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MPEG-V & Other Virtual Worlds Standards

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The Metaverse1 Case: Historical Review of Making one Virtual Worlds Standard (MPEG-V)

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Abstract

This paper takes an historical perspective to the Metaverse1 project. A group of about 30 EU-based organizations, totalling about 100 people, worked for about 3 years from mid 2008 to mid 2011 to develop a global standard that will connect virtual worlds and real worlds. The project, which was under the Eureka/ITEA2 framework, was one of the key contributors to the MPEG-V 'Media context and control' standard which was published by ISO/IEC in January 2011. The Metaverse1 project has developed a global framework enabling interoperability between virtual worlds such as Second Life, IMVU, OpenSim, Active Worlds, and Google Earth and with the real world in terms of sensors and actuators, vision and rendering systems, and applications in areas such as social and welfare systems, banking, insurance, tourism and real estate The paper includes these sections: a short review of the need for virtual worlds standards, the formation of the team and plan, general results and main outcome (MPEG-V standard). We will conclude with five challenges for virtual worlds' research that deals with interface, money, dependency, identity, and saleability. (The paper includes a side note with 10 lessons regarding a 2.5-years 216 person-years project like Metavsere1).

1. The Need for Virtual Worlds Standards

Readers of the Journal of Virtual Worlds Research, often lament the lack of standards within virtual worlds, and between virtual worlds and real worlds. The 2009 special issue on Technology, Economy, and Standards in Virtual Worlds (Sivan, Bloomfield & Gelissen) has covered in depth the origin of our journey to develop standards for virtual worlds. Now (Dec, 2011), about 3 years after our journey officially started, we take an historical approach, summarizing our journey to develop standards for virtual worlds (more precisely we summarise the first phase of an on-going journey conducted within the frame of an EU project called Metaverse1 (2011). The potential continuation of the journey will be explored in the conclusion section of this paper).

First, as a background, let us review project-launching assumptions (with some updates):

1. Virtual worlds are destined to become "big." That is, "big" in the sense of meaningful, influential, and lucrative for various current and new players. Every aspect of our lives will be affected by virtual worlds. Beyond being simply another media, virtual worlds will be part of our regular lives, and they are going to enhance, improve, and better our quality of life. Much like the internet, virtual worlds will allow us to do "traditional" things more effectively, and try out entirely new things as well. 2011 Update: The impact of full virtual worlds is yet to be seen. Social media (e.g., Facebook) and Mobile media (e.g., IPhone and Android, in phone and formats) are grabbing the attention.
2. Real virtual worlds are defined as an integration of four factors: 3D, Community, Creation, and Commerce (AKA 3D3C). The more we have of these factors the closer we get to real virtual worlds. In that sense IMVU, Second Life, and Entropia are more real virtual worlds than Club Penguin, World of Warcraft, and SIMS on-line. 2011 Update: nothing has changed here since this definition is conceptual.
3. "Standards" are a key for virtual worlds to become "big." People often link standards with competing concepts: "open" and "free" on the one hand and propriety patents, limitation of creativity on the other. Like many other human constructs, standards are not inherently good or bad – what you do with a standard gives them their positive or negative value. 2011 update: In this paper, we report on the progress we made with MPEG-V standard (MPEG-V, 2011). See part 4 of this paper.
4. A stacked approach is better than a Monolith approach (to be later contrasted with the Stacked approach). Currently the virtual worlds industry operates more like the Computer Gaming Industry than like the internet industry. Each developer, be it private (e.g., Linden, IMVU) or an open source (e.g., ex-Sun Darkstar, OpenSim) develops its own server, client, and rules of engagement. The inherent rationale of these efforts is a combination of "we know best" and "we will conquer the world." 2011 Update: while this may be the case (see Microsoft Windows, Apple iPod/iTunes/iPhone, or Google search), I believe the common public good calls for a Stacked approach like the internet or GSM, where different forces can innovate in particular spots of the value chain. I will be happy if one firm or organization succeed to capture the virtual worlds market and allow it to blossom (MS-Windows, for example, facilitated the entire PC industry, Amazon or Google is now doing it for Cloud computing, and Apple with mobile devices). Yet, I think, the virtual world market is too complex and long term in nature for one firm. Thus, a more inclusive model (like the internet) may be more appropriate.

5. Market Conditions: There are many players in the field of virtual worlds – all with various goals and takes on the field. Some of these players may have a direct and meaningful contribution to make. Currently the Open-Second Life ecosystem has potential to turn into the standard. The co-operation between Linden and Open source work seems to advance the state of the art. Yet, some voices look at this endeavour as Linden's attempt (planned or not planned) to stall the larger goal of standards. Standards are not always about technical value; they are more often about business models. 2011 update: we still do not have a standard that directly deal with the core issue of virtual worlds. In fact, the efforts, under the ISOC/IETF-VWRAP effort have stalled. On May, 19 2011 the Peter Saint-Andre, responsible area director wrote to the mailing list (IETF, 2011):

   The VWRAP working group was chartered to produce a comprehensive application protocol defining the interactions between virtual agents (avatars) and collaborative, three-dimensional virtual environments (virtual worlds). Unfortunately, the technology and market landscape changed significantly after the working group was chartered, and the working group lost several key participants, resulting in a lack of energy to complete the chartered deliverables. Although the remaining participants have discussed the possibility of focusing on a smaller scope (interoperability among virtual world technologies instead of a comprehensive virtual worlds protocol), those discussions remain preliminary at this time. Nevertheless, the mailing list will remain open to encourage further exploration of these topics.

