

3D Virtual Training Systems Architecture

January 21-24, 2018

ISO/IEC JTC 1/SC 24/WG 9 & Web3D Meetings
Seoul, Korea

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Virtual Training Systems

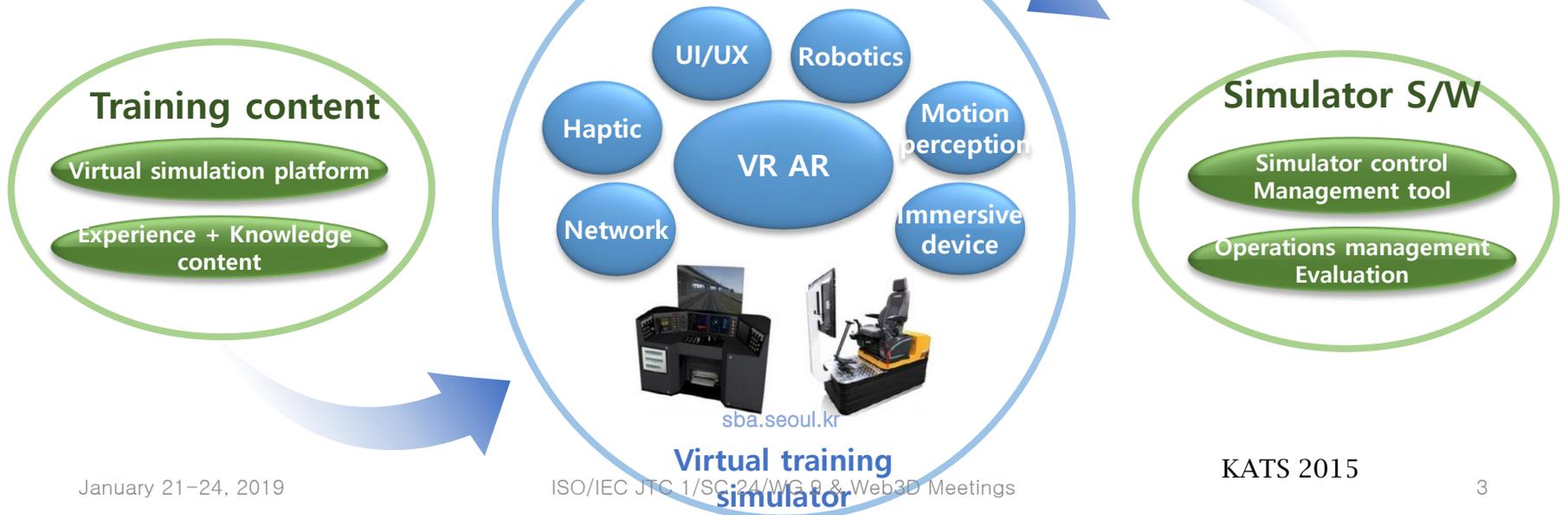
- Definition
 - Training systems using real world information and 3D virtual environments
 - One typical area in systems integration for visualization
- Basic technologies for virtual training systems
 - VR/AR/MR
 - IoT sensors
 - Systems integration

Virtual training systems

Application areas of VR AR education



Virtual training system



Application areas of virtual education and training systems

VR AR

3D Simulation

Virtual education and training systems integration

Real and virtual environment and sensor devices simulation

Systems integration standardization

Training system 1

Training system 2

Training system 3

Training system 4

...

