Network Gaming Utilizing Ubiquitous Computing

by Marcus Smith

What does it mean to be "ubiquitous?" It means being or seeming to be everywhere at the same time, a sort of omnipresence. In relation to computing, it suggests that computers will have an omnipresent place in society. They will become as commonplace as automobiles or cellular telephones, both objects which at first were very localized by price and availability, but soon became readily available to buyers. These ubiquitous computers, in whatever form that they come into play, will start localized and, if the expansive trend of the PC market continues, will soon likewise become worldwide in availability to the common man.

This concept of ubiquitous computing can be implemented in many markets. Cellular telephones are a popular example of budding ubiquitous computing; they are fast being seen everywhere, integral parts of many people's daily lives. They are sources of information – they can call up weather and stock reports – and entertainment – casual conversation and games.

Let us focus on the latter aspect: entertainment, in particular games.

"The interactive entertainment industry has ballooned into a multibillion-dollar business, with revenues rivaling box-office movie receipts for the first time in its 25-year history. In other words, what took Hollywood 75 years to do, the gaming industry has surpassed in less than a third of the time" [1]. This trend has been emphasized in the popularity of devices such as the Sony Playstation 2 and Nintendo's GameCube and Gameboy Advance, the former of which has expanded the general capabilities of old

game platforms to the level of the PC by allowing for Internet access and thus network games, and the latter of which continues to improve on the hand-held portable game platform with improvements like better resolution, color, and the ability to communicate via cables with other GBAs to play multiplayer games like Mario Kart Advance [2].

With this emphasis on designing games for Internet access and multiple players in the interactive entertainment industry, I would like to discuss how ubiquitous computing is seen in both reality and in science fiction. The focus will be on the correlation between ubiquitous computing and entertainment in network gaming, and possible future applications of this pairing based on ideas in the science fiction genre.

Ubiquitous Computing

First, let us look at ubiquitous computing. What is it really?

Mark Weiser, considered the father of ubiquitous computing, defines it as the third wave in computing, a time of "calm computing" where technology is in the background of daily living. In this route, computers will become objects that are so thoroughly imbedded into our lives that they are naturally used without real thought. It is not the same as virtual reality: people are not put into a computer-generated world. Instead, the computer lives with people. [14].

How will computers be a part of our daily life? Weiser suggests that computers will become imbedded in clothing, household products, etc. In an argument with Nicholas Negroponte at the MIT Media Lab, he stresses that key words involving ubiquitous computing will be "invisible" and "connection" [13]. These ubiquitous devices will be a natural part of our lives. A computer set inside of clothes might register

when they needed to be washed. A computer in a dishwasher might say when it's full. Something built into a light may turn it off when no one is around to conserve energy. These devices will perform small functions to better life, to improve on it, working with people instead of for them like an android or AI.

How will these ingrained devices work? What will cause the dishwasher to report when it's full, or the light to register when there's no one present? The answer: context awareness.

Context awareness related to computing is very rigid. The context itself can be just about anything: time, location, preferences. How it is perceived as data is variable. The context can be defined according to a user or the system that utilizes it; it could be dynamic or constant. Typically, data based on users or entities is constant, while system-based context is to some degree dynamic [6]. Regardless of its form, it is this concept of context awareness in computers that will allow for them to interact with the real world by using the given context as data to fulfill specified acts, i.e. displaying data, triggering events, etc.

Fritz Hohl, at a seminar in Dagstuhl on ubiquitous computing, makes reference to a context service system by which the digital world is integrated into the real world. Its overall role is to model the real world in the digital one, so that changes in the real world would be reflected, and the system could act accordingly. An example in this system might be an "intelligent" copy machine that changes its preferences and settings according to user. The context being the user, the machine is able to handle both switches in setting and in whom to bill any charges to [6].

His discussion brings to point two methods by which a context-based system would be implemented. The importance of these matters is that, to have ubiquitous devices ever present and working, a system would be required by which they can interact with the real world.

The first method is for local interaction set to a specific place. Short-range communication would be done through devices like Bluetooth and WLAN, wireless methods. With very cheap computers and devices that use this wireless architecture, local communication would be moderately effective [6].

The second method is for remote interaction. LANs, PANs, and various access points to the network and/or Internet would be required for this. All devices in the system would have access to this network, by which data could be acted on [6].

