IMMERSIVE EDUCATION INITIATIVE PROCESS DOCUMENT

http://MediaGrid.org/process/Immersive_Education_Initiative_Process_Document.pdf

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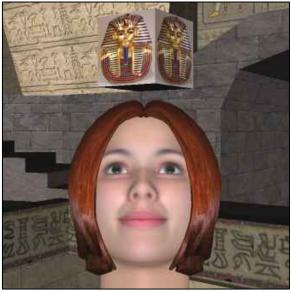# 1. Immersive Education Overview

Immersive Education combines interactive 3D graphics, commercial game and simulation technology, virtual reality, voice chat, Web cameras (webcams) and rich digital media with collaborative online course environments and classrooms. Immersive Education uses these and other advanced technologies to take distance learning and self-directed learning to a new level.

Unlike traditional distance learning, Immersive Education is designed to engage students in the same way that today's best video games grab and keep the attention of players. Immersive Education combines interactive virtual reality, simulations and learning games with sophisticated digital media and collaborative online environments. Immersive Education gives students a sense of "being there" even when attending class in person is not possible or practical. This, in turn provides faculty and remote students with the ability to connect and communicate in a way that greatly enhances the learning experience.

Immersive Education is developed by the Immersive Education Initiative [PUB1], a non-profit international collaboration of universities, colleges, research institutes, consortia and companies that are working together to define and develop open standards, best practices, platforms, and communities of support for virtual worlds, simulations and game-based learning and training systems. Membership is free and open to the public but merit-based and restricted to organizations and individuals that have experience using virtual worlds, simulations, or game-based learning technologies.

The Immersive Education Initiative is an official activity of the Media Grid international standards organization [PUB2]. The Media Grid standards organization is a not-for-profit standards body that is actively applying open standards to specific problem spaces, such as distance learning, digital libraries, and the impact of digital media on culture and society. As an open standards body the Media Grid is vendor-neutral and technology-neutral; the Grid Institute leads the design and development of the Media Grid in collaboration with industry, academia, and governments from around the world.

The Media Grid is a novel decentralized network infrastructure and software development platform based on new and emerging distributed computational grid technology. The Media Grid is an on-demand public computing utility that a wide range of software programs and Web sites can access for delivery and storage of content (graphics, video, animations, movies, music, games, text, and so forth), media processing services (such as data visualization and simulation, medical image sharpening and enhancement, motion picture scene rendering, special effects, transformations and compositing, and other digital media manipulation capabilities) as well as traditional grid services not focused on digital media. Simply put, the Media Grid is a public network that builds upon, and improves, the existing Internet and World Wide Web to provide advanced digital media delivery, storage, and processing capabilities in addition to general grid computing capabilities not specifically related to media.
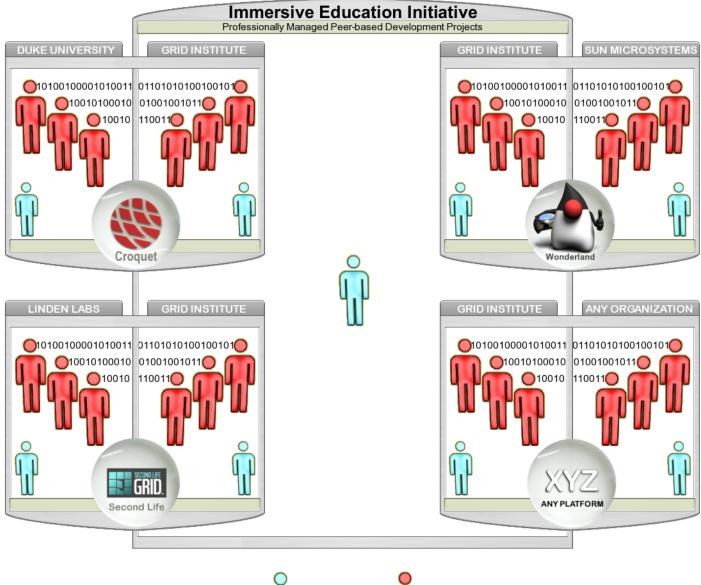
> Immersive Education and the Media Grid were recently recognized with a national award by Computerworld as "*innovative, promising technologies which hold the potential to **significantly affect society** in the near future* "

