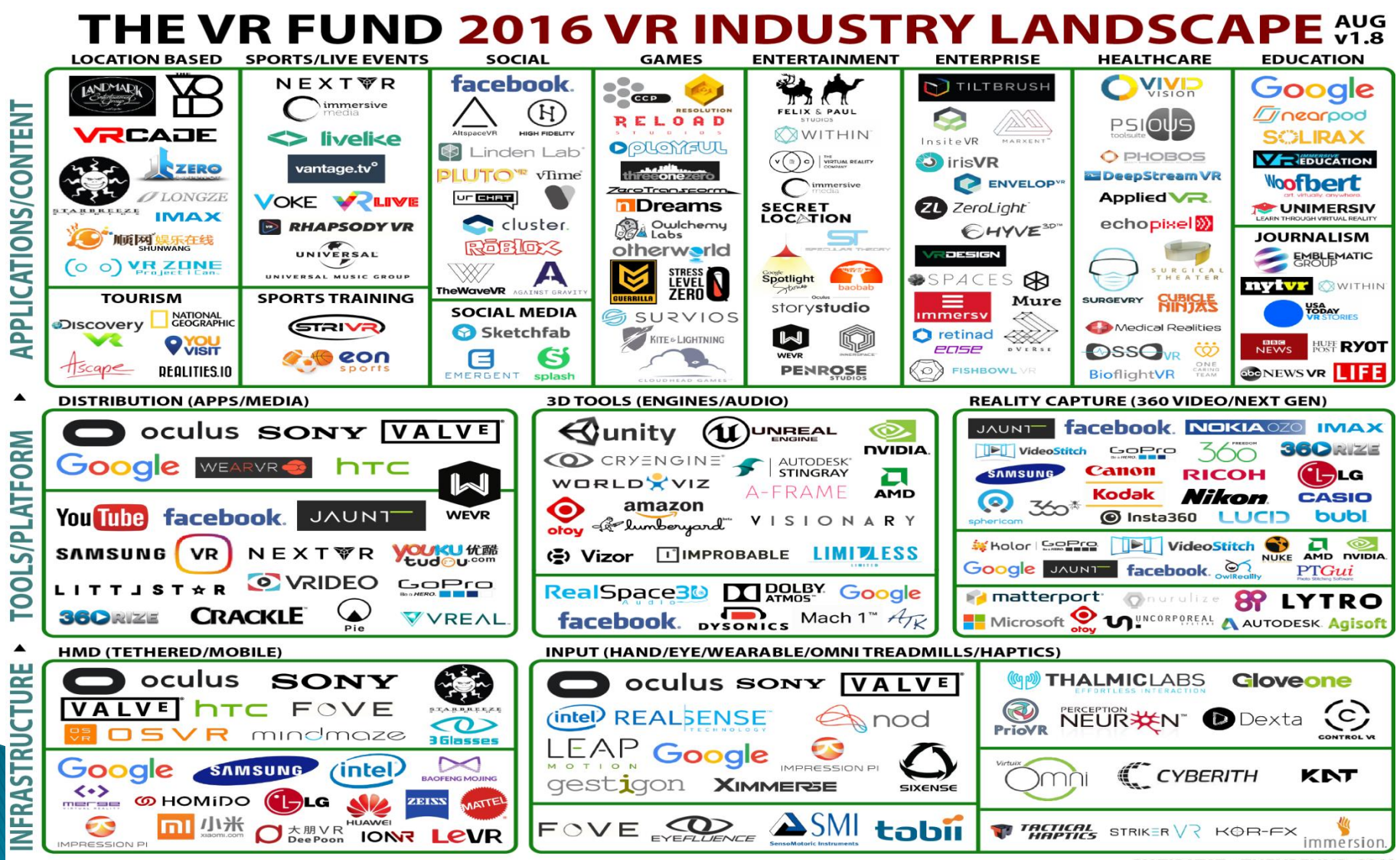
VR 시장의 재조명


Betting on New Worlds
Venture funding for virtual reality and augmented reality (before and after Facebook's purchase of Oculus)
PRE-FACEBOOK
TOTAL
Number of Investments: 50
Investment value: $316 million
POST-FACEBOOK
TOTAL
Number of Investments: 91
Investment value: $1.1 billion
$700 million
600
500
400
300
200
100
0
35
30
25
20
15
10
5
0
Investment value (left scale)
Number of investments (right scale)
4Q 2012
1Q 2013
2Q
3Q
4Q
1Q 2014
2Q
3Q
4Q
1Q 2015
2Q
3Q
Source: CB Insights
THE WALL STREET JOURNAL.