6. We are just starting. The efforts to develop standards for virtual worlds will take a long time. The key is to define a path, arrive at some accomplishments, and then continue. 2011 update: this is of course still true as this paper will outline, especially in the last section where we list five core challenges.

These assumptions were the seeding grounds for the Metaverse1 Project. We envisioned the Metaverse1 as a research and development community around standards for virtual worlds. We started with the EU based Metaverse1 consortium which includes about 30 organizations mostly based in Europe to set "global standards between real and virtual worlds." The target, early on, was MPEG-V (Moving Picture Experts Group Virtual Worlds Standard). The MPEG group is part of the International Standards Organization (ISO).

This was our original plan:

In this context, the project will also pay attention to the associated business models to be developed as a very important aspect. It can be stated that a Metaverse can't exist without appropriate associated business models. At the same time, issues of money Laundry, child pornography, international terror and other social ills also call for attention. The Right standards can both protect and enable and the project will take these legal and ethical issues into account.

Metaverse1 will provide a global framework of standards between virtual worlds and the real worlds will enable an initial and sustainable industry. Where needed, as derived form the use case scenarios and the results of the SOTA (State of Technology Assessment), Metaverse1 technologies will be developed to close essential gaps in the overall framework.

The objective of the ITEA2 project Metaverse1 was to define interoperability in such a way that it would be possible to exchange information between virtual worlds. For example, personalization of an avatar in one virtual world could be applied to an avatar in another world. This would be useful for example in translating social skills to supply feedback to users established in one coaching system to another virtual world for a similar coaching or training application in a different context or domain.

Even more important and needed from a business point of view is the development of a standard interface between the real physical world and the virtual (simulation / serious games) world. This would make it possible to attach real world sensors – such as vital body sign parameters and / or environmental sensors – to provide input to simulations or alternatively obtain feedback from such models into the real world, for example to control comfort conditions in terms of lighting, temperature or ventilation in a room or for personal wellbeing.

2. The Formation of the Metaverse1 Consortia and Plan

Israeli professor Yesha Sivan, head of the information systems programme at the Tel Aviv Academic College, brought the idea of standardisation in the field of virtual worlds to the ITEA2 project outline event in Dusseldorf in 2007. Jean Gelissen from Philips Research teamed up with Sivan and took on the role of project leader.

ITEA 2, the follow-up to the successful ITEA programme, is a strategic pan-European programme for advanced pre-competitive R&D in Software-intensive Systems and Services (SiSS). ITEA 2 stimulates and supports projects that will give European industry a leading edge in the area of SiSS (in which software represents a significant segment in terms of system functionality, system development cost & risk and system development time). It has the ambition to mobilise a total of 20,000 person-years over the full eight-year period (2006 – 2014) of the programme, requiring a significant increase in investment. This ambition is based on experience in ITEA, the need to further close the gap in R&D investment (3% of GDP, Lisbon objective) and the ever growing importance of SiSS. As one of the main EUREKA cluster programmes ITEA 2 has close links with other EUREKA projects and the Framework Programmes of the European Commission. Our projects are supported financially by all members of the EUREKA framework (this meant that funding for each member organization was obtained locally from its government).

Many of the technologies required were not new but it was necessary to identify what was missing and develop suitable solutions. Metaverse1 defined a series of use cases and then looked at what technologies were available in terms to cater to the cases. Next to that, all the existing technologies and the ones developed in the context of the Metaverse1 project had to be assembled in a Framework that would form the basis of the foreseen standard.

Consortium members came from a range of areas (See Figure 1). Spanish partners focused on tourism and virtual travel applications. French partners were interested in technology simulation for museums, with a model allowing people to be present virtually in the space station and experience effects of low gravity. Dutch partners were more focused on ambient assisted living for elderly people – including connectivity with caretakers.

Other partners from the Netherlands were interested in simulation models to help in urban redevelopment projects: currently, the public is invited to look at plans or a model in the town hall and give their opinion. Virtual worlds allow viewing from any angle or place remotely (over screens or mobile phones (if you consider augmented reality). Therefore, when developing a new shopping centre, sports facility or apartment building, planning authorities can demonstrate the impact more directly.

Such a scheme was tried out in the Netherlands and a second version has been used to help students to find preferred accommodation. A similar approach is relevant for many types of other urban planning – from modelling utility systems for maintenance or extension to locating new transport systems.

Partners in Belgium and France were interested in the symbiosis between video conference and meetings in a virtual world. Video conferencing has limitations – particularly in being static. Meetings in a virtual world can be much more dynamic. People can move around, change seats and participate in subgroups in a virtual world, but there is still a lack of reality – it is not possible to see facial expressions for example. Therefore, the idea was to combine the two approaches by projecting 3D footage of participants on their avatars in the virtual world – offering a new way of teleconferencing.

