TECHNICAL AND USAGE ISSUES FOR MOBILE MULTIPLAYER GAMES

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ABSTRACT[1]

This paper presents the results of an undergoing project dealing with issues for mobile multiplayer games. First it takes a technical point of view. It presents our work-in-progress on the following issues: Communication middleware (through a prototype compliant to the *Open Mobile Alliance* specifications), high level communication abstractions (which can be provided to multiplayer games), latency awareness (through a prototype mixing high latency GPRS communications with low latency Bluetooth communications), consistency (taking into account mobile phone limited resources), and databases (investigating three solutions based on grid DBMS). Our work also studies sociological and psychological aspects. After presenting the methodology used for the study, it shows how mobile gaming provides a second skin to its player (giving him the ability to withdraw from others, or to stay present to them), and is a tool for socialisation and appropriating time (by favouring a feeling of mastery). This last point suggests that mobile multiplayer games can only be appreciated if they take into account player's time constraints.

INTRODUCTION

Computer games, whether played on a PC or a console, are among the most commercially successful applications. Now many companies are convinced there will be such a success with mobile games. For instance, *Datamonitor* projects that by 2005, 80 percent of all mobile users in the US and Western Europe will play mobile games at least occasionally (Leavitt 2003). Indeed customers base more and more their decision for buying a mobile phone on the quality of its embedded games. Nevertheless when considering mobile multiplayer games, the success remains confidential. For instance *TibiaME* (mobile version of PC's *Tibia* game) experiences 50 daily players (Nokia 2003b) to be compared to the thousands of MMOG regular players (Woodcock 2004). In order to better understand the reasons of this lack of success, the *Groupe des Écoles des Télécommunications* has started an internally funded project called MEGA (Mobile MultiplayEr Games Architecture). Its goal is to analyse issues for mobile multiplayer games. This work-in-progress paper presents the first results of this project in the technical field and the usage field.

[1] The work presented in this paper takes place in the context of a *Groupe des Écoles des Télécommunications* internal project, done in cooperation with the following partners: *CNAM-CEDRIC*, *France Telecom Research & Development*, *Pastagames*, *Université Bretagne Sud*.

TECHNICAL ISSUES FOR MOBILE MULTIPLAYER GAMES

Today technical issues for mobile monoplayer games are well known: Limited size for applications (Nokia 2003a), scarce energy resources (Capra et al. 2001)... the main issue being the devices anarchy (Palm 2003). Indeed when PC market is rather homogeneous, mobile market experiences heterogeneity is the rule. For instance depending upon its firmware the same mobile phone can have a different behaviour.

To identify technical issues for mobile multiplayer games, we had a state-of-the-art activity. In addition we provided an inquiry towards game industry actors: developers, editors, technology providers, mobile operators... Until now we got back few answers (some actors consider the subject to be too strategic to answer to the inquiry). Nevertheless it confirms several issues identified thanks to our state-of-the-art: Communication middleware, communication abstractions, latency, consistency and databases.

Communication Middleware

A console/PC world multiplayer game can be run on a single machine as a split-screen application. With a mobile this alternative is not realistic: Developers of multiplayer mobile game have to deal with network communications. If they do not want to move out of their basic trade they may be interested in using a communication middleware.

There are two levels of functionalities in a communication middleware: On one hand, the "intermediation level" which takes care of the management of game communities, forums, high score storage, and on the other hand, the "middleware level" responsible for the communications between modules during game play. Both levels are standardized by the *Open Mobile Alliance* (OMA 2003, OMA 2004).

Some companies (e.g. Terraplay (Terraplay 2004)) propose products taking care of those levels. Nevertheless they are not OMA-compliant. Moreover their cost is not compatible with budgets of small developer studios (a mobile game budget is about 100 k$ (Nokia 2003a)).