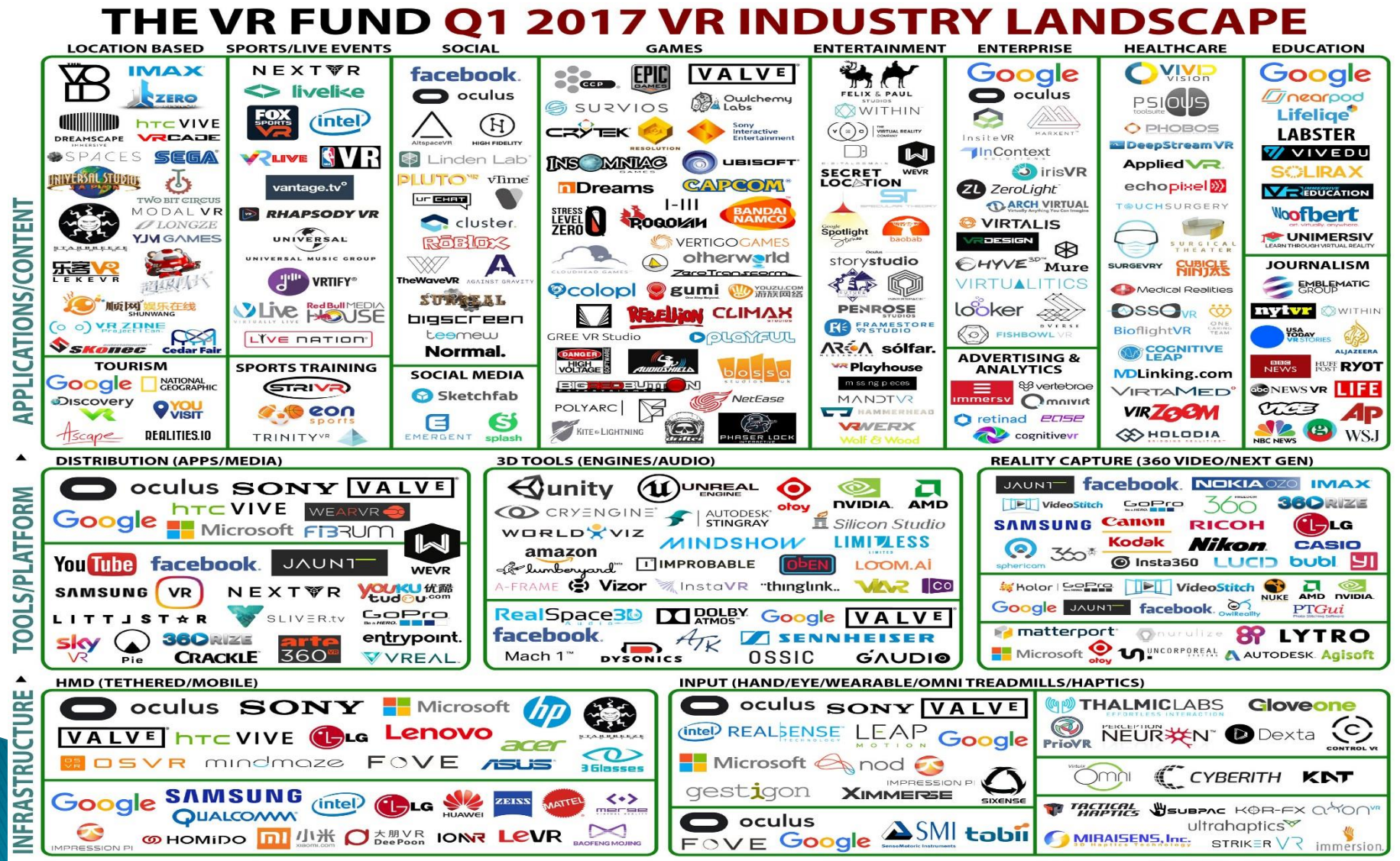
2015년 VR 시장 현황



2016년 VR 시장 현황

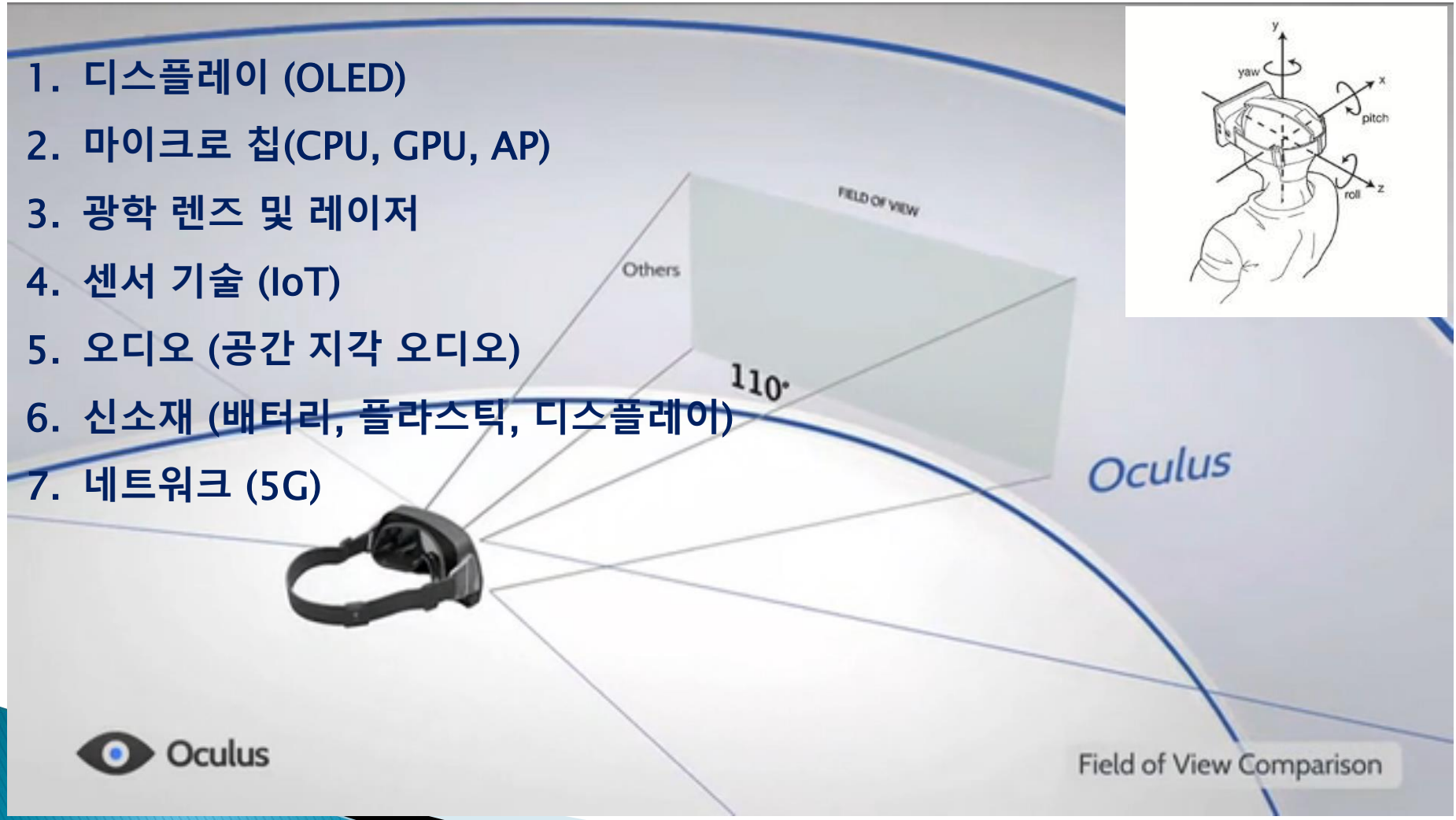


2017년 VR 시장 현황

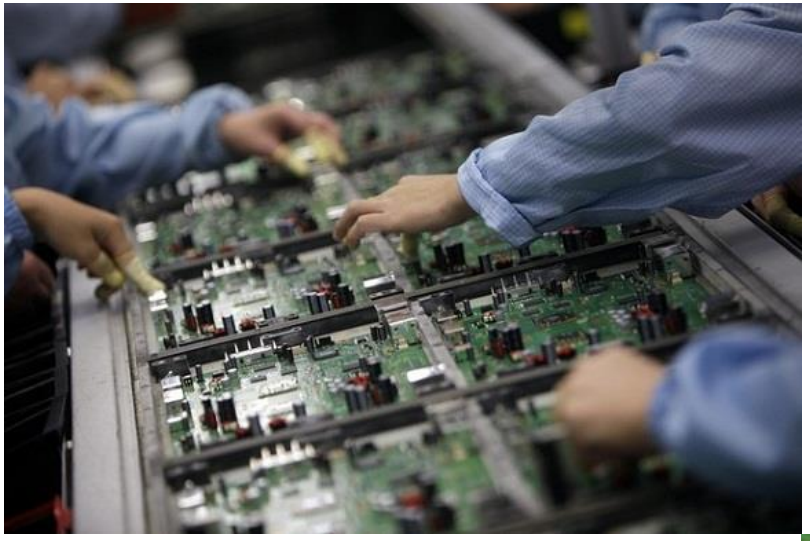


왜 가상현실 산업인가?

1. 디스플레이 (OLED)
2. 마이크로 칩(CPU, GPU, AP)
3. 광학 렌즈 및 레이저
4. 센서 기술 (IoT)
5. 오디오 (공간 지각 오디오)
6. 신소재 (배터리, 플라스틱, 디스플레이)
7. 네트워크 (5G)



VR에서 주목해야 할 두 가지



제조 산업의 성장 한계
(기존 산업의 포화)

새로운 사용자 경험
(몰입감 & 현장감)

VR – 차세대 컴퓨팅 플랫폼

- 수확 체감 – 디스플레이, 그래픽 카드 & 이동통신

OLED

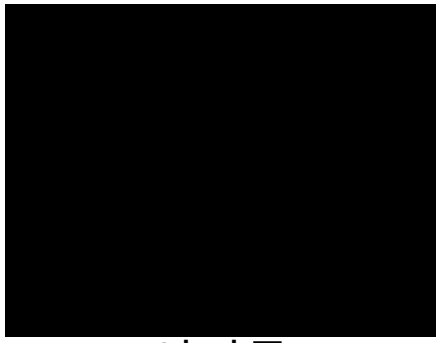
재생률