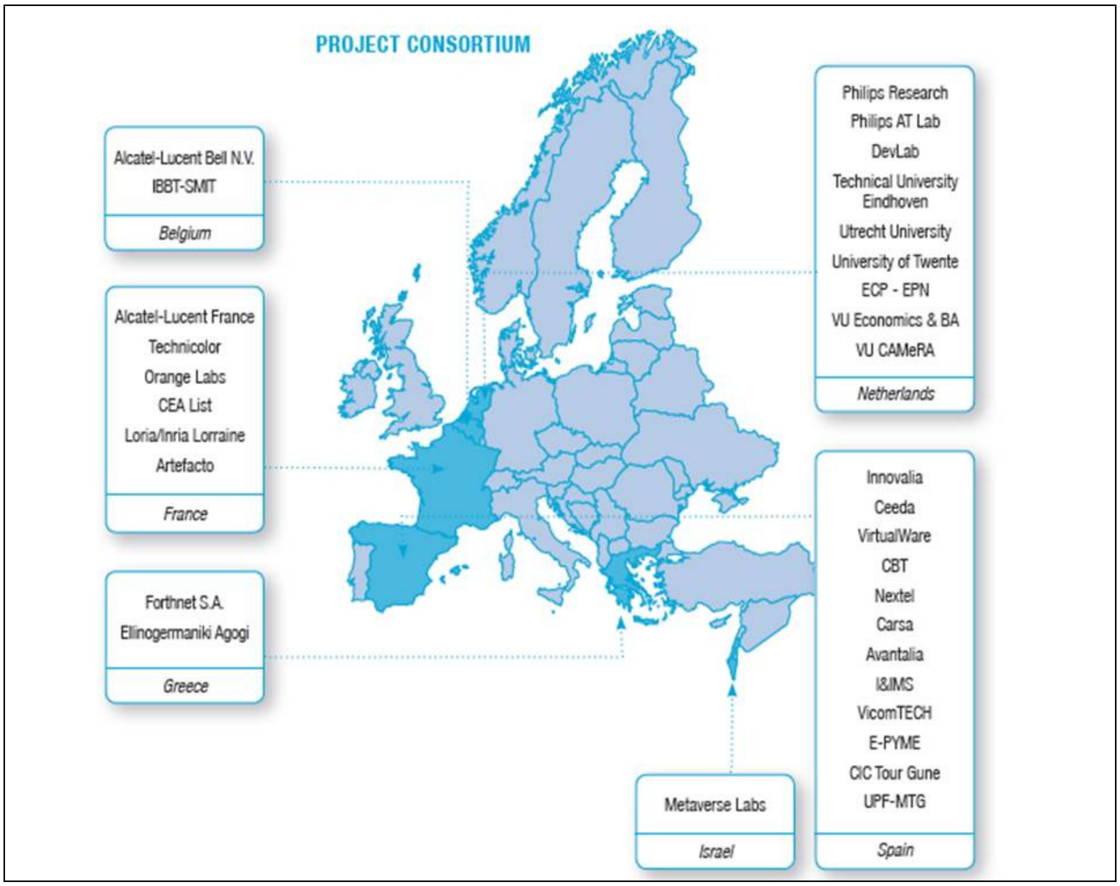

Figure 1: Metaverse1 Members Per Country

The Metaverse1 defined a series of use cases and then looked at what was available in terms of virtual worlds (technologies, interfaces, etc).

Some 18 missing items were defined and the necessary technologies to be further developed (note: naturally, these items also stem from the specific research goals of team members):

- Sensor / Actuator / Robot Integration (Being able to transfer data and actions between systems in terms of available (sensor) signals to avoid clicking a mouse and keying in information)
- Crowd simulation / Path Finding
- Advanced Physical Engine
- Multi Linguality (Providing support for multiple languages – crucial in social contexts)
- Avatar Modelling
- 3D Avatar Mixer
- 3D Presence
- 3D Streaming (Feeding real-time 3D video streams into a virtual world)
- Sound Scape (for inclusion of real audio input – for example taking original sounds such as fountains or on the beach at locations in Gran Canaria and integrating them into a virtual tourism application)
- Mapping on IPTV
- Tactile Information
- Hybrid Communication

The project adopted the following work plan (Figure 2) with five Work Packages (WPs):