This is why, in cooperation with Pastagames (Pastagames 2004) and CNAM-CEDRIC, we are developing the prototype of an open source middleware: *GAming Services Platform* (GASP). Based on OMA specifications, GASP shall offer both functionalities levels with GPRS communications between mobiles and a server for DoJa (iMalin 2004) or MIDP2 (Knudsen 2003) multiplayer games. A version allowing Bluetooth-only communications between mobiles is foreseen.

Communication Abstractions Dedicated to Games

As it happened in other software industry sectors, it is likely that in the mid-term, game developers will use software components to increase their productivity (by automatically taking care of the device anarchy, for instance). In this context communications will be managed by dedicated software components (Cariou 2003).

This is why we have undertaken an analysis of games and game middlewares in order to extract the communication abstractions present in games. Doing so we will be able to specify these communication abstractions and propose architectural variants of their implementations. Game developers would be able to select abstract communication patterns and choose the appropriate implementation depending on the underlying platform or the network architecture as it is proposed in (Cariou et al. 2002).

Latency

Latency is defined by the response time between an action and the materialization of its effect on all players' machines. With First-Person Shooter games it must be less than 100 milliseconds. For Real-Time Strategy games it can be as high as 500 milliseconds as long as the jitter (the variance of the latency over time) is low (Smed et al. 2001). Now with mobile phone networks such as GPRS, observed latency is around 1 second (Nokia 2004).

The first solution to deal with this gap is to develop games compatible with this 1 second latency, e.g. turn-based games (Nokia 2003a).

Another solution is to take advantage of all of the available communication infrastructures to make other game types available. For instance, *Real Tournament* project relies on a wireless MAN consisting of GPRS and IEEE 802.11 hotspots (Mitchell et al. 2003).

In MEGA project, we are prototyping the mixing of GPRS and Bluetooth, by extending zone-based architecture (Matas Riera et al. 2003). In our architecture, we use a tree of mobiles. The root of the tree is the server. It interacts with its children through GPRS connections. Each of them interacts with its own children through Bluetooth connection. If scatternets are provided in the Bluetooth implementation, these "level-2" children can be in contact with "level-3" children, which themselves can be in contact with "level-4" children...

Communications are based on *dynamic multicast* principles (Ramakrishna et al. 2003) with the following addition. A child can send two types of messages: "Global" messages to be sent to all of the machines participating to the protocol whereas "Local" messages to be sent to all mobiles having the same "level-1" mobile as the sender. To send a message, a mobile sends it to its father, which sends it to its own father... If the message is "global", when it reaches the root of the tree, the root is responsible for forwarding it to all of its children, which in turn forward it to all of their own children... If the message is "local", this process takes place as soon as the message reaches "level-1" child.

We believe this architecture is well adapted to games where several groups of players play together. A subtree of mobiles under a "level-1" mobile handles each group. Communications inside the group are "local" messages handled only with Bluetooth, thus guaranteeing low latencies. Communications between groups require GPRS. Their latency can be integrated in the game design so that it does not reduce game experience. We intend to evaluate the behaviour of this architecture regarding latency with experimentation.

Consistency

Two machines participating to a multiplayer game can have at the same time a different vision of the game state because message propagation time is not bounded and messages can be lost. Several algorithms have been proposed to keep game sessions consistent. For example in *Trailing State Synchronization* (TSS), each machine keeps several states of the whole game. If an inconsistency is detected TSS switched the game from the leading state to one of the trailing states (Cronin et al. 2002).

Our goal is to study the applicability of such algorithms in a context of limited resources as with a mobile phone. We are currently experimenting a simple mechanism as mentioned in (Bernier 2001). The main idea is to send messages like "I have moved from x1 to x2; Meanwhile I did this and that" and suppose that clients are trustworthy (which is ensured by GASP platform). One of the main drawbacks of this algorithm is that it can lead to strong inconsistencies of the type "I have been shot by a dead man" (Mauve 2000). Now if we use this algorithm in the context of a game where players cooperate, we avoid such problem. Thus we can take advantage of the qualities of this algorithm: Limited stream of data from mobiles to server and acceptable streams of data from server to mobiles.