At the same seminar in Dagstuhl, Albrecht Schmidt explored examples of context-aware machines. These examples included a mobile phone that uses sensors to determine where it is (hand, pocket, etc.) and, if a call is received, react accordingly by ringing a certain way or length of time or volume; and a context-aware phone book application for a mobile phone that will be able to determine the connection state of the phone, whether the user is available for calls, the user's location, etc [10].

As can be seen, this notion of ubiquitous computing as it relates to context awareness is open to a lot of interpretation and application. With the proper devices and the proper networking system put into play, human-computer interaction can be as expansive or as focused as is desired. Ubiquitous computing can be focused on how to integrate computers into the home itself, or it can be expanded to focus on the home, the workspace, perhaps even globally.

As a final example, let us look at the Siemens Corporate Research (SCR) and their creation of a small-screen/composite device (SS/CD) architecture for ubiquitous computing in a communication system. A user-centric system, this focuses on how smaller, mobile devices can be used together with composite devices to trade and display information through whatever mediums are available [9].

It should be noted that the SS/CD architecture is designed with a focus on enhancing multimedia capabilities of small screen devices. So, while the theme is of ubiquitous computing utilizing context awareness, the emphasis is on how a device such as a PDA can, when given multimedia information, act upon the given data with the possible assistance of any required composite devices in the area, such as a television or standard PC.

SCR, in designing this system, required that research be focused in two ways. First, a distributive computing infrastructure made up of composite devices and small screen devices; this system would enable small devices, when accessing multimedia data, to redirect via a server any form of media not applicable on that device to any nearby composite device that could handle it. Second, “smart” mechanisms would need to be developed that could process multimedia in its various levels and transfer it between small screen and composite devices [9].

The design of this framework included server and client side components. The server handled most of the work. It stored information on all available composite devices, managed the pool of available multimedia data, determined which composite devices could handle what media types, and how to process and deliver the media. The client side was merely the PDA with the required application to access the server [9].

SCR tested this architecture in a hospital-based environment, where patient data could be stored in a sort of hypermedia, combining text, images, sounds, etc. I offer an example here of how this framework could be utilized:

Suppose Dr. Ginsberg wanted to look at the medical records of a patient suffering from cuts that may have been self-inflicted. He had available on his person a PDA linked wirelessly to the hospital's server – a system set for local interaction on the basis of context awareness – and he was standing in a lounge with a television set and a small speaker. Pulling up the patient's file, he could see that stored with the text file are pictures taken of the wounds and a small sound byte from another doctor in regards to a mental evaluation of the patient. His PDA is unable to handle playing sound, and he wants to look at the pictures while reading the file. Using the SS/CD application, he is able to transfer the pictures to the television and the sound byte to the speaker. Thus, he is able to look at both the records and the wounds while listening to the evaluation, and so is able to make his own judgment call as to whether the damage was self-inflicted.

From here, we have a good understanding of the basics of ubiquitous computing. Through an awareness of the environment, integrated computers can interact with humans on a less physical, more user-centric level. Users can interact with multiple computers nearby seamlessly. I will focus on particular uses of ubiquitous computing in the entertainment field.

Ubiquitous Gaming

How would ubiquitous gaming work? It goes back to the general notion of ubiquitous computing and context awareness. Weiser argued that a goal of ubiquitous

computing would be for these computing objects to be aware of our context. As humans process context naturally in their interaction, technology utilizing sensors and current networking and software can possibly "sense" aspects of a user's context as well [4].

So, ubiquitous gaming is a hybrid game type in the gaming world. Mobile games have been present almost as long as platform games, varying in their abilities. Handheld devices like the Gameboy Advance have recently acquired networking abilities [2]. Nokia Game and Botfighters rely on the player's location as part of the game experience. Elsewhere, computer developers have incorporated live data into virtual environments in games such as Black and White, where the weather in the game is the same as the real-life location [3]. Take this conglomerate of ideas, and add the notion of integrating the real and virtual world and players, and you have a general idea of ubiquitous gaming.

Let us look at some early and recent work in the field:

Pirates! is a game collaboration designed by Nokia and PLAY, and is one of the first attempts to make a social computer game experience. The users of this game interact not just with a computer, but with other users by adopting the role of pirates, whose ships are modified handheld computers. Only by interacting with other users can a single pirate get anywhere in the game. The handheld computers, when in range of each other, can start a duel between pirates. Certain places in the environment of the game will allow a user to "discover" a hidden island on his PDA screen and thus acquire treasure, or claim an island to return his cargo to, etc. It is reliant on the player being social and ready to walk around, not sit in front of a board or screen [7].