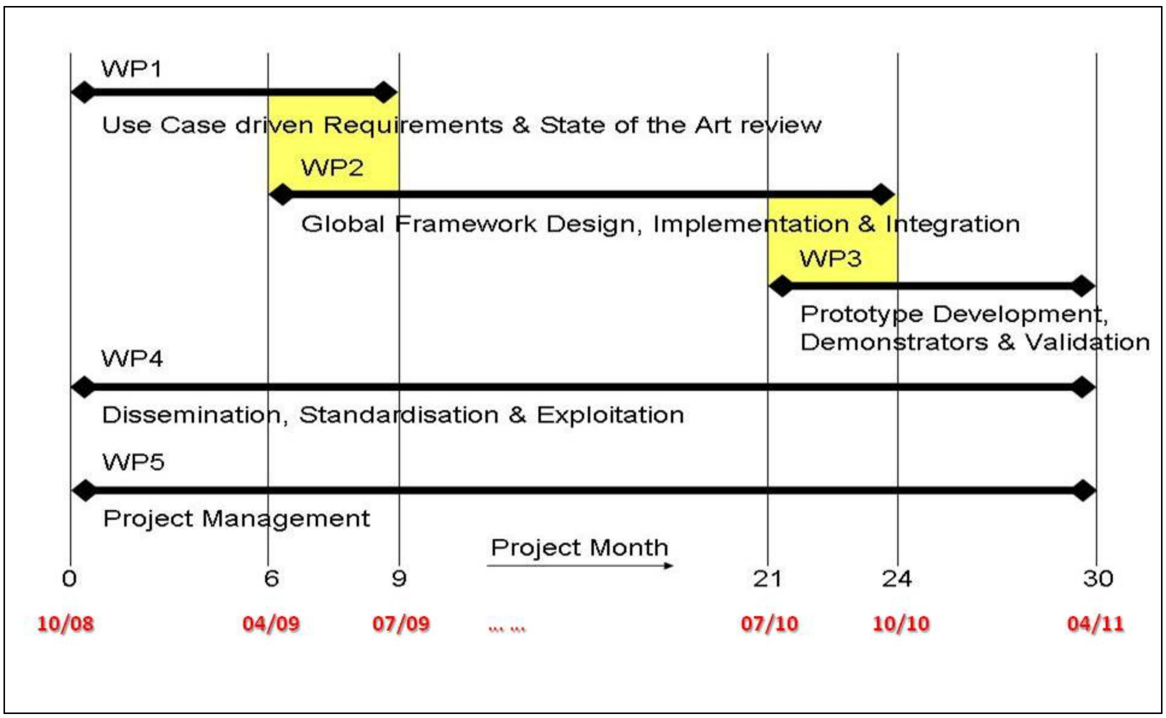

Figure 2: Metaverse1 Work Packages (WPs)

WP1 goal was to develop specific use cases to drive needs and missing technologies and standards. WP2 aim was to define the framework for standards (this was the main work that led to MPEG-V), WP3 aim was to develop the demos that will use the framework for the use cases.

In parallel we had two administrative work packages. WP4 had to do with dissemination, Standardization and exploitation (finding business opportunities). WP5 had to do with the management of the project.

3. Results

3.1 Dissemination

- 68 publications published in international journals / conference proceedings
- 34 presentations / demonstrations at international conferences/fairs
- 2 project organised international conferences
  - March 23, 2011, Shefayim Kibbutz, Israel: 3D3CWorlds Conference
  - January 25 – 26, 2011, Deagu, South-Korea: First International MPEG-V Awareness Event & International Conference (See Figure 3.)

Figure 3: MPEG-V Banner in Korea (January 2011)

- 4 magazine articles
- 2 special issues of the Journal for Virtual World Research (JVWR), Technology, Economy, and Standards in Virtual Worlds (Sivan, Bloomfield & Gelissen 2009) and this issue on MPEG-V and Other Virtual Worlds Standards (Gelissen, Preda, Cruz-Lara and Sivan 2011).

3.2 Exploitation

- 2 new product / service combinations:
  - Virtual Travel / Virtual Traces for the Tourist Industry
  - Decision making on spatial problems, tools for (real) Estate Planning
- 4 new systems:
  - Mixed Reality for Next Generation Video Conferencing
  - Social Presence for the Disclosure of (Cultural) Heritage
  - Serious Gaming for Ambient Assisted Living (Social Connectivity)
  - Virtual Presence for Ambient Assisted Living (Safety)

- (Industrial) exploitation is visualised demonstrators enabling future business for the project partners:
    - Virtual Travel / Virtual Traces (Tourist Industry, **Innovalia**)
    - Serious Gaming (Ambient Assisted Living: Social Connectivity)
    - Mixed Reality (Next Generation Video Conferencing, **Alcatel Lucent**)
    - Social Presence (Disclosure of Cultural Heritage)
    - Virtual Presence (Ambient Assisted Living: Safety, **Sallandelectronics**)
    - Decision making on spatial spacial problems (Tools for (real) Estate Planning)
    - Tactile Information (Tactile Feedback, **Philips**)

Standardisation (next chapter)

- Creation & completion of the ISO/IEC 23005 (MPEG-V) International Standard
    - First edition completed focused on multimedia
    - Second edition in development focused on bio sensors

4. Main Outcome: The MPEG-V Standard

In parallel to the work of Metavsere1, Jean Gelissen from Philips Research took charge of connecting Metaverse1's effort to the standards group ISO/ IEC JTC1 / SC29 / WG11 better known as MPEG (2011). Gelissen has been active in MPEG for more than 12 years. MPEG has received 3 Emmy Awards for MPEG-2 (1) and H264 (2). Some of MPEG's track record:

- MPEG-1 Digital Video Disc (& CDI)
- MPEG-2 Broadcast TV (SD & HD), DVD, …
- MPEG-4 Object Based Coding (Still & Movie Digital Camera's, H264)
- MPEG-7 Multimedia Description (TV Anytime, …)
- MPEG-21 Total Multimedia Delivery Chain
- MPEG-E (ISO/IEC 23004) Multi Media Middleware (the result of 3 earlier ITEA projects, Robocop, Space4U and Trust4All …)
- MPEG-V (ISO/IEC 23005) the result of the ITEA2 Metaverse1 initiative

MPEG follows the formal ISO/IEC process that is preceded with a lobby process (Convener, Systems Chair) to create awareness followed by a first 'in-official' document: the Context & Objectives (based on the Metaverse1 project plan). The next steps are the drafting & call for requirements and the conception of a working draft. After this last informal stage the formal process (with a balloting process by all the member countries) is started with the following stages:

- CD (Committee Draft)
- FCD (Final Committee Draft)
- FDIS (Final Draft International Standard)

- IS (International Standard)

The ultimate result (at the IS level) was presented early 2011, and became an official standard ISO/IEC 23005 (MPEG-V) in the same year.