Databases

In the context of mobile multiplayer games, requirements for management of persistent data can be important (important number of players, multimedia data...). In MEGA we study this subject according to two directions:

- Characterize the requirements: This direction should have received inputs from the answers to the inquiry. As these inputs are too scarce, we have decided to concentrate ourselves on the game architecture presented previously.

- Evaluation of solutions based on grid DBMS: MMOG games induce high constraints on DBMS (100.000 simultaneous players generate a load of 200 transactions per second on the DBMS (Butterfly.net and IDC 2003)). Clearly mobile multiplayer games are currently far from overloading that much the DBMS they use. Nevertheless we want to study several alternatives to mysql and Postgresql commonly used by small development studios. Thus we have made a comparative analysis of C-JDBC (ObjectWeb 2004), lega@net (Ganarski et al. 2003) and Postgres-R (Postgres-R 2003): By running on grids they allow better performances and fault-tolerance. We are currently making a deeper evaluation of C-JDBC by testing it against TPC-W benchmark (a web site oriented benchmark, but significant enough for interactive applications like games).

This section presented several technical issues for mobile multiplayer games studied in the context of MEGA project. One can notice that there is never a killer solution for an issue. There are only solutions more adapted to certain types of games than other solutions.

Next session takes an interest in usage issues.

SOCIOLOGICAL AND PSYCHOLOGICAL ISSUES FOR MOBILE MULTIPLAYER GAMES

In order to identify the potential usages of interactive games in mobility situations, it is necessary to joint mobility experiences, game experiences, and mobile phone usage.

Understanding usage logics means understanding dynamicity of mobile interactive games usages thanks to the knowledge of mobile usages on one hand and mobile players on the other hand. For instance, mobile phone usage plays a part in daily life looking more and more like an "occupational zapping" (Jauréguiberry 2003); how does it influence the way people play?

Moreover are on-line players the same as mobile players and, if it is the case, how to joint these different usages?

As sociologist and psychologist, our research on these questions studies: daily practices of mobility, how players using mobile phones occupy time and space, how they carry out their social commitments. First subsection describes our methodology. Second subsection joints game practises, time and socialisation. Final subsection presents our first results.

Methodology

We have led one hour-long qualitative interviews with players. We followed classical method to collect players' anecdotes in order to understand the impact of the situation on game practise. Interviews are oriented according to four themes: 1) Game practise (buying act, frequency, duration, type of games); 2) Game experience (motivations, game pleasure, requirements, experiential dimension); 3) Mobility (circumstances, moments which trigger the desire to play) and multiactivity (usage of the mobile and its different functionalities, mobile and daily life); 4) Sociability (communications with other players outside of the game, forums, communications during the game).

Our inquiry was split into two phases. First phase consisted in interviews inside a population of players, students of Telecommunication engineering schools. Our goal was to apprehend categories of most-used games, criteria pertinent in game practises, and explanatory phenomena in game practises. Second phase concerned a sample of players selected thanks to two game development companies (one develops *Clint* a multiplayer game (Clint 2003), the other one develops games to be downloaded). We selected this sample according to the type of games and the profile of the players. Our goal was to check the impact of game and technology on the practises:
1) Teenagers/adults/man/woman; 2) Large audience games (Tetris, arcade, sport)/ "gamer" games (action, adventure); 3) Embedded games/downloadable games/WAP; 4) Monoplayer/multiplayer.

Game Practices, Time and Socialisation

There are almost no multiplayer online games in France. We identified one (*Clint*) where game phases are sequential and do not group more than two players. This usage leads to a discontinuous time for the player. Only persons very motivated by this game play it.

Generally speaking it seems game practises on mobile take fully place in the time (as it is experienced by the players) and game vector (that is the mobile phone by itself) has a very important role.

