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POWER MANAGEMENT IN MOBILE DEVICES BY VARIOUS PROTOCOLS

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ABSTRACT

Mobile devices are battery powered device. But battery is a limited source of energy depend upon their shape .in this paper various protocols and different power management techniques aiming to reduce power consumption mobile devices are describe. Static techniques, applied at design time, have been presented on the other hand, dynamic power management techniques, applied at runtime were also discussed.

Keywords: Wireless Networks, Mobile Devices, Battery.

1. INTRODUCTION

In today's world of mobile communications, power is most consuming source. The mobile host can only operate as long as its battery maintains power. Wireless networks consist of small portable devices such as PDAs, mobile phones, headsets etc., which have limited processing power and battery energy. Message transmission consumes energy and transmission energy requirements vary with time depending on the channel conditions. The use of mobile devices is directly affected by batteries. Because some time, battery needs to be replaced or recharged. Many physical components are responsible for energy consumption in a mobile device [2].

The portable devices have limited battery energy that is why it is required to manage it properly. Some people try to reduce the physical dimensions of batteries but it will only reduce the amount of charge retained by the batteries. It will turn to reduce the amount of time a user can use the mobile device being forced to recharge the batteries. Such restrictions tend to under estimate the use of mobile device [3]. Hence, there are three major requirements of energy consumption which are:

- The device should save power as much as possible.
- The device should keep the user informed of energy consumption state and events.
- The device should take actions before battery to get empty.

The trend in mobile computing is towards more communication dependent activities, with mobile users switching from traditional wired Ethernet communication to wireless communication by using Ethernet cards. When inserted, many wireless communication devices consume energy continuously. Although dependent on the specific machine and wireless devices, this energy consumption can represent over 50% of total system power for current hand held computers and up to 10% for high end laptops. This trend leads to design power efficient communication subsystems [6].

The main need of battery management is interacting and involving the user in managing their resource. For mobile phones, users get into habits of charging their mobile at suitable periods, as they know their call patterns and the device has been optimized for low power stand modes. For laptops, users get into habits of bringing charger adapter with them. There are numbers of factors which require changing these habits. Firstly, there is an expectation from users to always on their mobile phone. Secondly, Bluetooth during data transfer continuously consume energy. Thirdly, background applications consumes significant amount of energy [5].

Because of above requirements, communication devices need to be properly managed so that they conserve power. Hence, we need protocols or algorithms which provide power savings with low cost and computationally simple. There are some methods and techniques for power management like Static Power Management and Dynamic Power Management, Static Leakage Management, Predictive Schemes, Stochastic Dynamic Programming. There are also some suspension strategies like basic strategy, timeout strategy, and sleep duration strategy.

2. RELATED WORK

In mobile communications, power is most consuming source. The mobile can work only until its battery maintains power. Mostly, mobile devices are directly affected by their batteries that need to be replaced or recharged. Message transmission consumes significant energy and the transmission energy requirements vary with time depending on the channel conditions. Many physical components are responsible for power consumption in a mobile computing device. So energy is a limited source [2].

Wireless devices have limited processing power and battery energy. There are various methods and techniques to handle energy consumption. Static Power Management refers to the keeps an idle system in a power efficient state until further processing is required. It is applied at a design time and managed by a technique known as static leakage management (SLM), static power consumption can result in several low power modes, from standby to a deep sleep mode, which mimics the power-off state but has faster wake up latency [3].

Static Leakage Management refers to put the entire device in low-power mode either automatically when no application is running or upon user request. The mechanism for doing this is called SLM, which initiates standby or device-off mode. The main difference between the two modes is that in standby mode, the system state is in saved in internal memory and whereas in device-off mode the system state is saved in external memory. Dynamic Power Management refers to the save energy in devices by turning on and off under operating system control. These are applied during the run time, when the system is serving the light load work or not processing. DPM can be implemented in different ways. DPM can be classified into predictive schemes and stochastic optimum control schemes. Predictive Schemes refers to predict a device's usage behavior in future, usually based on the past history of usage patterns and decide to change power states accordingly. Stochastic Dynamic Programming refers to optimal policy for discharging the cells of a battery programming. The cells are optimally scheduled to serve the packets [3].

2.1 Different Energy Consumption Protocols

Various techniques, both hardware and software, have been proposed to reduce a mobile host's power consumption during operation. Most software level techniques have concentrated on non-communication components of the mobile host, such as displays, disks and CPUS. In particular, researchers have looked at methods to turn off the display after some period of inactivity (as often implemented in BIOS or screen savers), to spin down the hard disk of the mobile host and to slow down or stop the CPU depending on work load. The principle underlying the techniques for controlling these components is to estimate (or guess) when the device not be used and suspend it for those intervals. Stemm, et.al [8] have identified the problem of excess energy consumption by network interfaces in handheld devices and have provided trace driven simulation results for simples software level timeout strategies. The new IEEE 802.11 standard that is being adopted by some vendors adopts lower level solutions (at the MAC and PHY layer) to support idle time power management. Hardware level solutions for managing the communication device focus on modulating the power used by the mobile transmitter during active communication.