The design of Pirates! is a shining example of how ubiquitous gaming begins. The computer elements of the game were PDAs modified with wireless LAN cards and

proximity sensors, wireless LAN base stations, a game and file server, a logon server, and a projector and controlling laptop [7]. All of this technology relates to a context-awareness system based on local interaction. Users and the environment – it was a hotel in this instance – are the main pieces; save for the PDAs that they carry, all remaining technology is solely in support of the users and, save for the PDAs, the rest of the technology is out of sight and thus out of mind.

However, Pirates! still has the flaw of being very technology reliant. Users interacted more with their screens than each other. Audience participation by non-users could offer help as to where other pirates and islands were, but a pirate player had to rely on watching his PDA screen to get anywhere. More work for a future version will be working on including more real world interaction [7].

So Pirates! is a start. But a greater step was taken into the field.

A Research Atelier in February of 2002 was created at the University of Gothenburg, whose intention is to apply ubiquitous computing to the entertainment industry. The work done there was focused around the question of "What will you do to entertain yourself after work/school/daycare in 2010?" Scenarios for future societies were created based off of key factors and whether influences such as relationships and social/political gaps. From these scenarios, three groups selected one and worked on and designed games based around them. Three games in particular will be looked at: the SpyGame, Multi Monster Mania, and the Guild [3].

The SpyGame is based on the future scenario of a socio-political gap in society, where the affluent ruling class, having little leisure time, exercised a type of control over the poorer class with its greater leisure time. In the simpler terms of the actual game,

virtual players control physical players in an effort to take control of and deliver a specially designed suite-case [3].

The context in this game is in the environment and the players. The suitcase was specially designed to utilize sensors and other equipment built into it. By gathering data on who held it, the current weather, ambient noise, etc., the suitcase would transmit information about the physical location and which player carried it to a virtual chat environment. From here, virtual players would communicate with each other in their teams and direct their paired physical players via mobile phones as to where to go. The premise of the game was for physical players to get the suite-case among members of their team in a set amount of time so that the suite-case could be delivered to a point in the city. The spying aspect came in the virtual chat room, where the opposing team could spy on the data from the suite-case and the other virtual players and use their own physical players to try and obtain the suite-case for their own delivery [3].

Multi Monster Mania is based on a Gibsonian future where street kids can use special cards to create monsters for use in games. Various types of cards are available. Monster cards, location cards, game field cards, and modifier cards: the first and the third cards are the most variable of them. By using different game cards in relation to location cards, monster cards and modifier cards are used to play various types of games, i.e. the Hatchery game [3].

In this game, the cards are both context and context-gathering devices. The cards are perceived as miniaturized, specialized PDAs. They have built-in sensory technology that allows them to recognize and interact with each other. Monster cards can breed through the use of a special gene-splicing-and-recombining algorithm that transfers its

new monster on to an empty card. Games are played by proximity of game cards with other cards. Modifier cards work on proximity with monster cards [3].

The Guild is the largest evolution of a social game. It is based on joining a network of player communities, or guilds, without any defined limit as to how interaction can occur. The basis behind each guild can be its own in accordance with the networked story. The Guild could be based on alien takeover, or it could be nothing more than rival groups of practical jokers. It is pretty much an open design game-wise [3].

Context in this game is variable in this game, different from the others. So far, in regards to this ubiquitous computing in creating games, there is technology that works on it. In this case, though, there is no set technology. Computers and websites come into play strongly just as a means to research a Guild to join. There otherwise are no strong uses of technology. Guild tokens, considered at first to be computerized, were replaced in design with more standard and common objects like pins. So the overall context in this game is the Guild players themselves, those whom are a part of the game. Context can vary depending on, for example, if two or more Guild members are present in the same room, or if members of rival Guilds are present in the same room [3].

All of these games were built on small design. They all have their own design issues, of which I won't look into. The point of looking at these games was to show how context and ubiquitous computing is involved in the design these games. All of them emphasize the way that humans will use multiple computers for their entertainment (or not, in the case of the Guild) and stress more human-human interaction. We will now be looking briefly at network games and suggest afterwards how ubiquitous computing can be interwoven into their design in the future.

Network Games

Network applications come in one of three classes based on distributive interactive real-time applications: military simulations, networked virtual environments, and multiplayer computer games. As of late, more emphasis has been given to the latter, multiplayer computer games, in light of the entertainment industry's push to incorporate network technology into that field. Also, computer games can encompass all fields that military simulators and NVEs can. Their ability to extend beyond real world environments gives them a greater marketing value [12].