olleh

이동통신

VR – 차세대 플랫폼

- 독특한 컨텐트 경험 – 생산성과 비용절감



어디든

무엇이든

어떤 것이든

시간

공간

실제 VR사용 시나리오

게임 콘솔

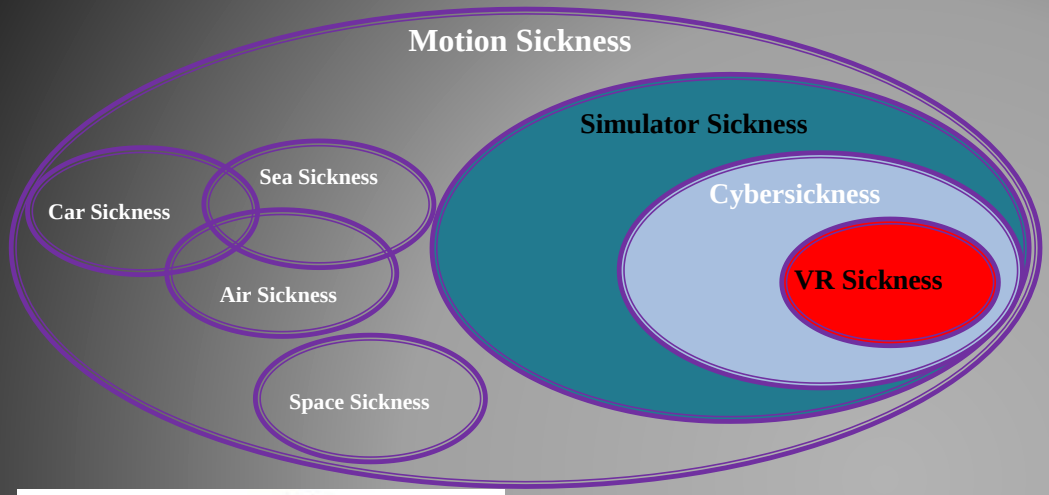
실시간 비디오 상영

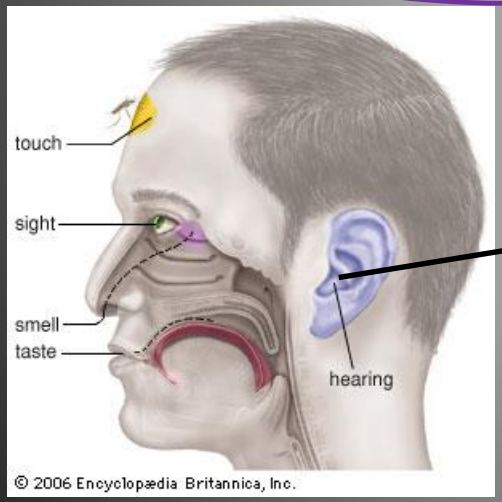
멀티 사용자간 플레이

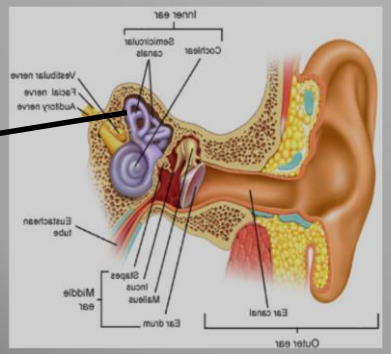
소셜 미디어 경험

이종 통신망 연결 테스트

산업이 풀어야 할 문제







- VR Sickness는 Motion Sickness의 일부
- 시각 기관과 전정 기관과의 정보 불일치에 의해 발생
- 다양한 국제표준기구에서 VR의 기술적 문제에 대해 논의 중 (IEEE 3079, IEEE 2048, Khronos Group, ISO/IEC JTC1 /SC24, SC29 WG11(MPEG), W3C, ITU-T SG12)