machine

archi-
tecture

road

facility

interior

manufac-
turing

medicine

health

sports

harbor

aircraft

military

science

engi-
neering

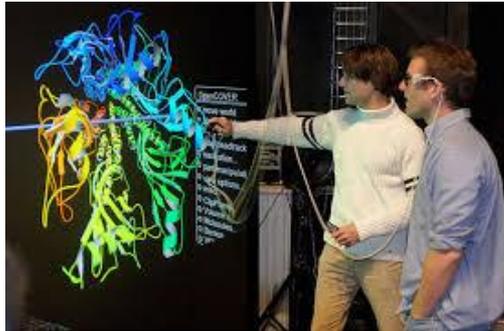
electro-
nics

space

Virtual Education and Training Systems Technologies and Application Areas

- VR/AR/MR integration into training and education systems
 - Information modeling and exchange
 - Visualization and simulation
 - Sensor representation
 - Real world representation
 - Graphical user interaction
- Areas related to VR/AR/MR information modeling and rendering
 - Science and engineering education
 - Medical education
 - Training for manipulating industrial equipment or devices
 - Ex: flight, car, ship, heavy vehicle, heavy equipment, army, transportation
 - Manuals for manipulating electronic and manufacturing products
 - Ex: camera, video, 3D printer, 3D scanner, home appliance
 - Education materials for making products
 - Ex: clothing, furniture, interior design, food, manually produced products

VR AR Based Education (1)



sites.google.com



linkedin.com



clicktoeducation.com



learncube.com



webschool.in

Education content and materials

Learning and teaching

VR AR Based Training Systems (1)



Driving simulation
(Road Traffic Authority, 2013)



CycleOps virtual training
(CycleOps, 2012)



Boeing CRVS
(The Boeing Company)

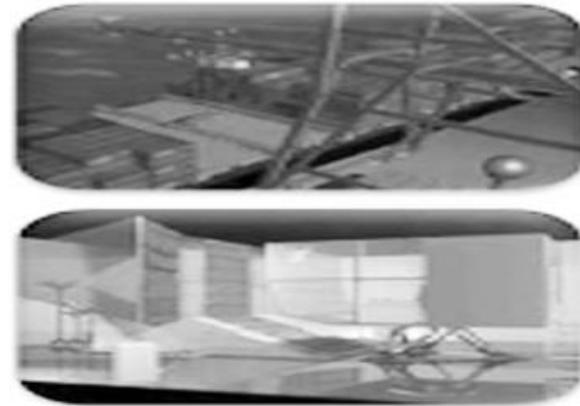


Military training
(STI, USA)

VR AR Based Training Systems (2)



Excavator simulator
(KETI)



Harbor crane training simulator
(Total Soft Bank)



Virtual medical education
(Virtual Medical Coaching)



Virtual military training

IoT Sensors for Virtual Training Systems (Examples)

- Automotive sensors
 - Light, temperature, position, ultrasonic, camera, etc.
- Bicycle sensors
 - Speed, position, light, cadence, etc.
- Flight sensors
 - Time of flight camera, displacement, inclination, ultrasonic, rotary, etc.
- Military sensors
 - Accelerometer, inclination, camera, night vision, etc.
- Medical sensors
 - Pressure, flow, oxygen, radiation, position, temperature, etc.
- Other VR training area sensors

Standard Technology for Virtual Education and Training Systems

- Virtual environment representation for education and training
 - VR/AR scene representation
 - Education and training information representation
- Virtual simulation interface with virtual environments
 - A virtual scene control interface with sensor devices
- Virtual simulation with real world environments and sensors
 - A sensor control interface with sensor devices for training
- Education and training information database description and manipulation