2. Areas of Focus

Members of the Immersive Education Initiative collaborate in ten focus areas chaired by faculty, administrators, and researchers from Grid Institute, Boston College, Loyola Marymount University, Columbia University, M.I.T., and other leading organizations. Refer to the Immersive Education Initiative's Talking Points document [PUB3] for details:

1. **Platform Ecosystem and Education Grid.** In the context of Immersive Education the term *platform* refers to any virtual world, simulator or 3D environment that may be used for teaching or training purposes. The Immersive Education platform has evolved considerably over the past decade and the next generation is now under development. Whereas the previous two generations were based on specific client-side platforms tied to proprietary server-side infrastructures, the future of Immersive Education revolves around multiple client-side platforms working in unison through the server-side Education Grid. The Platform Ecosystem and Education Grid provide educators with a comprehensive end-to-end infrastructure for a new generation of learning environments, learning games, and simulations.

2. **Design and develop "Web3D Books".** Web3D Books are Web-based digital books that support bidirectional interaction with Immersive Education learning experiences. Web3D Books are used to assemble and present any combination of text, imagery (such as images and videos), audio, Web content (HTML pages, Flash animation, etc.), and Web-based 3D content (such as Shockwave and X3D). A Web3D Book can be thought of as a Web-based presentation container that seamlessly guides learners through three-dimensional (3D) immersive learning experiences.

3. **Define, develop and publish best practices related to pedagogy, learning assessment, and learning outcomes.** How, for example, do we conduct classes or training and educational sessions in a virtual learning environment? How do we assess how well our students and learners are doing? How do we determine that desired learning outcomes have been achieved?

4. **Define, develop and publish best practices for constructing Immersive Education learning environment**s (classes, training scenarios, and simulations), including student-faculty course content development ecosystems.

5. **Design, develop and promote open and platform-neutral file formats** that enable interoperable learning environments to be seamlessly deployed across a wide variety of virtual world and game platforms (e.g., Second Life, World of Warcraft, Open Croquet, Wonderland, There.com, and other 3D/VR platforms).

6. **Curricula**. We are developing a complete curriculum that teaches students, faculty, and trainers how to a) create compelling Immersive Education experiences, and b) how to conduct courses using Immersive Education technology.

7. **A.I. and game-based learning frameworks.** We are developing advanced forms of Artificial Intelligence (A.I.) and game-based learning tools for guided and self-directed education and training environments.

8. **Immersive illness (mental health).** As virtual world and game-based learning systems become more compelling and powerful, numerous forms of so-called "immersive illness" (such as addiction, alienation, and mental schisms) will affect some users. The Immersive Education Initiative is defining best practices and early-warning systems that will help teachers, faculty, and trainers identify and assist at-risk users.

9. **Summits, conferences, meetings and training.** Starting in 2008 Immersive Education will have a dedicated track at Boston's annual Digital Media Summit. Faculty and staff will receive hands-on training and support during Summits and also at meetings and conferences convened throughout the year.

10. **Communities of Support.** Many organizations don't have the resources, staff expertise, or funding necessary to take full advantage of virtual world and game-based learning technology, which is why we are developing open standards and technologies that are easy to use, well documented and free. But that alone won't do it; best practices, student-faculty content creation ecosystems, and sustainable communities of support are equally as important. To support these objectives, the Immersive Education Initiative is developing funding models to provide long term sources of funding for our members.

3. Professionally Managed Peer-based Development

Immersive Education projects are professionally managed by the Grid Institute and conducted in close collaboration with Immersive Education Initiative members. As the following figure illustrates, peer-based software development practices are employed: Grid Institute software engineers and managers work directly with peers from collaborating organizations. Design and development tasks and activities are conducted by recognized experts in the field. Research is led by credentialed scientists and researchers working in cooperation with seasoned project managers, industry liaisons, and Initiative collaborators.

4. Communication and Development Processes

Individual and group-wide communications include direct email, email discussion groups, conference calls, virtual world meetings, and in-person meetings. Continual building and integration of the entire system may be conducted daily using dedicated open source tools such as CruiseControl and Dashboard. Open source version control systems are utilized for team-based, code-level collaboration and to archive daily builds online. In addition to these daily progress indicators quarterly progress reports and project management documents will be released to the public through ImmersiveEducation.org and Initiative member Web sites.