The earliest example of multiplayer computer games, and one still well known today, are MUDs. Multi-User Dungeons (MUDs), were created first starting in the 1980s. They were text-based games in which users logged on to a server holding a shared database of rooms. Depending on the particular make of the room, a user could, for example, open a door out to another room, or drink from a stream, or battle a dragon. Particular embedded programming languages could be used to add or remove rooms and items to the database [12].

MUDs are still popular today, and have branched off to include MUCKs, MUSHs, and MOOs.

These days, though, multiplayer computer games have focused on 2D and 3D games. Doom and Quake, first person shooters, allowed for multiple users to connect to a server and, from there, join up with other users in their games to complete levels. Ultima Online, a RPG, puts a host of characters into a singe world environment from where users can interact with each other and the world. There is no break-up into

individual game worlds, like Doom, but rather multiple adventures all taking place in the same world.

With the push to broadband Internet connections, both personal computers and video game consoles are striving to utilize that technology. Sony's Playstation 2, for example has, in the works, many games that will utilize broadband or LAN connections for multiplayer games, such as the long anticipated Final Fantasy XI. One of its latest releases, .hack//infection, even allows the player to assume control of a character entering a massive multiplayer online role-playing game (MMORPG), where game play is dependent upon the player both advancing in the .hack actual game world, and on properly handling information given via message boards and e-mails in .hack's simulated real world.

Speaking of connections, a brief look must be taken at general communication architectures and, in particular, those of massive multiplayer games.

The client/server architecture for gaming is considered very good for first-person shooters. In this manner, all processing is done on the server's side. Client computers connect to the server, with a minimal amount of data being passed to the server. It is up to the server to then process this data according to the current state of the game, and update the game for the client [5].

For example, stepping into a certain corridor in a shooting game may cause a trap to go off. The client sends data as to where the user has stepped. The server, receiving this data, processes that information and decides that, by being in the proper place, the trap should be activated. Thus the client's state – being in a corridor – is updated by being put into the next state – the client sees the trap go off.

Peer to peer architecture is suitable to real-time strategy games, requiring high bandwidth and good local connections among the users. Input from users must be synchronized so that all users have their game states updated according to the states of other users. Central servers, if used, are often used akin to lobbies [5].

Diablo III, a PC RPG, has a central server, Battlenet, where users may communicate with each other and search for games to join. A single player opens a game and makes it available for other users to join to. When joining, the players connect their computers together through that game. So, for a party of a necromancer and a paladin, when encountering a hoard of skeletons, both players' game states are updated simultaneously so that the battle flows naturally. The necromancer will see the paladin destroy a paladin at the same time that the paladin player initiates the command; at the same time, the paladin will see the necromancer will cast a spell simultaneous with the necromancer player's executing the command.

For massive multiplayer games, fast becoming the staple of network games, are all role-playing games of some sort. That there could be hundreds to thousands of players makes peer to peer impossible. Therefore, depending on the game, communication must be split up. Access to the game itself is client-server, along with any interaction that involves changes to the environment, i.e. picking up a box off the ground. For communication between players, a minor peer-to-peer method is used [5].

So we now have a general idea about network games. How can ubiquitous computing work with this concept? As ubiquitous computing is in itself a new field, we must look to science fiction. Network gaming itself used to be something thought of as

only a concept in literature. So, through look at current literature and movies, we will examine what possibilities exist.

Ubiquitous Network Gaming

Ubiquitous gaming emphasizes a push towards human-human interaction. Multi Monster Mania also pointed out the popularity of card games. So, an excellent example of a ubiquitous network game comes straight from the popularity of card games: the Yu-Gi-Oh! cartoon television series.

Based off of the Yu-Gi-Oh! card game, the television show follows the premise of players dueling each other in a card game called Duel Monsters. The antagonist of the series, Seto Kaiba, initiates a Duel Monsters tournament that expands over an entire city. His invention, the Duel Disk, allows all duelists to see the cards they play as life-like holograms that can attack each other. Furthermore, all cards inserted into the Duel Disk are monitored and tracked by a satellite system linked to Kaiba's database. Thus, through his Duel Disks, he can monitor every duel in place throughout the city and what cards are in use where [16].