2.2 Energy Consumption Based on Battery Model

Saswati Sarkar and Maria Adamou, presented a framework for computing the optimal discharge strategy which maximizes the lifetime of a node by exploiting the battery characteristics and adapting to the varying power requirements for wireless operations. The complexity of the optimal computation is linear in the number of system states. Saswati Sarkar presented a simple discharge strategy which can be executed online without any table lookup and attains near maximum lifetime [1].

2.3 Energy Consumption Based on Stochastic Dynamic Programming

Battery consists of several electrochemical cells from which power needs to be drained when the node transmits a packet. When a cell is allowed to rest in between discharge periods, it was able to recover part of its charge, because of the diffusion mechanism [2] thus, the total energy delivered is increased. The "theoretical capacity"(C) of a cell is the maximum energy it can deliver. A cell can deliver C units only if all the available active material of the cell is used. The "nominal capacity" of a cell (N) is the total energy it can deliver under a constant current discharge. When a packet needs to be transmitted by the device, a certain number of charge units need to be discharged from the battery, from one or more of its cells. When a cell is not being drained it can recover one charge unit with a certain probability, due to the diffusion process. As a result, the actual energy delivered by a cell, during its lifetime, is between N and C charge units. It delivers N charge units if it does not recover any charge, while it C delivers units under maximum possible recovery. The problem here is how to efficiently assign the packets to the cells. The objective is to optimize the charge recovery process and thus, maximize the total energy delivered by all the cells. This in turn maximizes the battery lifetime.

2.4 Energy Consumption Based on Location Information

Muhammad.A, Mazliham M.S and Shahrulniza. M. focusing on the power management on the location estimation based history. The derived algorithm was divided into two parts: First: while the device was located in a single terrain only and secondly: when the device was falling at the intersection of two or more terrains. Location of the handheld device was used as parameter for cluster calculation [3]. Muhammad. A, Mazliham considered GSM architecture and cell phone which operated as a portable device. While the device was not participating in the communication, it was directed to change its state from the active mode to a park mode so the device will save the battery power. This technique falls in the Dynamic Power Management (DPM) category as it was dealing with the battery power during run time [3].

2.5 Energy Consumption Based on Dynamic Management

System level dynamic management provides a power management saving the battery life by sending the idle components of the system in the low power state. L. Benini and G. De Micheli used the concept that if any component or even the device is not participating in the communication, then sent the device into low power state, where device will be able to receive data as moved into listen mode [4].

2.6 Energy Consumption Based on Context Aware

Nishkam Ravi, James Scott, Lu Han and Liviu Iftode proposed a system for context aware battery management that warns the user when it detects that the phone battery can run out before the next charging opportunity is encountered. At the heart of this system, algorithms that predict: (1) when the next charging opportunity will be available, (2) how much call-time will be required by the user and (3) how long the battery will last if the current set of applications continue to execute [5].

IEEE 802.11 standard provides a Power Saving Mode (PSM) that periodically disables the network interface during the periods of no activity in order to minimize the battery [7].

2.7 Energy Consumption Based on Host Communication

Robin kravets, P. Krishnan presented the design and implementation of an innovative transport level protocol capable of significantly reducing the power usage of the communication device. The protocol achieved power savings by selectively choosing short periods of time to suspend communications and shut down the communication device. It manages the important task of queuing data for future delivery during periods of communication suspension and decides when to restart communication. It provided a simple model for mobile communication that provides an adaptable functionality at the transport layer for suspending and resuming communication. Power savings were attained by suspending communications and the communication device for short periods of time. During these suspensions, data transmissions were queued up in both the mobile host and any other host trying to communicate with the mobile host. The key to balancing power savings and data delay lies in identifying when to suspend and restart communications. By abstracting power management to a higher level, Robin kravets describe application specific information about how to balance power savings and data delay. A base station using this protocol has enough knowledge about the state of the mobile host to know when it is suspended and can use this information to employ scheduling technique. Current wireless communication devices operate in two modes: transmit mode and receive mode. The transmit mode is used during data transmission. The receive mode is the default mode for both receiving data and listening for incoming data. Robin kravets addressed the tradeoff between reducing power consumption and reducing delay for incoming data [6].

Based on the investigation of literature survey of various researchers, this will help us to improve the performance of power management.

3. CONCLUSION

The various power management protocols illustrated by many researchers as explained above have been suggested to improve the performance of battery for mobile devices. They presented various characteristics of mobile devices to improve the performance which makes them reliable and stable. The parameters which are basically included location information, next charging opportunity etc. These protocols are used in many applications of wireless networks.

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