Starting with the next generation of Immersive Education the entire infrastructure is being decomposed into software modules that are isolated from one another to the extent possible. By building the infrastructure following a loosely coupled, service-oriented architecture (SOA) in which the various software components are independent from one another we will increase our productivity while simultaneously reducing module interdependencies. This approach also enables much of our work to proceed in parallel and provides us with

the opportunity to continually adjust our ongoing software development efforts on a module-by-module basis, reducing the likelihood that any one component of the system will negatively impact the development of other modules. We use industry-standard load testing and security vulnerability tools (both commercial and open source) to continually test these aspects of the Immersive Education infrastructure as it evolves.

Developing the Immersive Education Platform Ecosystem and Education Grid is a complex endeavor that requires the integration of new technologies with an array of existing and emerging technologies. To reduce the risks involved with integrating new and emerging solutions into a comprehensive infrastructure that meets our design goals we will apply the Pure Programming methodology at all stages of our work. Because a significant portion of our work will be conducted before the methodology and corresponding tools are fully developed our early

Pure Programming : Towards Zero-Defect Software
Pure Programming is a novel software methodology under development by the Media Grid standards organization. Currently no development methodology exists that enables us to rapidly build highly secure, stable, and scalable distributed software systems that are simple to use and extend. Consequently, Media Grid collaborators are building the Pure Programming methodology and corresponding tools by inventing new practices and integrating traditional software engineering and clean-room practices with modern agile and extreme programming techniques. Pure Programming is a complete methodology applicable to all stages of the software development life cycle, starting with early concept and prototype design, progressing through the main coding and testing, and continuing through deployment and maintenance. Pure Programming reduces defects and hardens software code as it is being developed by integrating code-level documentation, testing and purity checks directly into each stage of the development life cycle. In the interest of advancing the state of software development, the Pure Programming methodology and tools will be distributed to the public free of charge together with comprehensive case-studies detailing how they are used to implement Immersive Education.

efforts will be coordinated specifically to influence Pure Programming as it evolves; to this end, Immersive Education developers and project managers will collaborate with the Media Grid's Pure Programming team on an ongoing basis.

5. Technology Working Groups (TWGs)

Immersive Education standards are developed through *Media Grid Technology Working Groups* (TWG). Media Grid TWGs develop, deliver and maintain technological materials such as technical reports, design documents, specifications, reference implementations, software implementations, conformance test suites, best practices, and reviews of deliverables produced by other TWGs. Any member can submit a proposal to form a new TWG (see section 6.1 Technology Working Group Proposal).

Technology Working Group participation is open to all members. To participate requires that a member is in good standing, adheres to the Media Grid Intellectual Property Policy [PUB4], and meets the criteria set forth in the Membership Criteria section of the TWG charter. Members participate in a TWG from the time they join that group until either: 1) the TWG is closed or otherwise ceases operations, or 2) the member resigns from the group. To resign from a TWG a member must notify the TWG chairs and be removed from all communications systems used by the group (such as mailing lists, discussion forums, wikis, in-world meeting and collaboration spaces, and any other form of communication used by the group).

5.1 Invited Experts

Invited Expert status may be extended to non-members in cases where external review or participation is deemed necessary by the chairs of a Technology Working Group. Invited Expert status is temporary, and can only be granted to an individual or organization by the Board, Initiative chairs and TWG chairs. Invited Expert status is granted for a specified period of time and under the terms of a Board-approved Invited Expert agreement that defines confidentiality terms and intellectual property terms that are the same required for all members. Invited Expert status may not be used to circumvent membership, policy or procedures. Invited Experts participate in a TWG until either 1) the period of time for their temporary membership expires, 2) or the TWG is closed or otherwise ceases operations, or 3) the Invited Expert resigns from the group.

5.2 Invited Observers

Invited Observer status may be extended to non-members in cases deemed necessary by the chairs of a Technology Working Group. Invited Observers may only observe TWG proceedings and must not participate directly (i.e., Invited Observers cannot not actively contribute to a TWG and are, for example, specifically prohibited from making submissions, voting and expressing opinions to the group). Invited Observer status is temporary, and can only be granted to an individual or organization by the Board, Initiative chairs and TWG chairs. Invited Observer status is granted for a specified period of time and under the terms of a Board-approved Invited Observer agreement that defines confidentiality terms and intellectual property terms that are the same required for all members. Invited Observer status may not be used to circumvent membership, policy or procedures. Invited Observer participate in a TWG until either 1) the period of time for their temporary membership expires, 2) or the TWG is closed or otherwise ceases operations, or 3) the Invited Observer resigns from the group.