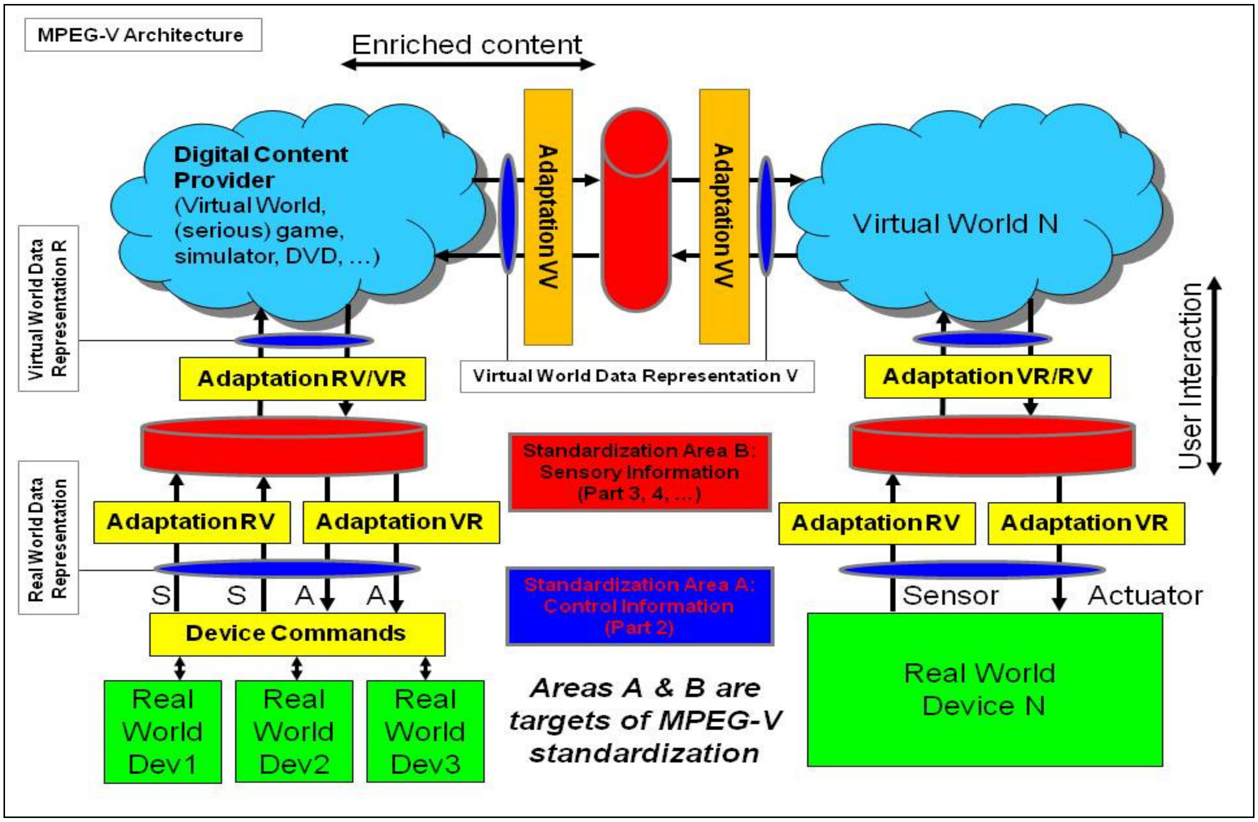

Figure 4: MPEG-V Overview (January, 2011)

It would also make it possible to obtain input for 3D worlds from 2D digital sources. A lot of what is done today is already available in some kind of IT system. So a standard interface would make it easy to obtain input from all types of existing systems – such as traffic reports, weather forecasts, property details or tourist information – for a virtual world representation or simulation.

The first version of the ISO/IEC 23005-1:2010 (MPEG-V, Media context and control) standard is made up of several parts referring to (See Figure 4):

- Architecture and use case scenarios;
- Metadata to describe device capabilities, sensor and actuator data and user preferences;
- Metadata to represent sensory effects;
- Metadata to represent virtual-object and avatar characteristics; and
- Syntax and semantics for all the above data formats and reference software.

MPEG-V took into account some products already on the market that could be adapted to the standard. This included amBX, originally developed by Philips, which is a system allowing the addition of extensions to multimedia and computer games. amBX makes it possible, for example, to add thunderstorm effects to games or films and is used in the Korean RoSE system to automate special effects for stage performances.

