Games on the ‘Net!

Michael Zyda
Naval Postgraduate School
MOVES Academic Group
Monterey, California 93943-5118
Zyda@acm.org

Abstract

Games and interactive entertainment (IE) on the ‘Net are the future. In this paper, we describe what this interactive experience looks like (Interactive TV, 3D Avatar Chat and RPG, Quake 2007, Shooters 2013!, ExtremeSports 2015!, MartialArts Forever! and VR Sex). We describe how people interact with such systems. We describe the hardware necessary for the home and for the ‘Net. We define the technical requirements to make IE happen. And we define the uncompleted work, the research and development that needs to be done to make our multiplayer, 3D virtual environments of live and autonomous characters compeling enough for consumers to hand over their hard-earned Euros.

Interactive Entertainment

Games and interactive entertainment (IE) are the main technology drivers for the ‘Net. For the purposes of this paper, we shorten Internet of the Future to ‘Net to distinguish it from today’s World Wide Wait. We believe that the ‘Net will evolve from today’s Internet, provided sufficient R&D work is accomplished and sufficient capital is provided. We can’t say exactly when all this will evolve but we are hopeful. We also probably cannot say for certain what future entertainment on the ‘Net looks like but we can hypothesize from what games look like today. So we start out by looking at hypothetical versions of today’s entertainment extrapolated into the future to identify perhaps what R&D we need to accomplish to get there. We need to look at what these IE systems will look like and how people will interact with such systems.

To make our job a little bit easier, we make some assumptions on what we will have in the future:

- Infinite bandwidth to the home.
- Infinite 3D graphics capability & computing power in the home.
- Affordable for the home.

If this becomes so, what will our games and IE systems be? Again, scenarios derived from today are the best we can do. We will probably have the following IE systems:

- Interactive TV - chattin’ with Julie...
- 3D Avatar Chat & RPG (Role Playing Games) - persistent worlds, GangsOnline, SaveThePrincess, SlayTheBeast ...
- Quake 2007 – “smell the blood” (the nth version of this very special shooter ...)
- Shooters 2013! - these will always be with us!
- ExtremeSports 2015! - the word Extreme is rapidly becoming a cliché but what the heck!
- MartialArts Forever! - at least its not MaritalArts.
- VR Sex - the technology driver ...

Interactive TV

Probably the earliest vision of what Interactive TV will look like is captured in the 1966 motion picture "Fahrenheit 451," with Oskar Werner and Julie Christie. Interactivity in that clip shows Julie Christie participating in a television story with two on-screen characters. When it is time for Julie to respond, the characters look in her direction and a red light blinks on her set, appealing for a response. The message is that her response can possibly change story direction, that she can chat meaningfully with the on-screen characters and be "part of something". The technology necessary for such a system is networking to support two-way video/audio, entity streams (streams of state information for the involved characters) and sufficient resources that branching storylines based on user response can be "handled". Of course, the cynical tone of the film shows that no matter what her response, the story just goes on as planned. In our future, we really do want the story to change! So the requirement for autonomous characters and an interactive storyline engine is critical to being able to actually do this. The user experience with this system is reflected in the film piece. Julie has both individual and group concerns. She needs to know from people in the room how did she do? She also needs to know how her interactions were perceived by her friends watching elsewhere.

3D Avatar Chat & RPG

Chat rooms and role playing games (RPGs) are popular now and will be more so as we move to 3D avatar (3D character body) display and synchronized audio. With respect to interactivity, we want to have a 3D avatar, with animated face. We want to chat with others or with autonomous characters over the 'Net. Autonomous characters are players not being run by a human but rather by a computer program that is compelling enough for the player to believe that he/she is actually playing against some sort of intelligence. Our graphics are going to have to be very good for future 3D avatar chat. Our autonomy will have to be more compelling than today's. We want to see the lips move on the character to whom we are speaking. This has to be synched with the sound. Our character's movements cannot lag. The 'Net is going to have to let us chat/play with people who are located just about anywhere. We will have audio and entity streams transiting the net. We are going to be a knight fighting the giant, our body motions tracked. We are going to find ourselves talking to Lara Croft of TombRaider and she's going to answer back. We are going to feel as if we are interacting with Lara.