VR QoE를 위한 기술적 요구사항

- **Technicolor, Oct. 2016 (m39532, MPEG 116th Meeting)**

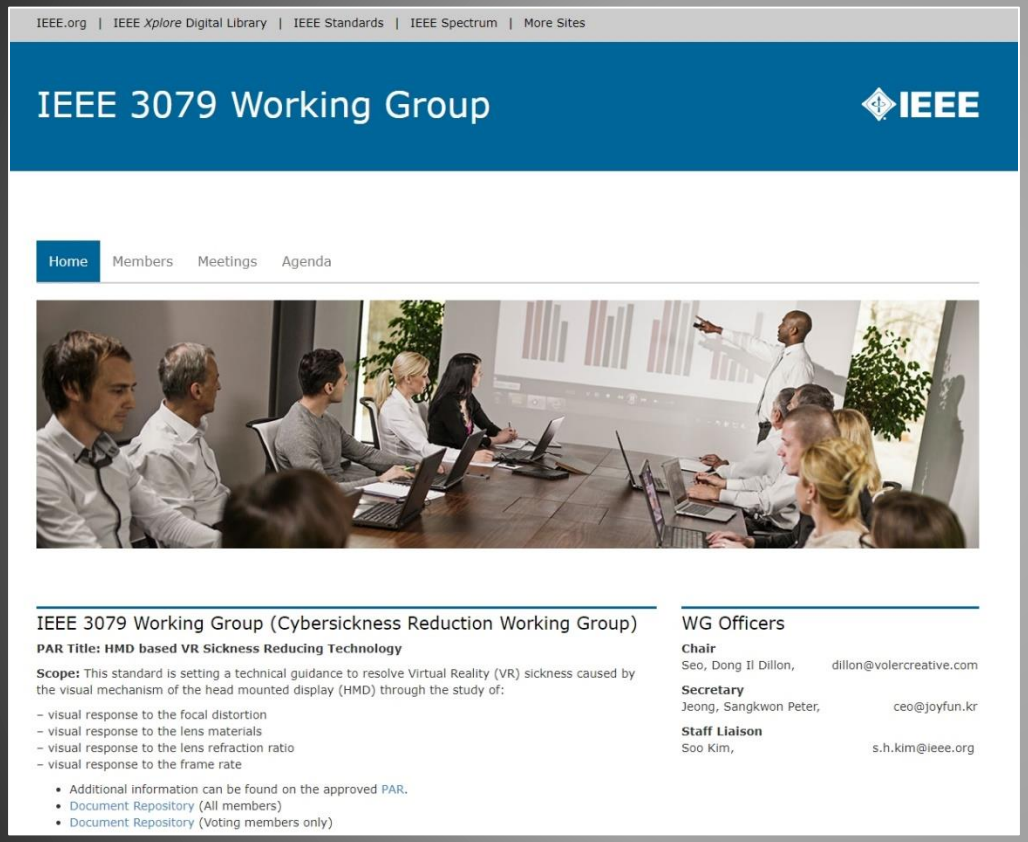
Requirement	details
pixels/degree	- 40 pix/deg - no HMD is capable of displaying 40pix/deg today
video resolution	- 3 times 4K(3840x1920) vertical resolution = 11520x6480
framerate	- 90 FPS - 90 FPS framerate offers a latency low enough to prevent nausea
3D Audio	- support of scene-based and/or environmental audio - 360 surround sound, object-based audio, Ambisonics
motion-to-photon latency & motion-to-audio latency	- how much time there is between the user interacts and an image / audio - maximum 20ms
foreground & parallax	- objects in the foreground shall be far enough to prevent nausea - if objects are too close it is likely they can become an important cause of nausea - interactive parallax with background shall be present for such objects - pic1 shows how it is possible to look behind the figure in the foreground

산업적 관계성

- **QoE 문제 해결을 위한 기술 발전은 다음의 산업적 혜택 제공**
  - 이동통신사
    - 5G 상 실감형 미디어 (VR & AR) 기반의 앱 지원 가능
    - 요구하는 QoS 충족 및 더 많은 사용자 지원 가능
  - HMD 제조사
    - QoE & QoS 향상 가능 및 기기 가격 단가 하락 가능
  - 콘텐트 개발사
    - 적은 비용으로 고사양 콘텐트 제작 가능
    - Cloud 기반 VR 서비스 가능
  - 플랫폼 홀더
    - 양질의 VR 콘텐트 확보를 통한 VR 생태계 확장 가능

IEEE 3079

IEEE P3079



IEEE.org | IEEE *Xplore* Digital Library | IEEE Standards | IEEE Spectrum | More Sites

IEEE 3079 Working Group

IEEE

Home | Members | Meetings | Agenda

IEEE 3079 Working Group (Cybersickness Reduction Working Group)

PAR Title: HMD based VR Sickness Reducing Technology

Scope: This standard is setting a technical guidance to resolve Virtual Reality (VR) sickness caused by the visual mechanism of the head mounted display (HMD) through the study of:

- visual response to the focal distortion
- visual response to the lens materials
- visual response to the lens refraction ratio
- visual response to the frame rate

- Additional information can be found on the approved PAR.
- Document Repository (All members)
- Document Repository (Voting members only)

WG Officers

Chair
Seo, Dong Il Dillon, dillon@volercreative.com

Secretary
Jeong, Sangkwon Peter, ceo@joyfun.kr

Staff Liaison
Soo Kim, s.h.kim@ieee.org

URL:
http://sites.ieee.org/sagroups-3079/

PAR

PAR Title: HMD Based VR Sickness Reduction Technology

P3079

Submitter Email: inten.konv@gmail.com
Type of Project: Modify Existing Approved PAR
PAR Request Date: 27-Feb-2018
PAR Approval Date: 14-May-2018
PAR Expiration Date: 31-Dec-2020
Status: Modification to a Previously Approved PAR
Root PAR: P3333.3 **Approved on:** 07-Dec-2016