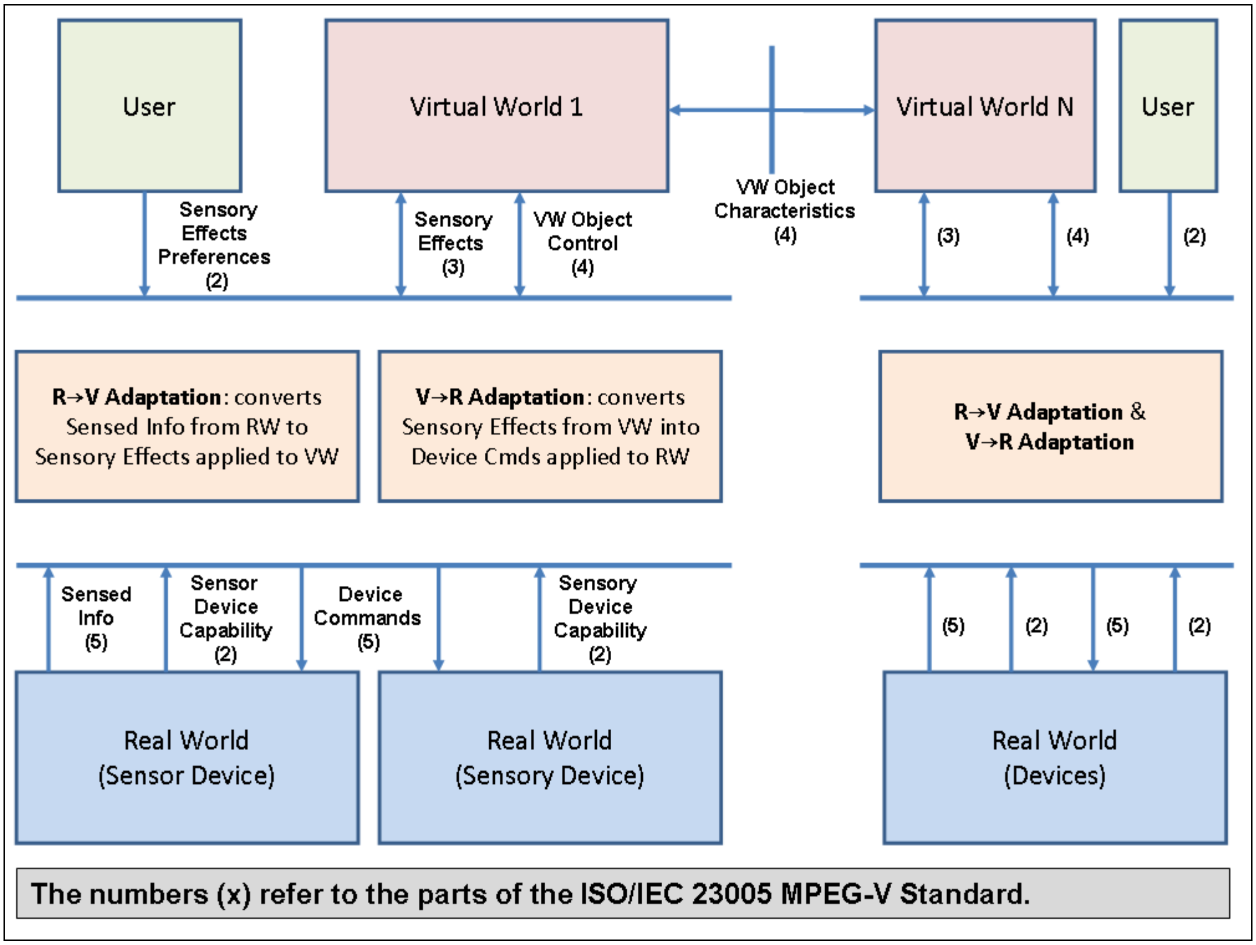

Figure 5: MPEG-V Parts (December, 2011)

Figure 5 depicts a more detailed technical view to MPEG-V. The following paragraphs will describe the internal parts of the standards.

4.1 Part 1: Architecture (not in Figure 5)

Part 1 specifies the Architecture of MPEG-V (Media context and control).

4.2 Part 2: Control Information

Part 2 specifies syntax and semantics required to provide interoperability in controlling devices in real as well as virtual worlds. The adaptation engine (RV or VR engine), which is not within the scope of standardization, takes five inputs (sensory effects (SE), user's sensory effect preferences (USEP), sensory devices capabilities (SDC), sensor capability (SC), and sensed information (SI)) and outputs sensory devices commands (SDC) and/or sensed information (SI) to control the devices in real worlds or virtual worlds' object. The scope of this part covers the interfaces between the adaptation engine and the capability descriptions of actuators/sensors in the real world and the user's sensory preference information, which characterizes devices and users, so that appropriate information to control devices (actuators and sensors) can be generated. In other words, user's sensory preferences, sensory device capabilities, and sensor capabilities are within the scope of this part.

4.3 Part 3: Sensory Information

Part 3 specifies syntax and semantics of description schemes and descriptors that represent sensory information. This, in turn, enhances the experience of users while consuming media resources.

4.4 Part 4: Virtual world object characteristics

Part 4 specifies syntax and semantics of description schemes and descriptors used to characterize a virtual world object related metadata, making possible to migrate a virtual world object (or only its characteristics) from one virtual world to another and/or control a virtual world object in a virtual world by real word devices.

4.5 Part 5: Data formats for interaction devices

Part 5 specifies syntax and semantics of the data formats for interaction devices, i.e., Device Commands and Sensed Information, required for providing interoperability in controlling interaction devices and in sensing information from interaction devices in real as well as virtual worlds. This part aims to provide data formats for industry-ready interaction devices: sensors and actuators. The same data formats for interaction devices can be used by various applications supported by different MPEG technologies. Not only ISO/IEC 23005 but also other International Standards such as ISO/IEC 23007 (MPEG-U) and scene representation specifications (for example ISO/IEC 14496-20) can simply refer this part of ISO/IEC 23005 to use the defined data formats.