Like Multi Monster Mania, it isn't the technology that is the focus. Kaiba's ability to monitor all duels and cards is utilized solely to watch for rare cards and to ensure that no cheating takes place. The focus is on the human-human interaction, in how the duelists play the game. This can be considered as a ubiquitous network game because, in a small way, all the duelists use a client/server communication architecture through their Duel Disks. When a card is placed into the Duel Disk, it is scanned, and its data sent via satellite to KaibaCorp where the server reads the data, then streams

information to the holographic projectors on the Disk as to what the particular Monster looks like, how it reacts to attack and defense, etc. In short, all the visual and audio effects that make up the Duel Monsters and their states are initiated and updated by the KaibaCorp server.

As stated earlier, technology should not be the overwhelming focus of ubiquitous computing. It should be present, but discreet. So what are some discreet technologies that science fiction offers?

Tad Williams, in his series Otherland, offers the neurocannula. This device is grafted into the back of the neck, presumably where the brain stem begins. It serves as a network jack; humans can plug themselves into the VR version of the Internet in that world and thus experience the multimedia content of the net without having to rely on headsets and data-gloves or other peripheral devices. With a telematic jack inserted into the neurocannula, plugs are not required; there is a wireless connection. Through the use of these devices, Williams shows how users can enter their characters in their games with full-surround multimedia capabilities as though they were actually in the game world, such as Orlando Gardiner's Thargor character in the Middle Country RPG game [15].

Syne Mitchell offers an alternative approach and a response to Mark Weiser's view on the future of ubiquitous computing in her book, Technogenesis: data jewelry. These microcomputers use induction electronics and data gems to stimulate electronic fields in particular points of the human brain. Through this, synchronization occurs and the mind is connected to the Net. There are no wires; there is something of a permeating field around the world that is the Net now, where data includes not just numbers and data,

but also memories, emotions, and trains of thought. By this, similar to the neurocannula, users can have a full sensory and multimedia experience when playing a game [8].

Mitchell's perception of the Net brings to mind an intriguing look of what computing could become, an ultimate manner of ubiquitous computing: humans directly connected with humans. In Techogenesis, it is often pointed out that the Net, by using induction technology to connect the human brain to the Net and shaping it from thoughts and feelings and data, anyone connected to the Net can, with the proper talent of data mining, could, for example, search for information related to a car accident by sorting through scenes of the accident as remembered through the eyes of any witnesses, searching for any conversation or thoughts about the accident, along with relevant standard information like the make of the cars involved and what time it occurred [8].

But is that the limit? *Serial Experiments Lain*, a Japanese animated series, offers a final possibility. Lain, the heroine, starts off the series with a NAVI, a standard computer. By adding a particular processor chip to her computer, and other peripheral devices to increase the computing power, she eventually is able to enter the Wired – a surreal layer of the Internet with full multimedia access, not just text windows, akin to virtual reality – without the need for any computer devices whatsoever. This gives her alone the ability to, at the finale of the series, actually "reset" human memories and thus remove herself from the memories of all who ever knew her [11].

Conclusion

Ubiquitous computing: a method by which humans can interact with multiple computers seamlessly without the computers impeding on the environment. Its potential

is reliant solely on human ingenuity. Given the proper context and design, there may come a time where computers are literally just about everywhere and we will never notice most of them and thus fulfill Mark Weiser's view on ubiquitous computing.

PC and game consoles are the first step in network gaming. Add ubiquitous computing, and the entertainment field can expand to greater proportions. Card games like Magic: the Gathering may one day end up with computing devices similar to the Yu-Gi-Oh Duel Disk, where holographic battles can be played. Network games like Everquest and Ultima Online may soon not require PCs and laptops to be in front of them; induction devices could allow gamers to log in and play no matter where they are. And, on a very slim chance, there could come a point where ubiquitous computing becomes a key to transcending computing devices altogether, where human brains can touch and commune with each other in a living neural network of data, a living Internet that spans across the globe.

Mere fiction? Perhaps. But there exists what is called the Schumann Resonance, which is the resonance frequencies (6-50Hz) of the Earth's electromagnetic field, the base frequency being 7.83 Hz. It was theorized by Nikola Telsa, who was the first to observe this frequencies, that they might some day be used for "…power transmission and transmission of intelligible messages to any point in the globe," or a wireless system of energy transmission. *Serial Experiments Lain* theorizes that it may be possible to hardwire the collective human consciousness and allow all people to connect to each other as well as a perceived Wired/Internet [17]. If that does occur, then all computing may very well become ubiquitous and secondary to the processing powers of not just one human brain, but a worldwide, a global brain.

And, in a network of human minds, games would be but a thought away.

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