Quake 2007

We are going to go into a dark, 3D world and fight monsters off the 'Net. We're going to hear them breathe and we're going to hear them die. Our 3D virtual environment (VE) will have fully articulated monsters, monsters steered by body-suited, armed opponents or computed autonomously. We are going to team with distant friends to accomplish our missions. We will have an audio stream and an entity stream. We will feel as if we are in the Quake-2007 VE. Our roommates will be able to smell the fear and us the blood.

Shooters 2013!

Our body motions will be tracked in our game cell unit, our fist will clench our weapon, our avatar may be altogether different from our corporeal norm. Our articulated avatars will be detailed and well-modeled and the behaviors so realistic that it will be difficult to tell if they are live or if they autonomous characters . Our demand will be for premium quality of service in our networking and we will insist on minimal lag. We will have entity streams for large numbers of players and audio streams from nearby players. And maybe video streams for offline chat. Our experience will be one of fear, comradery, excitement, sweaty palms, the entire gamut.

ExtremeSports 2015!

Imagine the view from the wrestler we will have and the thuds against our body as we perform ExtremeSports from the safety of our VR room. Our worlds will be rich in surface detail and there will not be a missed mogul in its depiction. The lag on our 'Net will be so low that we will be able to perform the most delicate motion. We will be Pele.

MartialArts Forever!

The tracking of our body movements in the VR cell with allow us to practice moves against fearsome opponents. The human avatars will be incredibly detailed, with each articulation smooth and the skin textures real. 'Net lag will be near zero as our quality of service is set to premium. We will feel that fist from Washington, DC. We will be in touch with our inner soldier and those out there too.

VR Sex

The eternal question - what is the input and the output device? The graphics - yes, very, very important . The'Net - reach out and touch someone. The experience - yes, whatever … OK, enough of that but sex was the driver behind the success of videotape in the home and is a big driver of the Internet . It will be a big driver of our future interactive entertainment systems.

So if we want to be able to do all this, what do we need?

We need hardware, a fast network, software, input devices, a whole lot of things that we have now and a whole lot more not yet started on. Compute power – we need as many cycles as we can get for under $700. We will see over 1000 Mhz clock rates easily over the next three years. Graphics - we are seeing chip sets that run 44M polygons per second and 1B textured pixels filled per second as announcements from chip manufacturers today. We should expect to see greater than 200M textured polygons per second in chips sets in two to three years. Network - we are seeing high-speed nets to the home. Brochures for DSL are being mailed to my house. DSL promises 1.5Mbps downstream and 384K bps back. With that speed network, we can interact with 500 players in a game and have a video stream to our home. The price needs to come down from $279 per month to $90 or less. Cable modems though are being more rapidly deployed. Their promised speeds are great but the shared nature of the LAN for some areas is distributing poor performance across a large number of users and they are not too happy. If we could keep the speeds up per household, then we can support games of 4,000 players and a video stream to the home (10M bps)! Latency - must be less than 100ms for high interactivity, maybe 200ms for some gaming apps.

Additional Technical Requirements

We do not just have computing, graphics and networking requirements. In fact, over the next fifteen years the availability of processor cycles, graphics power and networking bandwidth will seem infinite as compared to what we have today. We have though some pretty stiff software and hardware R&D that needs to be carried out for our future interactive entertainment systems. Our research agenda includes technologies for immersion, networked simulation, standards for interoperability, computer generated characters and tools for creating simulated environments (Figure 1, from [NRC,97]).

And one thing for sure is that as we look at this list, some of this work is hard and going to have to be developed on research cycles that are longer than the three years that has become the "norm" in the United States. Computer-generated characters are hard to do but their application and potential is enormous if we only just expend the requisite time on developing the technology. Interoperable large-scale, networked VEs are the same. We need to do more than just slap together large servers and declare victory as some R&D programs have done for this. We need to do careful

and considered work. And we need to do it in all the areas outlined in Figure 1 and detailed in [NRC,97].

Technologies for Immersion

- Image generation - real-time, graphics workstations capable of generating complex visual images.
- Tracking - technologies for keeping track of human participants in virtual environments.
- Full sensory interfaces - technologies for providing a wide range of sensory stimuli: visual, auditory, olfactory, and haptic.
- Locomotion - technologies that allow participants to walk through virtual environments while experiencing hills, bumps, obstructions, etc.