4.6 Part 6: Common Types and Tools (not in Figure 5)

Part 6 specifies syntax and semantics of the data types and tools common to the tools defined in other parts of MPEG-V. To be specific, data types which are used as basic building blocks in more than one tool of MPEG-V, for example; color-related basic types, and time stamp types which can be used in device commands and sensed information to specify timing. Also, several classification schemes which are used in more than one part of MPEG-V are defined in the annex of this part. Please note that most of the tools defined in this part are not intended to be used alone, but to be used as a part or as a supporting tool of other tools defined in other parts of MPEG-V.

4.7 Part 7: Conformance and Reference Software (not in Figure 5)

Part7 specifies the conformance and reference software. The conformance and reference software serves three main purposes:

- validation of the written specification of the several parts of MPEG-V;
- clarification of the written specification of the several parts of MPEG-V; and
- conformance testing for checking interoperability for the various applications against the reference software which aims to be compliant with MPEG-V.

In the 2011 standardization context, work is already advancing on a second version of the standard to extend its application domains. There is a lot of interest, for instance in biosensors – measuring vital body parameters and using them as inputs for either games or lifestyle-related applications. Next to that, Gas and Dust, Gaze Tracking, Smart Cameras, Attributed Coordinate, Multi-Pointing, Wind and Path Finding sensors are under consideration.

The MPEG-V standard defines a starting point. The real benefit of virtual worlds will arrive from applications – using the technical signals to create value. This is of interest to consumers, industry, and of course public authorities.

5. Conclusion: Five Challenges for Virtual Worlds Research

The three-year project, which started in 2009, created the opportunity to look at virtual worlds from multiple perspectives. The current state of virtual worlds was poignantly summarized as "what we have long known in MIS: if you build it, they will not necessarily come" (Wasko, Teigland, Leidner, and Jarvernpaa, 2011).

The following five research challenges, present our current take on what is missing. We believe these five core challenges are critical and thus should be tackled by academic and industrial research. By sharing these challenges, we hope to instigate further research.

1. **The interface challenge** – one of the key innovations in personal computers was the invention of the mouse (Engelbart, 1967). Together with windows (be it the Xerox, X, Apple, or Microsoft versions), the mouse was the hardware side of the interface. Action like click, double click, drag, (and programmatically mouse-up, mouse-down, etc' on the software level) allowed a new modes of operation. In a more modern example, iPhone commercialized the touch interface with actions like zoom, pinch, touch, touch and zoom. Virtual worlds lack such a standard interaction method (with or without a device). Each world has a somewhat different combination of commands. Mastering these commands is often difficult and causes a relative long learning curve before the user feels the value. Even worse, moving from one world to another calls for yet another set of commands. The key question is what would be the combination of hardware and software needed for interfacing virtual worlds.
2. **The money challenge** – in 2007, I had an opportunity to discuss "money" in virtual worlds in an open source meeting that took place in a virtual world's conference. Participants were mostly technical people that develop various parts of the OpenSim project. When I raised the issue of money, I was swiftly answered in the following way: "money is a layer that should be added after the system is done." We already had this approach when the Internet was conceived. The combination of pure engineering focus, that does not value commerce, and the "protective" system of banking that enjoys hefty commissions did not allow – till this day – for a universal and common payment system. Starting a commerce Internet site is still complicated. As noted in the 3D3C definition, we believe the full value of virtual worlds will be materialized, if it includes commerce. We can clearly see the value of such built-in commerce in the relatively small economy of Second Life (SL), where commerce in the form of products and services both within the virtual world, as well as in the real world, flourishes. Many people that use virtual worlds for educational goals (for example for teaching), artistic goals (making movies AKA machinima), and therapeutic goals (for example for trauma treatments) use subcontractors in the virtual world. A true global 24 economy is occurring within SL. The money challenge has also to do with taxing issues that may differ from country to country as well as some checks and balances to deal

with money laundering and other illegal activities. The key question: what factors do we need to include and where to enable globalisation of the Commerce in the 3D3C virtual world?

3. **The dependency challenge** – one of the key benefits of the internet is the ability to trust it. As a user, I can go to both Google search and Bing search. I can get my news from CNN or The Wall Street Journal, I can use email with outlook or Gmail. We have choices. Furthermore, we can often "save" our work and move it from one supplier to another. We lack that (yet) in virtual worlds. A virtual product or a service is often locked within one world. Often such worlds simply end (see Google Lively, 2011 , There.com , or Metaplace). SL's content creators are often lamenting the inability to move items from the official SL Grid to the more open OpenSim grids. The key question is how can such a trusted, robust, internet-like system, be developed so that it will sustain the 3D3C factors. (Note: there are several examples to closed trusted systems including Microsoft XBox, World of Warcraft and – of course – the more generic Apple's iPhone ecosystem. Whether the "ultimate" virtual world will be more like the Internet or more like Apple iPhone is yet to be seen.)
4. **The identity challenge** – In an earlier work, Sivan (2011), has lumped together a set of related issues under the term "identity." These issues include for example: privacy, security, authentication, anonymity, adult content, rights, and copyrights. Key questions here include: how do we balance anonymity, a key value of virtual worlds, with the need to prevent griefing; how do we protect fashion makers from the theft of textures; how do we allow software code (an integral of content) to run without taking too much server or client energies; what happens to an avatar when its owner die. The gist of this challenge relates to the yet-to-be-solved interaction between these issues. The key question here is how to take our real world – less than perfect – identity structures and bring them to the virtual world, then enhance them to match some of the new challenges. Note that such questions are not technical in nature, it has to do with what we value and what do we want to enable. Once we define that, the technical needed components can be developed.
5. **The many avatars saleability challenge** – one of the key technical challenges to virtual worlds can be seen in SL's "40-avatar-per island" limit. Say you are a firm that organize an event, once about 40 people have arrived to your virtual island, it is practically blocked and no other avatar can go in. For example, a DJ organized a party and could NOT get into his own party because there were too many avatars already in his island. The key question here – how to allow more people to participate in the same event. Contrast this with a web site that allows thousands of people to participate. You will note that in a real world, in a party for example, we also have a limit to the number of people we can interact with simultaneously. In a large stadium, you interact with just a small percentage of the thousands of people you see. The main challenge is to develop the correct mental framework, and supporting technology to solve this challenge.