1.1 Project Number: P3079
1.2 Type of Document: Standard
1.3 Life Cycle: Full Use

2.1 Title: Standard for Head Mounted Display (HMD) Based Virtual Reality (VR) Sickness Reduction Technology

Changes in title: Standard for Head Mounted Display (HMD) Based ~~3D~~Virtual ~~Content~~Reality ~~Motion~~(VR) Sickness ~~Reducing~~Reduction Technology

3.1 Working Group: Cybersickness Reduction Working Group (C/SAB/3079_WG)
Contact Information for Working Group Chair
Name: Dong Il Seo
Email Address: dseo1030@gmail.com
Phone: Cell
Contact Information for Working Group Vice-Chair
None

3.2 Sponsoring Society and Committee: IEEE Computer Society/Standards Activities Board (C/SAB)
Contact Information for Sponsor Chair
Name: p eastman
Email Address: peastman@cox.net
Phone: (602) 993-7085
Contact Information for Standards Representative
Name: Jon Rosdahl
Email Address: jrosdahl@ieee.org
Phone: 801-492-4023

3.3 Joint Sponsor: IEEE Consumer Electronics Society/Standards Committee (CES/SC)
Contact Information for Sponsor Chair
Name: Yu Yuan
Email Address: ywmedia@gmail.com
Phone: +1 917 624 8316
Contact Information for Standards Representative
Name: Yu Yuan
Email Address: ywmedia@gmail.com
Phone: +1 917 624 8316

4.1 Type of Ballot: Individual
4.2 Expected Date of submission of draft to the IEEE-SA for Initial Sponsor Ballot: 03/2019
4.3 Projected Completion Date for Submittal to RevCom
Note: Usual minimum time between initial sponsor ballot and submission to Revcom is 6 months.: 10/2019

5.1 Approximate number of people expected to be actively involved in the development of this project: 10

5.2 Scope: This standard provides technical guidance in respect to the reduction of Virtual Reality (VR) sickness, caused by the visual response to HMD based 3D content motion, through the study of:
visual response to the focal distortion
visual response to the lens materials
visual response to the lens refraction ratio

Changes in scope: This standard ~~is~~provides ~~setting a~~ technical guidance in respect to ~~resolve~~the reduction of Virtual Reality (VR) sickness, caused by the visual ~~mechanism~~response ~~of~~to ~~by the~~ HMD based 3D content motion~~sickness~~, through the study of: visual response to the focal distortion visual response to the lens materials visual response to the lens refraction ratio visual response to the frame rate

visual response to the frame rate

5.3 Is the completion of this standard dependent upon the completion of another standard: No
5.4 Purpose: This document will not include a purpose clause.
5.5 Need for the Project: HMD based 3D content is being used in various fields such as games, medical, education and art through Mixed Reality [Virtual Reality (VR) and Augmented Reality (AR) included] technology. However, a motion sickness, known as a 3D sickness and considered as one of the most critical problems, has not been resolved even though it is highly utilized.
Major companies from various regions such as the United States, Europe, Japan, China and Taiwan are releasing many devices and commercializing them but the industrial expansion will reach its limit if this 3D sickness problem is not resolved.
To overcome this limit, we are suggesting a minimum guideline as a standard by studying some of the 3D sickness originating factors such as focal distortion, lens materials, lens refraction and frame rates per second.
Moreover, our attempt to resolve this 3D sickness problem will facilitate the development of HMD based 3D content and will influence the 3D content developers, service providers, HMD manufacturers, HMD based content service providers and 3D display panel manufacturers very positively in developing a healthy ecosystem.
Therefore, a standard to reduce the motion sickness caused by HMD based 3D content needs to be established in order to protect the user¡¯s health and safety and develop the ecosystem.

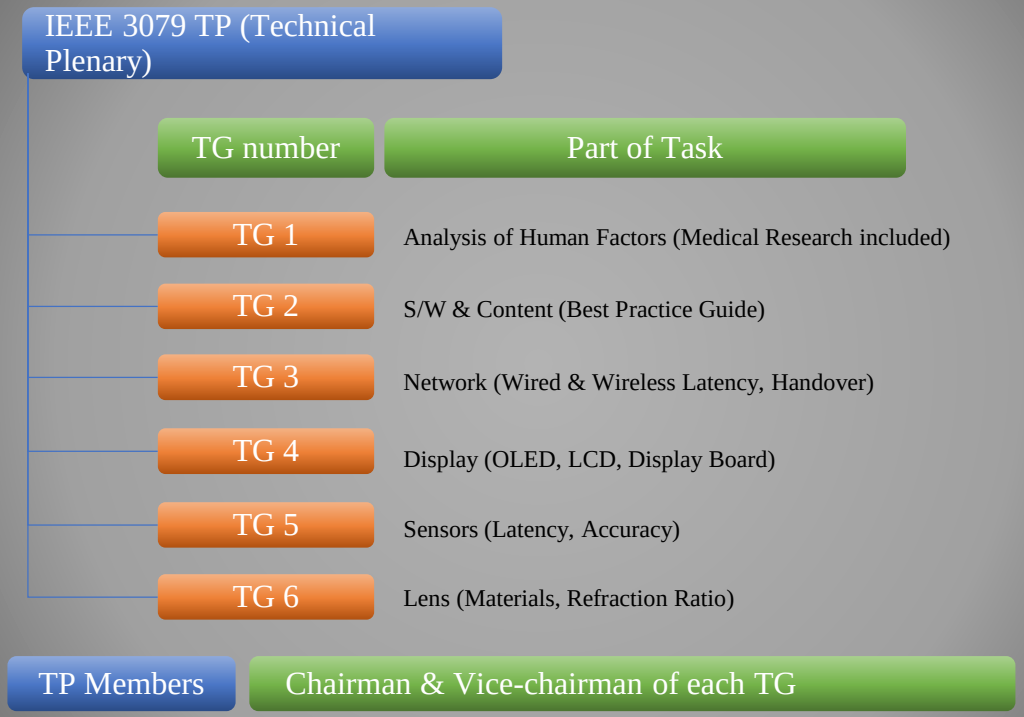
5.6 Stakeholders for the Standard: 3D Content, 3D Games, 3D Display Content, 3D Educational Content, 3D Movie Producers, 3D Monitors, 3D Display Panel and 3D Device Manufacturers

Intellectual Property
6.1.a. Is the Sponsor aware of any copyright permissions needed for this project?: No
6.1.b. Is the Sponsor aware of possible registration activity related to this project?: No