5.3 Good Standing

Participation by an individual in a TWG implies a serious commitment to the charter. A member is considered to be in good standing when the individual:

- attends the majority of TWG meetings and conference calls.
- is familiar with relevant TWG documents, including minutes of past meetings.

- actively follows discussions on the TWG's email list and discussion forum.
- produces deliverables, or drafts of deliverables, in a timely fashion.

5.4 Consensus

Media Grid standards are developed through TWG participant consensus. Consensus is considered to have been achieved when over 50% of participating members in good standing are in agreement with a decision and no formal objections are raised. Decisions may be made during in-person meetings, during virtual meetings, during conference calls, or via the group's email list or discussion forum. Abstaining is considered an explicit expression of no opinion and has no impact on consensus; abstaining does not count for or against a decision.

To promote consensus, TWG chairs are required to ensure that the TWG consider all legitimate views and objections, and endeavor to resolve them, irrespective of whether these views and objections are expressed by TWG members or by others (e.g., another TWG, a group in another organization, or the general public).

The set of individuals eligible to participate in a decision is the set of group participants in good standing. Quorum is not required for decisions unless the charter of the TWG specifically states otherwise.

5.5 Votes

5.5.1 Informal Votes ("straw polls")

TWG chairs may issue an informal vote ("straw poll") at any time to gauge the general consensus of the group on a given issue. TWG chairs are not required to record the results of informal votes. Any member of a TWG except Invited Observers may participate in an informal vote. Invited Observers are not permitted to vote.

5.5.2 Formal Votes

TWG chairs are responsible for conducting formal votes. Formal votes should only be conducted to resolve a substantive issue after the chairs have determined that all available means of achieving consensus through technical discussion and compromise have failed, and that a vote is necessary to break a deadlock. For all formal votes a TWG chair must record: 1) an explanation of the issue being voted on; 2) the reason to conduct the vote; 3) the outcome of the vote; 4) any formal objections.

Only members in good standing can participate in a formal vote. Invited Experts may participate in formal votes unless the TWG charter states otherwise. Invited Observers cannot vote. In the case that an Invited Observer casts a vote, formal or otherwise, it will not be counted or recorded.

Each organization represented in the TWG must have at most one formal vote even when the organization is represented by several participants in the group (including Invited Experts). For the purposes of voting a member or group of related members is considered a single organization. Other Media Grid TWGs are also considered to be an organization.

If a participant is unable to attend a formal vote, that individual may authorize anyone in the TWG to act as a proxy. The absent participant must inform the TWG chairs in writing who is acting as proxy, with written instructions on the use of the proxy.

5.6 Acknowledgements

For the purpose of attribution and process transparency all public materials produced by a Technology Working Group must include an "Acknowledgements" section, or a reference to such a section, that lists the individuals that contributed to that material and their associated organization(s). In cases where an individual is not employed the organization attribution may be omitted and the designation "Self Employed" or "Retired" may be used instead. Although public working drafts and final output materials produced by the TWG (e.g., specifications, implementations, reports, etc.) will be made public all other interim output materials, input materials and internal communications (group email, meeting minutes, non-public draft documents, etc.) are member-confidential and as such are available only to members of that group, related TWGs, group chairs and the Board. Final output materials produced by TWGs are published specifically as open international standards and, as such, other than during the internal development stage member contributions to a group are not confidential and are not subject to Non-Disclosure Agreements or other forms of intellectual property assertions that may encumber members [see Media Grid Intellectual Property Policy [PUB4]].

6. Standardization Process

Media Grid standards, and, by extension, any standard created by initiatives of the Media Grid (such as the Immersive Education Initiative), are created through a series of steps that comprise the *Media Grid Standardization Process*.

6.1 Technology Working Group (TWG) Proposal

Any member can submit a proposal to form a new TWG. Proposals for new TWGs may be submitted directly to the Media Grid Board or to the chairs of the specific Initiative under which the TWG will operate.

TWG proposals must, at a minimum, include: 1) a clear charter that includes a mission statement, milestones, and membership criteria, 2) at least two chairs from different organizations, 3) evidence of a global need for the work items to be conducted by the proposed TWG, and 4) support from other members.