These five core challenges (interface, money, dependency, identity, and many avatars) highlights key fronts where major technical progress is needed before we can harness the value of virtual worlds. As with previous technologies (e.g., electricity, phones, TV, Internet, GSM) the right combination of core technologies (like these five challenges) and accepted standards (like the direction MPEG-V is heading) will lead to the tipping point in virtual worlds. We hope that Metaverse1 and MPEG-V brought us closer to the inflection point, brining us closer to ubiquitous real virtual worlds.

6. A Side Note: 10 lessons regarding a 2.5-years 216 person-years project like Metavsere1

In Jun 21, 2011, project leaders were invited to present the Metaverse1 project to the High Level Group of the European community (this includes representatives from all the funding agencies of EU members). This meeting allowed us to reflect on the lessons learned from running a project that lasted about 3 years (official time table was 2.5 years, but in reality the project took about 3 years due to different start dates of the partners) and included a total of 216 person years in all partners. These ten lessons are listed here:

1. Define a specific lofty achievable goal (MPEG-V in our case)

Driving such a large-scale project with a remote location, agendas, and working styles was possible because we all had a specific goal. This goal was clear ("standards for virtual worlds"), large enough (so each team member could take a particular angle to it), and also deadline driven (the deadline was given to us by the MPEG-V process. Having a specific one goal that can be shared and communicated was beneficial.

2. Use an Internal knowledge/management system (MyMT1)

To share information, news, and outcomes we used a Google Sites based system called MyMT1. MyMT1, which started as a simple document sharing system, evolved to be a full-scale knowledge management system of the project. It included "outcome" tables that defined for each Work Package (WP) the list of needed outcomes by the WP leader. Then, each member could submit the needed results to the system. MyMT1 served as a central place for news, an historical record's archive (especially valuable for new individuals that joined Metaverse1 during its course). Lastly, the system served as the communication channel with the ITEA1 reviewers, cutting the need for special reports.

3. Grand meetings (of all projects in one place once a year)

During the three years of the project we have met about seven times in various formats. Smaller meetings aimed more at management tasks, setting deadlines, dealing with missing items, preparing for reviews. To other meetings (which we called "Assembly") we invited all members to join. These meetings proved to be fruitful in generating ideas, and feedback. Such value could be enhanced even further if we could meet with other parallel teams of other projects. Packing researchers into one physical place for 1-2 days creates many opportunities for cross-pollination of ideas, tips, and tricks.

4. More power to project leaders

ITEA2 projects are funded in two phases. First, a project is approved by the central ITEA office (it is "labelled"), then each partner requests funding from a local country funding agency. This approach creates a loose connection between the initial project plan and leadership, and actual work, as each partner is more receptive to its funding agency than to the originators of the project. As a result, this project was loosely managed due to its funding scheme: some of the key issues that were identified as missing were not dealt with (like money in virtual worlds) while other issues (with much less overall value) were dealt with because specific teams had vested interest in them (like line of research, or past research).

5. Synchronize timing with all governments

A key technical issue was the lack of sync between project timetable, and funding agencies' timetable. Some countries started the project in different times, which led to a mismatch in project management.

6. 4 year (even 5 year projects)

The current project lasted 3 years. The last year proved to be the most effective one. As people got to know each other, and there was enough level of skill in the group. I would recommend extending projects to 4-5 years. This will really allow people to think long term. This will also allow management to take the time to streamline and focus the research.

7. More energy per a partner (experts vs. workers)

Some of the partners had allocated only a minor investment (less than 1 FTE a year). Such low amount does not allow in-depth work or organizational commitment. Larger partners with more people contributed much more. Three persons per a partner are a minimum.

8. Train people in internal & external expression (movies, presentations, papers)

Early on, we identified the need for the proper presentation of results (this is especially needed in a visual project that deals with virtual worlds). Beyond a project report, and academic papers, which are common, we insisted on industry presentations and visual movies (in fact, defined outcome called specifically for movies). We have seen on-going improvements in the visual outcomes of team members.

9. Motivate and incentivize to cooperate

We were especially keen to enable teams of different members to cooperate, both within the same country and across countries. Such cooperation emphasized the need to define interfaces in the right way (which led and enhanced parts of the standards).

10. Think more about reuse, customers, and business

One of our key lessons was to expose the research and the research's results to end users, and business partners. Their comments often allowed us to better understand what we do, and how to present it. It also allowed us to get timely updates from the field and feedback on Metaveerse1 contribution.

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