7.1 Are there other standards or projects with a similar scope?: No
7.2 Joint Development
Is it the intent to develop this document jointly with another organization?: No

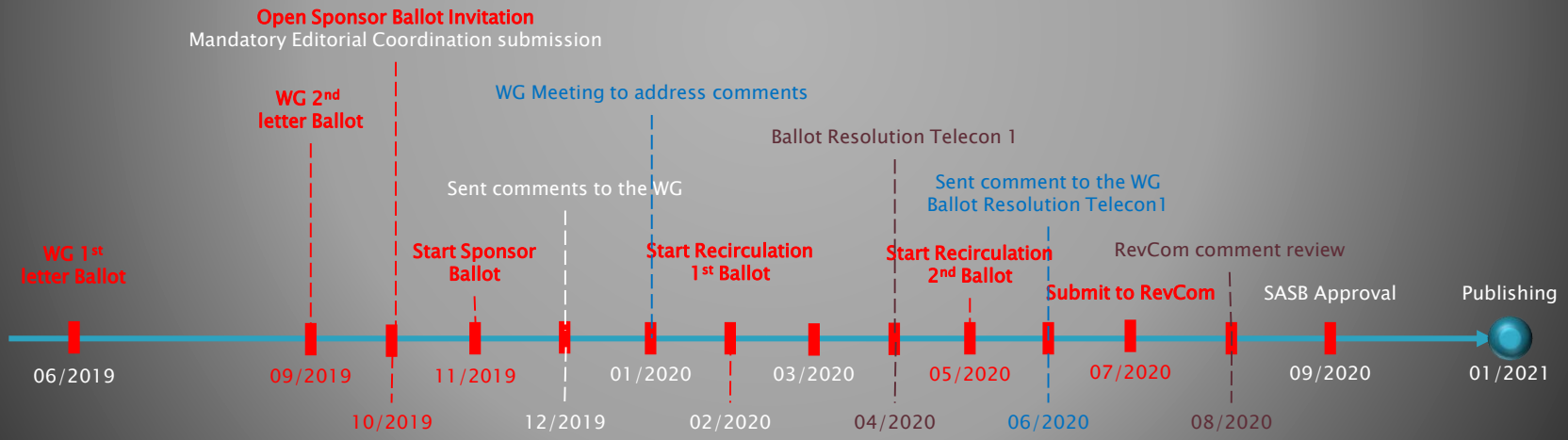
8.1 Additional Explanatory Notes: A modified PAR is submitted to update the title and scope statement to provide clarification that the standard covers Virtual Reality (VR) sickness, caused by the visual response to HMD based 3D content motion.
The document will provide a set of requirements for display manufacturers, network providers, rendering tool developers and content developers to follow in order to minimize the motion sickness caused by the virtual reality experience using a VR HMD.

Organization



Development Timeline

- PAR approved: 12/2016
- Working Group 1st Letter Ballot: 06/2019 (20 days)
  - Before July meeting
- Working Group 2nd Letter Ballot: 09/2019 (20 days)
  - Before October meeting
- Open Sponsor Ballot Invitation: 10/2019 (30 days)
- Start Sponsor Ballot: 11/2019 (30 days)
- Start Recirculation 1st Ballot: 02/2020 (10 days)
- Start Recirculation 2nd Ballot: 05/2020 (10 days)
- Submit to RevCom: 07/2020
- Publishing: 01/2021



IEEE 2048 WG

IEEE 2048 Structure Standard for Virtual Reality and Augmented Reality

PAR Number	Project Type	Committee	Title	Scope	Approval Date	PAR Expiration	Status
P2048.1							
P2048.2	New	CES/SC/VRAR	Standard for Virtual Reality and Augmented Reality: Immersive Video Taxonomy and Quality Metrics	This standard specifies the taxonomy and quality metrics for immersive video.	7-Dec-2016	31-Dec-2020	WG Draft Development
P2048.3							
P2048.4	New	CES/SC/VRAR	Standard for Virtual Reality and Augmented Reality: Person Identity	The standard specifies the requirements and methods for verifying a person's identify in virtual reality.	7-Dec-2016	31-Dec-2020	WG Draft Development
P2048.5							
P2048.6	New	CES/SC/VRAR	Standard for Virtual Reality and Augmented Reality: Immersive User Interface	This standard specifies the requirements and methods for enabling the immersive user interface in Virtual Reality (VR) applications, and the functions and interactions provided by the immersive user interface.	23-Mar-2017	31-Dec-2021	WG Draft Development
P2048.7							
P2048.8	New	CES/SC/VRAR	Standard for Virtual Reality and Augmented Reality: Interoperability between Virtual Objects and the Real World	This standard specifies the requirements, systems, methods, testing and verification for the interoperability between virtual objects and the real world in Augmented Reality (AR) and Mixed Reality (MR) applications.	23-Mar-2017	31-Dec-2021	WG Draft Development

IEEE 2048 Structure Standard for Virtual Reality and Augmented Reality

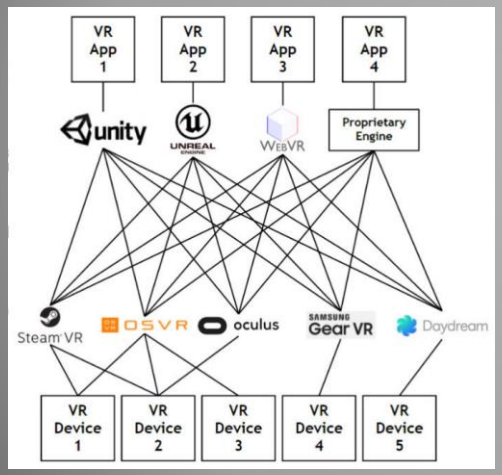
PAR Number	Project Type	Committee	Title	Scope	Approval Date	PAR Expiration	Status
P2048.9							
P2048.10	New	CES/SC/VRAR	Standard for Virtual Reality and Augmented Reality: Immersive Audio File and Stream Formats	This standard specifies the formats of immersive audio files and streams, and the functions and interactions enabled by the formats.	18-May-2017	31-Dec-2021	WG Draft Development
P2048.11							
P2048.12	New	CES/SC/VRAR	Standard for Virtual Reality and Augmented Reality: Content Ratings and Descriptors	This standard defines the content ratings and descriptors for Virtual Reality (VR), Augmented Reality (AR) and Mixed Reality (MR).	18-May-2017	31-Dec-2021	WG Draft Development