Networked Simulation

- Multicast and area of interest managers - to facilitate many-to-many communications while using limited bandwidth.
- Higher bandwidth networks - to allow faster communication of greater amounts of information among participants.
- Latency-reduction - techniques for reducing the true or perceived latency in distributed simulations.

Standards for Interoperability

- Virtual reality transfer protocol - to facilitate large scale networking of heterogeneous distributed virtual environments.
- Architectures for interoperability - network software architectures to allow scalability of distributed simulations without degrading performance.

Computer-Generated Characters

- Adaptability - development of computer generated characters that can modify their behavior automatically.
- Learning - development of computer generated characters that can modify their behavior over time.
- Individual behaviors - computer-generated characters that accurately portray the actions and responses of individual participants in a simulation rather than those of aggregated entities.
- Human representations - authentic avatars that look, move, and speak like humans.
- Spectator roles - ways of allowing observers into a simulation.

Tools for Creating Simulated Environments

- Database generation and manipulation - tools for managing and storing information in large databases, to allow rapid retrieval of information, feature extraction, creation, and simplification.
- Compositing - hardware and software packages that allow designers to form composite images with images taken from different sources (whether live-action footage or 3D models) and facilitate the addition or modification of lighting and environmental effects.
- Interactive tools - tools that use a variety of input devices (more than a mouse and keyboard) to construct models and simulations.

Figure 1 Technologies Necessary for Games on the 'Net [NRC,97]

Conclusions

We have taken a peak at what interactive entertainment of the future might be. Its certainly not going to be like chattin' with Julie but better! We see the possibilities but there is much, much more work to do. There is some hard R&D for us to be able to get this all to pass. BUT one thing for sure, if we go down this path, then we have the potential to become one with Lara Croft or whatever our poison might be!

References

[NRC,97] Zyda, Michael and Sheehan, Jerry (eds.), Modeling and Simulation: Linking Entertainment & Defense, National Academy Press, September 1997, ISBN 0-309-05842-2, 181 pages.

Acknowledgements

This work would not have been possible without the support of our sponsors: Advanced Network and Services, the Army Research Office, the N6 MOVES Research Center, and the National Tele-Immersion Initiative.

Biography

Michael Zyda is a Professor in the Department of Computer Science at the Naval Postgraduate School, Monterey, California. Professor Zyda is also the Academic Associate and Chair of the NPS Modeling, Virtual Environments and Simulation (MOVES) Academic Group. He has been at NPS since February of 1984. Professor Zyda's main focus in research is in the area of computer graphics, specifically the development of large-scale, networked 3D virtual environments. Professor Zyda was a member of the National Research Council's Committee on Virtual Reality Research and Development. Professor Zyda was the chair of the National Research Council's Computer Science and Telecommunications Board Committee on Modeling and Simulation: Linking Entertainment & Defense. Professor Zyda is currently a member of the National Research Council's Committee on Advanced Engineering Environments. Professor Zyda is also the Senior Editor for Virtual Environments for the MIT Press quarterly PRESENCE, the journal of teleoperation and virtual environments. He is a member of the Editorial Advisory Board of the journal Computers & Graphics. Professor Zyda is also a member of the Technical Advisory Board of the Fraunhofer Center for Research in Computer Graphics, Providence, Rhode Island. He is chair of the external advisory board for the Design Visualization Center at the University of California, Berkeley.

Professor Zyda has consulted for the White House Office of Science and Technology Policy, the Ministry of Industrial Development Sabah Province, Malaysia, Japan Tech Services Corporation, Tokyo, Hitachi Plant Construction & Engineering, Ohtsuka, SimGraphics Engineering, Pasadena, Silicon Graphics International, Geneva, Nihon Silicon Graphics KK, Advanced Telecommunications Inc., TecMagik and Paramount Digital Entertainment, among others.

Professor Zyda began his career in Computer Graphics in 1973 as part of an undergraduate research group, the Senses Bureau, at the University of California, San Diego. Professor Zyda received a BA in Bioengineering from the University of California, San Diego in La Jolla in 1976, an MS in Computer Science/Neurocybernetics from the University of Massachusetts, Amherst in 1978 and a DSc in Computer Science from Washington University, St. Louis, Missouri in 1984.

http://www.npsnet.nps.navy.mil/zyda