6.2 TWG Approval and Charter Development

The Board or Initiative chairs, in cooperation with any advisors, members and/or external experts selected by the Board or Initiative chairs, shall carefully consider each working group proposal for a period of no more than four weeks before either 1) approving the charter as-is, 2) suggesting modifications to charter that will lead to subsequent approval, or 3) disapprove the charter. Suggested modifications to the charter will be returned to the proponent(s) so that the charter may be reconsidered, revised, and resubmitted for review.

Upon approval the official HTML-based rendition of the TWG charter will be generated and made public and the corresponding web site and communications systems (e.g., email list, discussion forum, etc.) will be created.

6.3 TWG Public Launch and Calls for Participation

At least one week prior to the inception of the TWG operations a launch announcement must be sent to all Media Grid and Initiative members. The launch announcement shall include a summary of the TWG, as expressed by the TWG's mission statement, the launch event date, and details on how members may participate in the launch event. Open Calls for Participation may also be made via news releases, public announcements, messages posted to relevant groups, personal invitations extended by the Board, Director, Initiative chairs, and/or TWG chairs, and similar outreach mechanisms.

During the public launch event the charter of the TWG shall be presented and discussed, with explicit requests made to those in attendance to provide feedback and contributions to further refine and enhance the charter. Details on how to join the TWG, along with the date for of the TWG's official inception (actual start date of the TWG), must also be communicated during the public launch.

6.4 Specification Drafting and Software Implementation

TWG members, with guidance from the chairs, collaborate to produce a series of draft specifications, corresponding software and reference implementations, and related materials (such as conformance test suites).

The production of these items occurs through ongoing collaboration through the TWG's communications systems (email lists, discussion forums, etc.). Telephone conferences and/or virtual world meetings must be held at least once a month, with additional telephone conferences and virtual world meetings arranged at the

discretion of the group. Face-to-face (f2f) meetings must be held at least once a year, with additional f2f meetings arranged at the discretion of the group. To maximize working relationships between TWGs and relevant standards bodies and organizations f2f meetings may be held in conjunction with industry events, related standards meetings, or on location at member or collaborator organizations. All f2f meetings must be announced through the group's email list and may also be announced via TWG web pages.

TWG proceedings are confidential and restricted to members of the group. In-progress drafts are member confidential, whereas public Working Drafts and public output materials are explicitly made available to the general public for comment and review. As an open standards organization, and in recognition of the need for ongoing accountability to the general public, the Media Grid standards body requires TWGs to periodically publish a public summary of all technical decisions (together with the rationales for these decisions) made by the group since the last public summary. Deliverables produced by the group, such as specifications and software implementations, may be provided to external collaborators for review prior to being furnished to the general public.

6.5 Vetting and Ratification

Upon promoting a specification or related materials (such as implementations, conformance suites, etc.) to Final Draft status the TWG chairs must submit it to the Media Grid Legal Working Group for vetting and also to the Board for ratification. At that time the Board must alert all members that the specification and corresponding implementations have reached Final Draft status and are under consideration for ratification. Members are provided a 30 day period to comment on the Final Draft and raise Intellectual Property (IP) issues. Comments shall subsequently be addressed by the TWG, and IP issues shall be addressed by the Media Grid Legal Working Group and communicated back to the Board and TWG chairs for resolution. In the absence of IP issues the Board will ratify the specification and promote it to Final status unless it deems the charter to be unfulfilled or asserts that due process has not been followed.

6.6 Public Release

Upon ratification the Final specification and related materials (e.g., implementations, conformance suites, documentation, etc.) are released to the general public through the Media Grid web site and corresponding Initiative web site(s).

6.7 Maintenance

After a standard is released to the public the TWG remains active specifically to maintain the specification and any corresponding implementations and related materials, and to begin developing the next version of the standard.

7. REFERENCES

[PUB1] **Immersive Education Initiative home page**
http://ImmersiveEducation.org

[PUB2] **Media Grid home page**
http://MediaGrid.org

[PUB3] **Immersive Education Initiative Talking Points**
http://ImmersiveEducation.org/TalkingPoints.pdf

[PUB4] **Media Grid Intellectual Property Policy**
http://MediaGrid.org/policy/Media_Grid_Intellectual_Property_Policy.pdf

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