Khronos Group

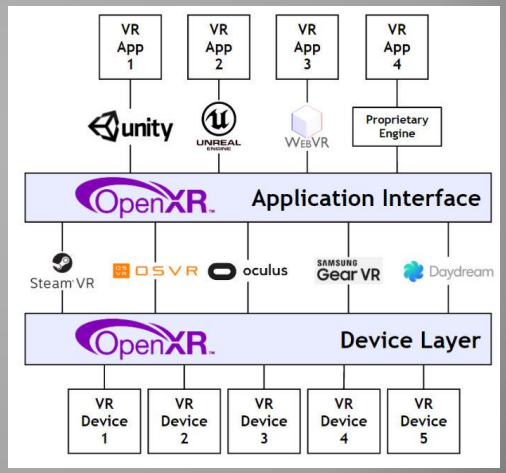
OpenXR

OpenXR – Cross-Platform, Portable, Virtual Reality

The OpenXR™ working group – previously known as the Khronos VR Initiative – is creating an open and royalty-free standard for VR and AR applications and devices.

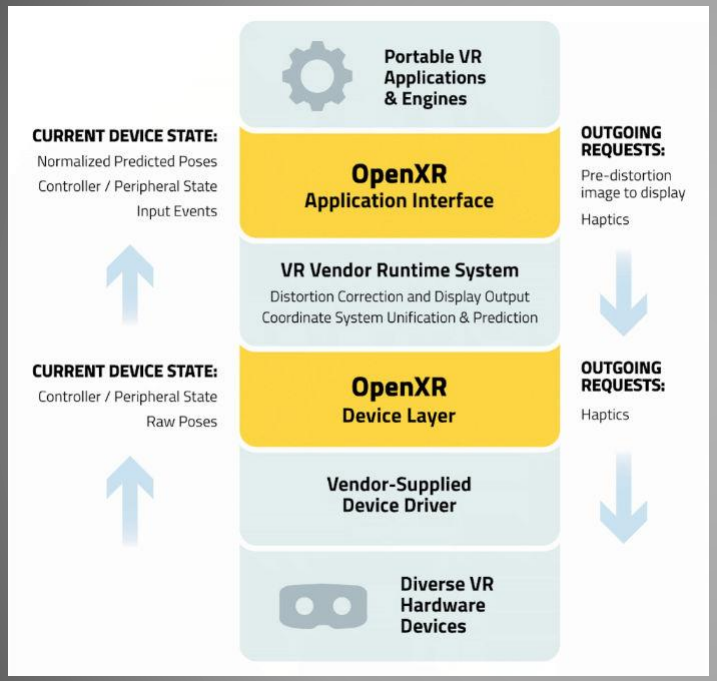


The Problem



The Solution

OpenXR Architecture

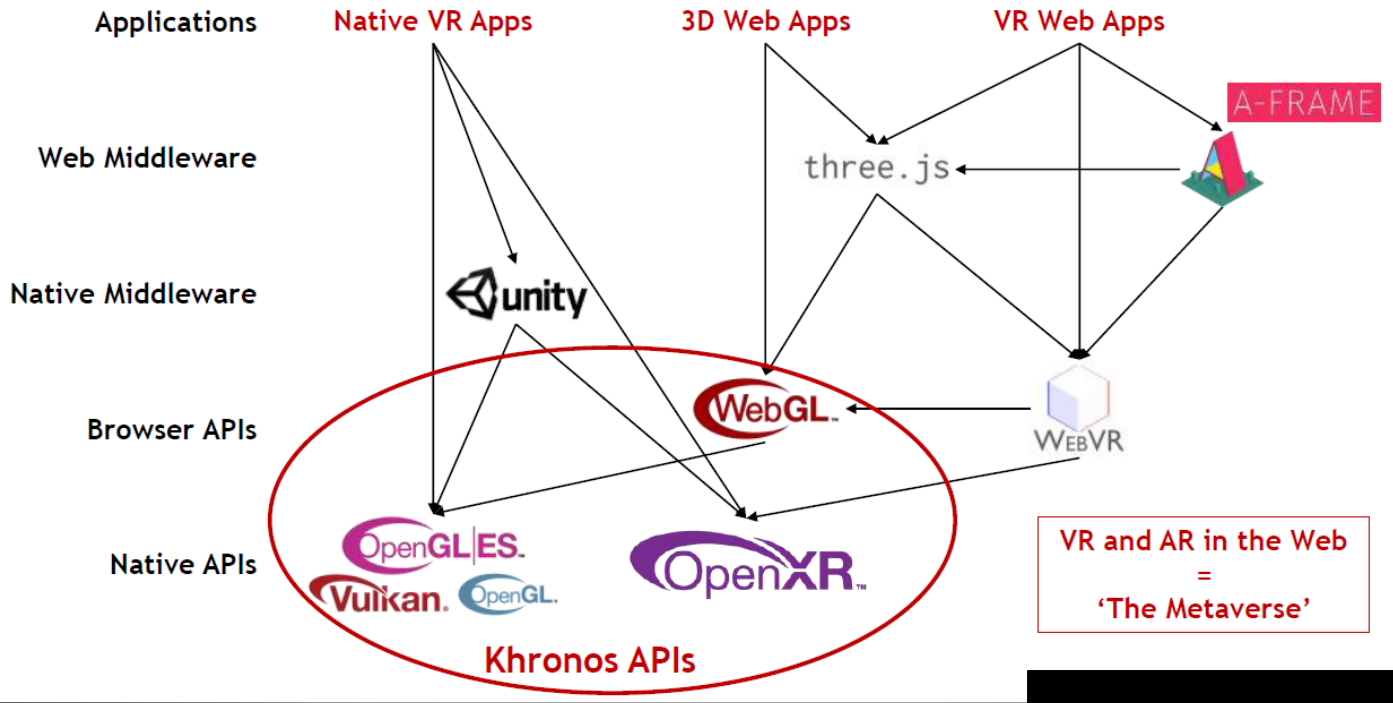


OpenXR defines two levels of API interfaces that a VR platform's runtime can use to access the OpenXR ecosystem.