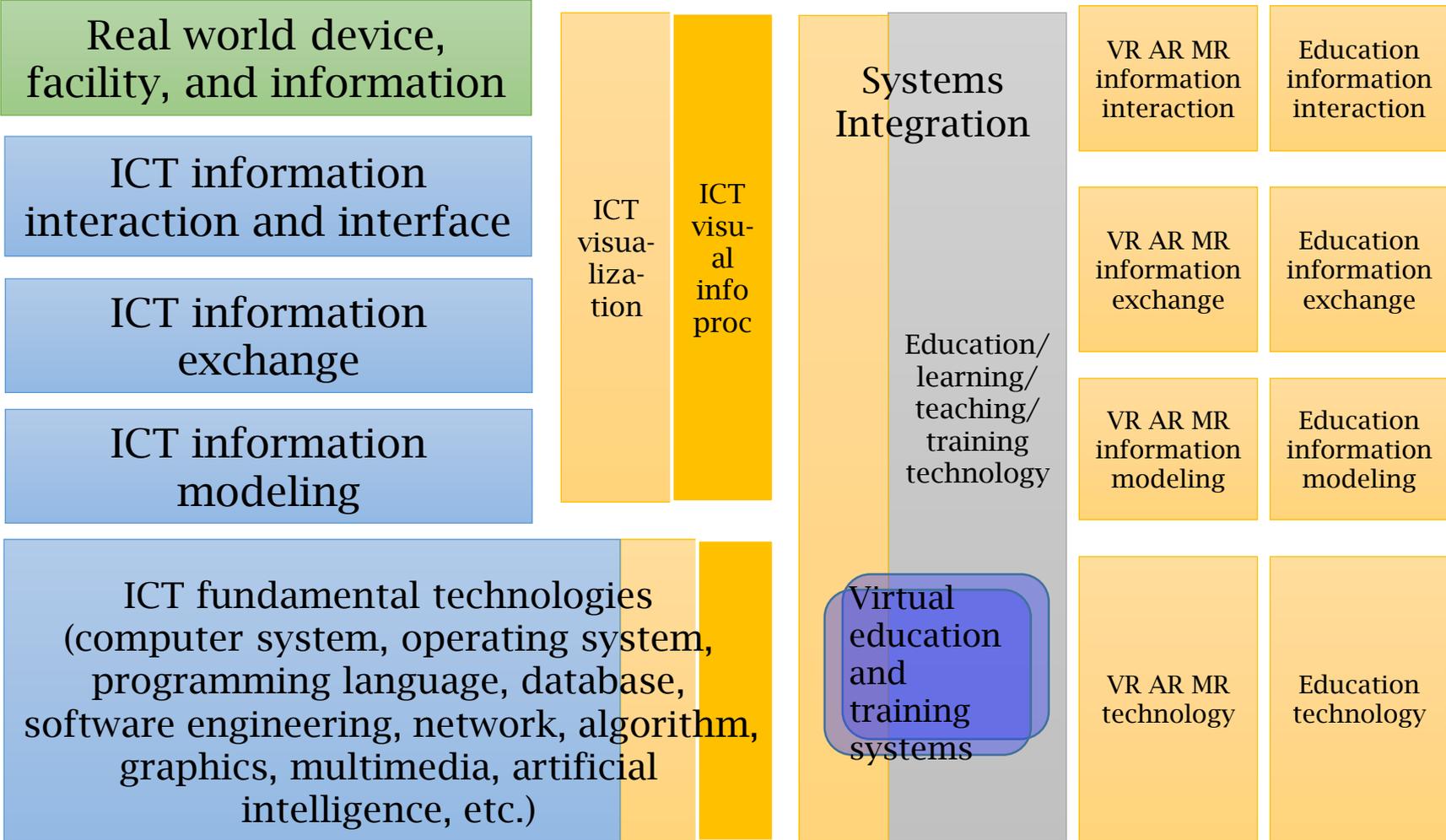
Virtual Education and Training Systems with IoT Sensors

- Representation of virtual education and training environments
 - Includes sensor representation
- Interaction with real and virtual education and training environments
 - Includes interaction with sensors
- Simulation of virtual education and training environments
 - Includes sensor simulation
- Interfaces for managing and controlling virtual education and training environments
 - Includes interfaces for managing and controlling sensors