In fact the usage of mobile for playing seems tightly linked not only to the actual offer (with its technical and ergonomical limits) but also (and perhaps above all) to the definition and social representation of time and its organisation.

Mobile phone as a game vector: A second skin
To summarize, it is the mobile phone by itself, as a device extending our body, which gives rise of the desire to play: Always accessible, within sight, it seems to invite the player. It appears as a console ever and everywhere available. Thus it is used in the time interstices, scraps of time made available to the player. At the same time, the mobile phone plays the role of a second skin: Its user plays a game to show his withdrawal from others (in bus or in subway), or on the contrary to stay present without fully engaging himself in the relation (the person plays in the presence of his partner in life who watches television). The mobile phone becomes a tool for socialisation.

A tool for socialisation
As seen above practising a game on a mobile becomes a tool for socialisation. One can use it to show how much he is in foreground or background with others. Used in a public life, it allows furtive withdrawals in private life, smoothing out boundaries between public and private lives, as between time at work and off work. It is a tool for socialisation as it allows to direct energies and to keep a level of presence with the

possibility of withdrawing, for instance during work meetings.

Reappropriating time
The activity of playing on a mobile is directly linked with the boredom, boredom during the constrained time, in particular in transport. In an epoch where time is more and more constrained, mobile gaming opens a space of freedom and gives a feeling of mastery. The game takes place in these moments, which last ten to forty minutes. Thus it is obvious that the games can only be monoplayer or without time constraints, which is not the case of MMORPGs that require long durations.

If the game allows an action, this reappropriation will be even more important. Undoubtly players are looking for that: An action, which favours feeling of mastery that opposes to the permanent uncertainty of our society (Balandier 1988). Mobile phone accompanies unceasing movement of its users. At the same time playing with it gives the ability to build permanence, an individual action, which make sense.

First Results

Until now we have made fifteen interviews with players. Concerning our first phase of interviews (the one with students of telecommunication schools), we can make the following statements:

- They all have a player past: They started to play very young with a console.
- They all play on other kinds of game support (consoles, PC).
- They do not really appreciate multiplayer games and WAP games, because either they are too costly in terms of connection time or they are not practical to use ("One cannot play in the subway"). Some do not know they exist.
- They mostly play to downloadable games of any kind: action games, adventure, arcade, and strategy. They download 2 to 3 games per month. They like easy to use and easy to understand games. They play during short period of times: 10 to 30 minutes.
- As a familiar object, the object "mobile phone" is an "inciter" to play. In daily life situations, it appeals to the player either because it is in the sight of the player or because it is used for another usage.
- Players play during idle time, waiting period, but also in constraint situations: at work, during a meeting or a course.
- Players play also at home on their sofa, in bed... Mobile gaming is also a relaxation moment.
- Two kinds of practises can already be distinguished: Some players may interrupt their activity in order to play because the desire to play takes over current activity; On the contrary, some other players planify their playing activity during the day.

After presenting the methodology used for the sociological and psychological study, this section presented how mobile gaming provides a second skin to its player (giving him the ability to withdraw from others, or to stay present to them), and is a tool for socialisation and appropriating time (by favouring a feeling of mastery). This last point suggests that mobile multiplayer games can only be appreciated if they take into account player's time constraints.

CONCLUSION

This paper presents the first results of an undergoing analysis of issues for mobile multiplayer games.

First it takes a technical point of view. It presents our work-in-progress on the following issues: Communication middleware, communication abstractions, latency, consistency, and databases. For each of these issues there is no killer solution, only solutions suitable to given types of games.

Then the paper takes a sociological and psychological point of view. After presenting the methodology used for the study, it shows how mobile gaming provides a second skin to its player, and is a tool for socialisation and appropriating time. This last point suggests that mobile multiplayer games can only be appreciated if they take into account player's time constraints.

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