Apps and engines use standardized interfaces to interrogate and drive devices. Devices can self-integrate to a standardized driver interface.

Standardized hardware/software interfaces reduce fragmentation while leaving implementation details open to encourage industry innovation.

Layered Ecosystem and VR in the Web



W3C

VR Standardization at W3C

W3C 4

Existing Relevant W3C Standardization (1)

- **Spatialized audio** in Web Audio WG
- **Gamepad** API, **Web Worker** in Web Platform WG
- Media **Streaming** handling in HTML Media Extension WG
- **Low-latency** data & AV transfer, **identity** hook in WebRTC WG
- **Depth camera**, dedicated **video worker** support in Device & Sensors Working Group

VR Standardization at W3C

Existing Relevant W3C Standardization (2)

- **Color space** management in CSS WG
- **Performance metrics** in Web Perf WG
- **UI Security** in Web App Security WG
- (Payments in Web Payments WG)

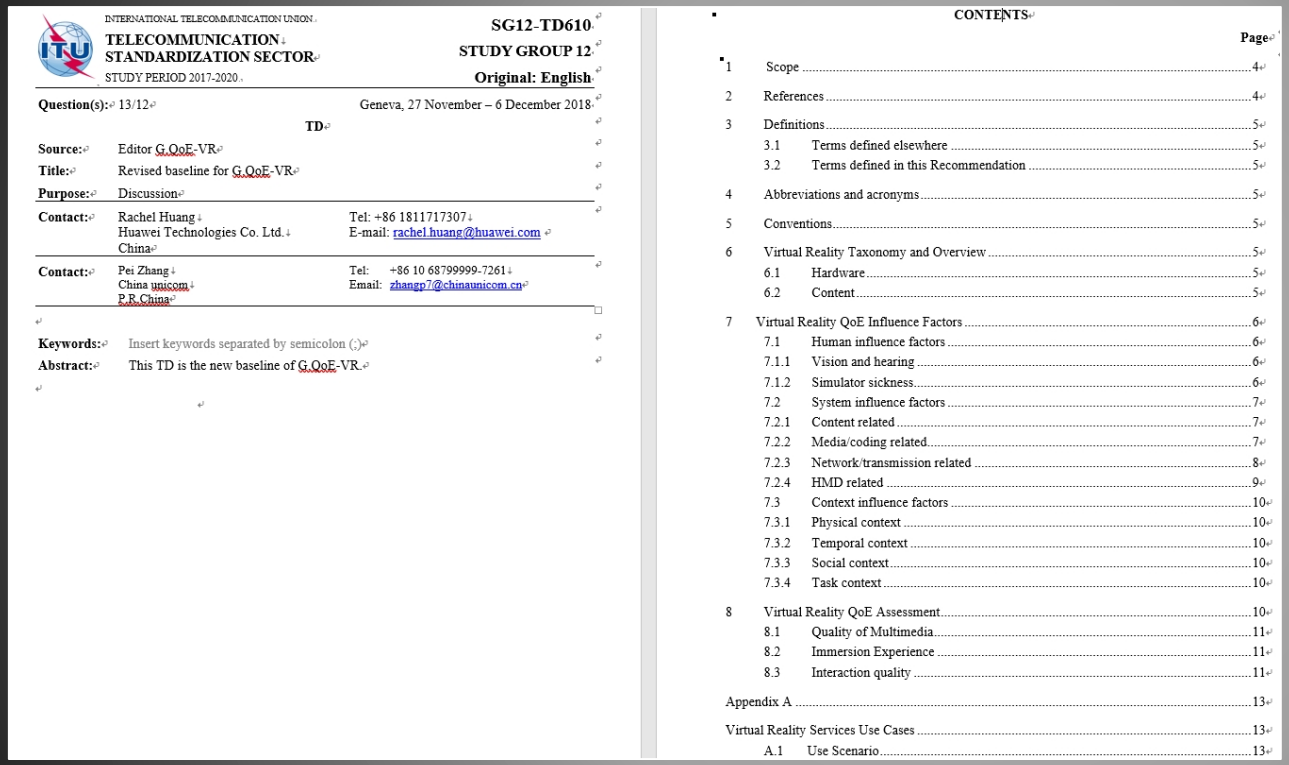
ISO/IEC JTC1 /SC24

ISO/IEC JTC1/SC24 Standard Spec

- ISO/IEC 19777-1, 19777-2: X3D Language Bindings ECMAScript Ed.2, Java Ed.2 (Under Development)
- ISO/IEC 19774-1, 19774-2: H-Anim Part 1 Architecture, Motion Data Animation (Published)
- ISO/IEC 18039: Standard MAR Reference Mode (Published)
- ISO/IEC 18038: Sensor representation in mixed and augmented reality(MAR) (Published)
- ISO/IEC 18040: Live Actor and Entity Representation in Mixed and Augmented(MAR) (Published)
- ISO/IEC 18520: Benchmarking of vision-based geometric registration and tracking methods for MAR (Published)
- ISO/IEC 21858: Information model for mixed and augmented reality(MAR) contents (Published)

ITU-T SG 12

ITU-T SG12 QoE – VR



INTERNATIONAL TELECOMMUNICATION UNION

TELECOMMUNICATION STANDARDIZATION SECTOR

STUDY PERIOD 2017-2020

SG12-TD610

STUDY GROUP 12

Original: English

Question(s): 13/12 Geneva, 27 November – 6 December 2018

TD

Source: Editor G.QoE-VR

Title: Revised baseline for G.QoE-VR

Purpose: Discussion

Contact: Rachel Huang, Huawei Technologies Co. Ltd., China — Tel: +86 1811717307, E-mail: rachel.huang@huawei.com

Contact: Pei Zhang, China unicom, P.R.China — Tel: +86 10 68799999-7261, Email: zhangp7@chinaunicom.cn

Keywords: Insert keywords separated by semicolon (;)

Abstract: This TD is the new baseline of G.QoE-VR.

CONTENTS

Page

- Status: Standard Document is under development
- Issues
  - Focusing on QoE without the understanding of VR content characteristics
  - Dealing with irrelevant senses such as smell for VR QoE
  - Missing MTP latency in the content