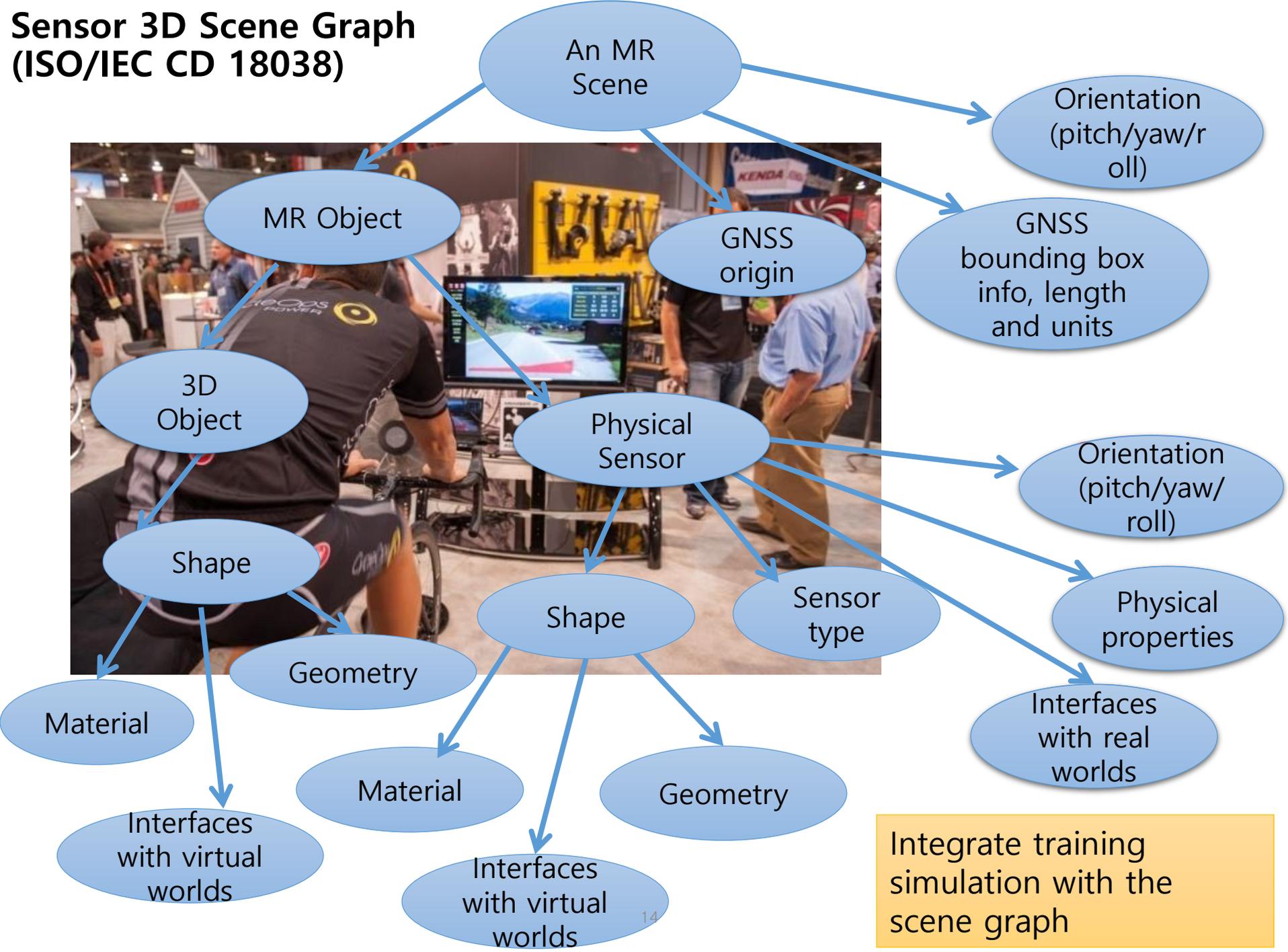
Standards and Standardization for Virtual Education and Training Systems in SC24

- Representation of virtual education and training environments
 - 3D virtual worlds
- Interaction with real and virtual training environments
 - IoT sensor and device representation and interactions with 3D scenes
- Simulation of virtual training environments
 - 3D visual training, learning, and teaching simulation
- Interfaces for managing and controlling virtual training environments
 - User interfaces for training, learning, and teaching information control from/to real and virtual worlds

