Application Assisted Power Management in Multiplayer Mobile Games – Poster & Demo

Bhojan Anand[‡], A. L. Ananda[‡], Chan Mun Choon[‡], Rajesh Krishna Balan[†]
[‡]National University of Singapore and [†]Singapore Management University

ABSTRACT

Multiplayer mobile games are an increasingly important class of mobile application. In our poster, we describe our overall system for optimizing the power and network characteristics of mobile devices during resource-intensive multiplayer game play. Our demo shows our prototype that identifies the current game action and uses that to tweak the power consumption of the mobile device. Our system is being designed to reduce the overall device power usage without sacrificing the end-user game experience.

1. SYSTEM ARCHITECTURE

Our system's architecture is depicted the Figure 1. We envision a three-tier architecture comprising of wireless game clients (cell phones), game servers (highly provisioned back-end servers), and access point proxies (used to isolate the effect of poor wireless latencies from the game player).

The consistency manager is used to maintain game server state between multiple game servers and the proxies. The network manger is used between the wireless clients and the proxies to provide the most optimized wireless connectivity for the required energy profile (proxy might choose to switch to higher latency lower power Bluetooth over 802.11g for a specific client for example). Finally, the resource manager is responsible for monitoring the current resource conditions and for deciding on the appropriate energy conservation techniques that achieve the best savings without impacting the end user experience. The resource manager will use different inputs and algorithms on the three different components. For example, the client resource manager will obtain inputs directly from the mobile phone's battery and use CPU and network throttling to achieve power savings while the server's resource manager will collaborate with the proxy to reduce the network bandwidth to resource constrained clients.

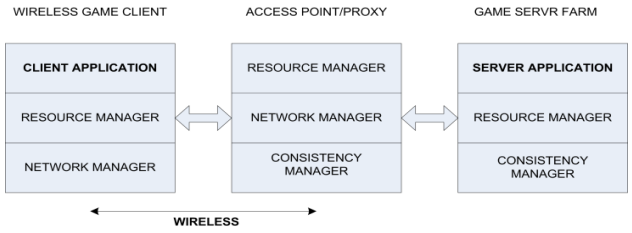

Figure 1 Top-Level System Architecture

2. CLIENT POWER MANAGEMENT

The client's resource manager, shown in Figure 2, collects and maintains data about the hardware status (*WNIC mode, Battery Level, CPU frequency*) and the client-server connectivity (*Latency, Estimated bandwidth, Connectivity*).

The resource manager computes a State Index for each game frame *'i'* using a combination of Action Data (what the player is doing), Interest Data (what the player is interacting with), Network Status and Power Status. This Index is used to determine the appropriate power conservation technique to use that best matches the current power and latency requirements. In particular, the resource manager can change the CPU frequency, the network traffic sending rate, the type of connection (Bluetooth, WiFi, reliable, etc.), and the network interface power mode (sleep, etc.).

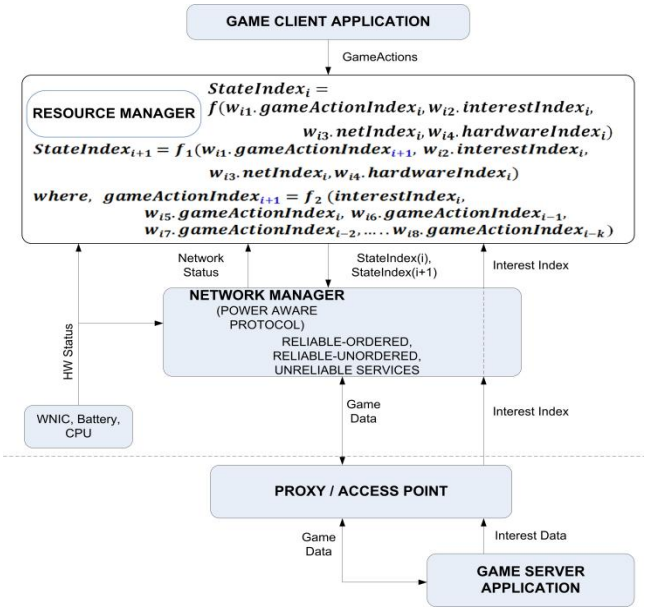

Figure 2 Information Flow for Resource Management

We use input from the game (Action Data and Interest Data) to ensure that our optimizations do not impact the end-user game experience. For example, during highly interactive game moments, we do not trigger more aggressive power saving modes. Our poster will go into more detail on each of the components and algorithms used in our system.

2.1 LEARNING GAME ACTIONS

The client's resource manager uses the current game state to trigger specific actions. We obtain these states by augmenting the game API as this is easier and more accurate than sniffing the game packets indirectly. We have developed this API extension to be easy to add to existing game engines.

3. DEMO

Our demo will show the Quake 2/Armageddon game running on a Google Android mobile device. We have augmented the game to report its current action and game state periodically. We use those actions and states to trigger specific power conservation modes. We will just require wireless connectivity between our Android mobile device and the game server (a laptop we will bring)

4. REFERENCES

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