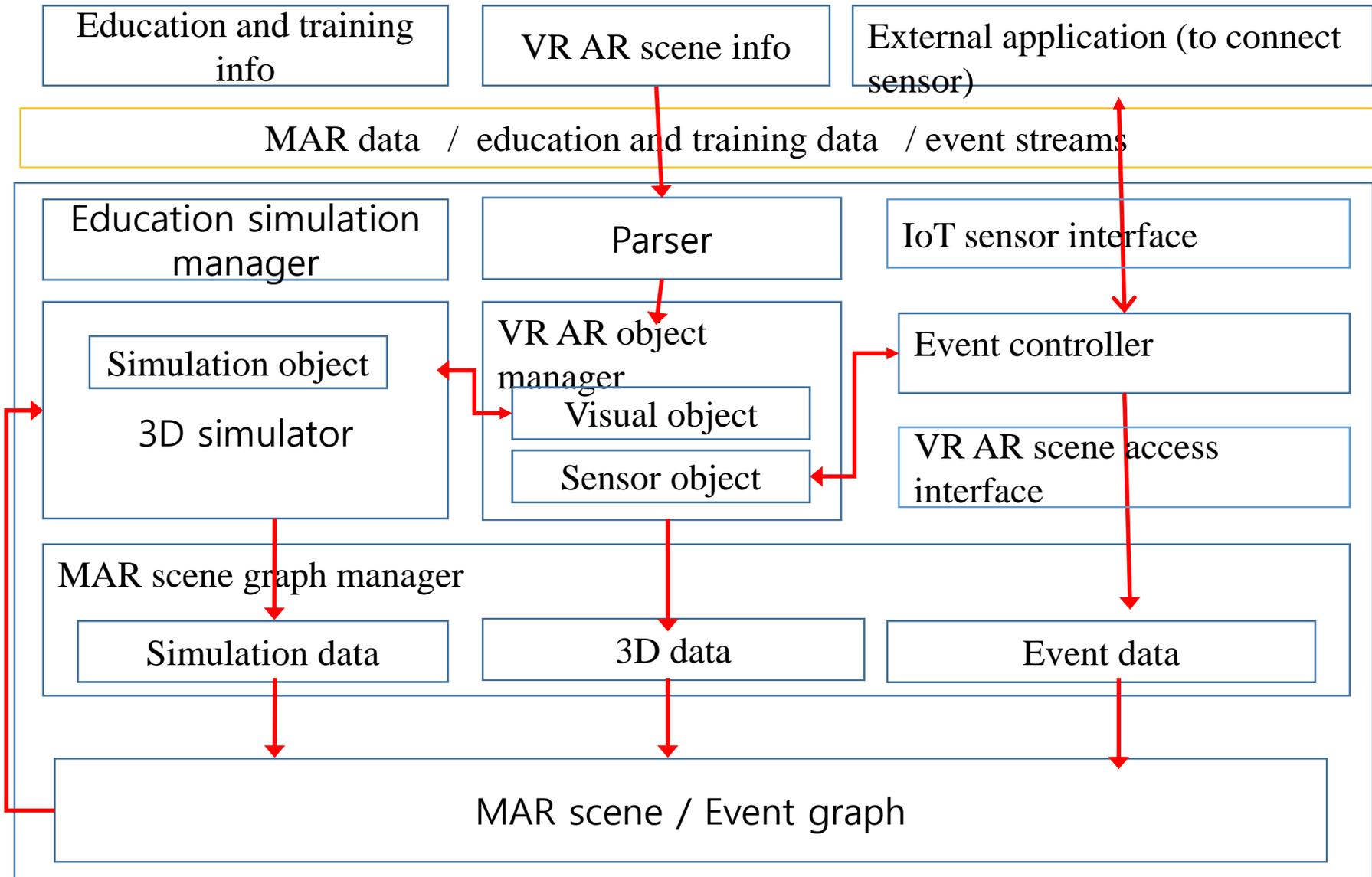
Architecture for Virtual Training Systems



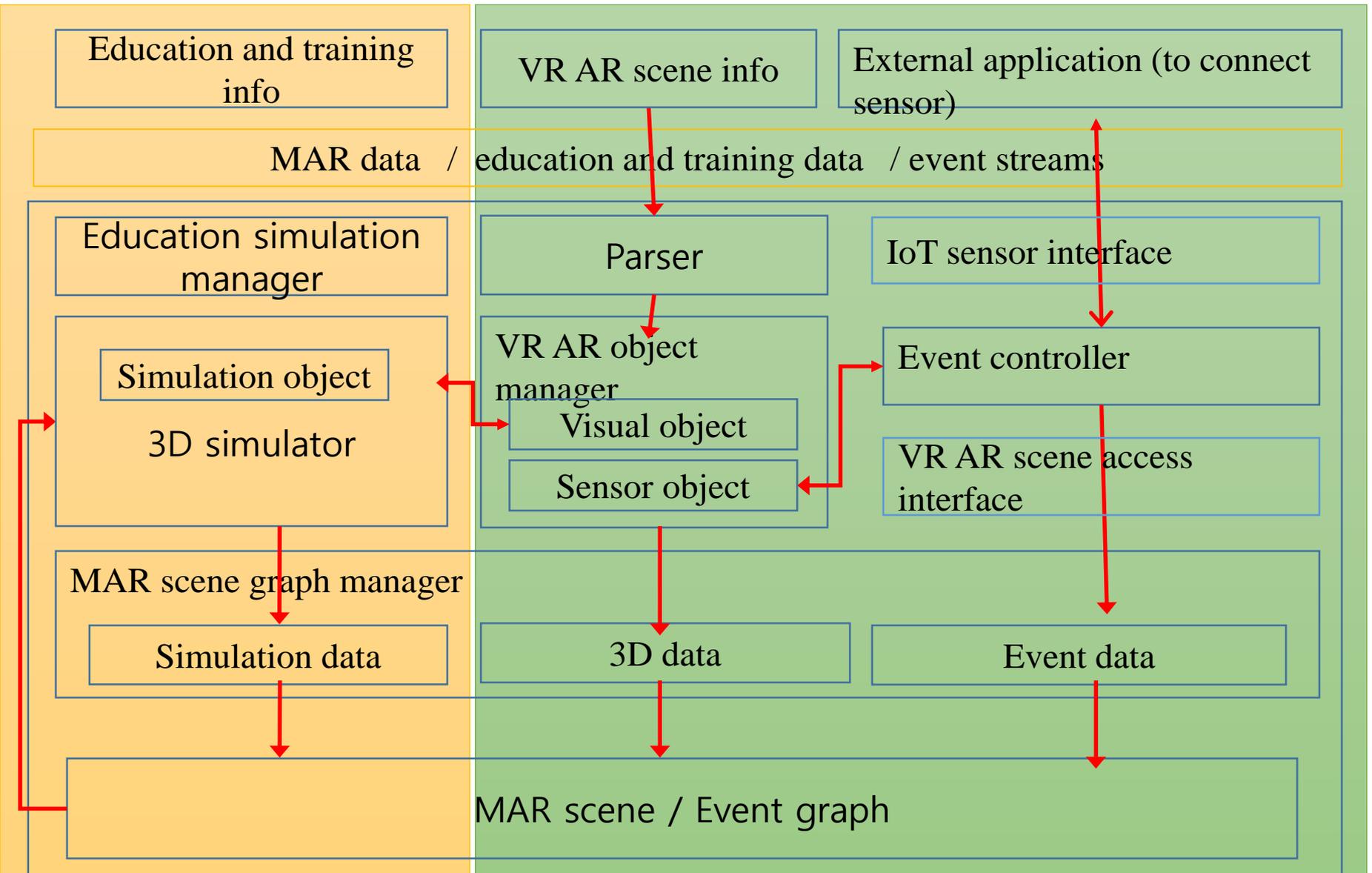
Sensor 3D Scene Graph (ISO/IEC CD 18038)



System Framework for Virtual Training Systems



System Framework for Virtual Training Systems



New Work Items for Virtual Training Systems

- Information modeling and architecture for virtual training systems
 - 3D scene graph generation and management
 - 3D object management
 - Training simulation management in virtual environments
 - Sensor event interface
- System framework for virtual training systems

JTC 1 VR AR for Education Ad Hoc Group

- Systems integration methodology for virtual education and training based on JTC1 standards
- JTC1 standards and standardization for virtual training and education systems
 - SC 24, SC 29, and SC 36 standards and work items
 - Other standards would be included
- Guidelines for developing virtual education and training systems using JTC1 standards

- Differences between SC24 and JTC1
 - SC24: Virtual training systems integration for visualization
 - JTC1: Systems integration using all related JTC1 standards for virtual training systems

Conclusions

- Work items for virtual training systems
 - Information modeling for virtual education and training systems
 - Architecture for virtual education and training systems
- Cooperation with JTC1 VR AR for education ad hoc group