Advanced Power Management Techniques in Next-Generation Wireless Networks

WIRELESS

JOHN JOSEPH

UNIVERSITY OF DODODMA

October 9, 2015

INTRODUCTION

With the proliferation of wireless services and anytime anywhere communication providing always on connectivity, the mobile devices tend to decrease size and have more computation power hence tend to consume power or high power drainage

The next generation wireless technology should provide an effective means that can help in the eradication of the power drainage problem and increase longer battery life in the mobile devices or any devices that uses wireless technologies for communication example of the standards are next-generation wireless standards, such as IEEE 802.16m and Third Generation Partnership Program (3GPP) Long Term Evolution (LTE).

The next-generation wireless standards, Should provide very efficient power conservation mechanisms to achieve longer battery life while providing enhanced user experience and quality of service (QoS).

The wireless communication can involve the mobile station and the base station transversal which allow the use wireless frequency with the specific channel to communicate among each other but Mobile stations (MSs) are not always engaged in active communications.

For significant durations, MSs are waiting for incoming or outgoing packets. These standby periods can be used for power conservation

In the beginning the mobile station where using the idle mode while the mobile node is not on a call works best. As due to the fact that the voice calls have low data rates, the devices use a small frequency band and/or time period for transmission/reception operations but due to the advancement mobile device or mobile station they tend to have the ability to support data and voice communication.

Finally, the total average talk time per day by an average mobile phone user is not high. On the other hand, traffic in next-generation broadband wireless systems is bursty with significant periods of no traffic during a session (e.g., reading time during a web browsing session).

Due to the fact that the Users spend significant amounts of time using different mobile Internet applications. Therefore this always facilitate on consumption of significant amount of power to the mobile devices the average.

Data rate used by Internet applications is very high, the devices have to use a larger frequency band and/or time period for transmission/ reception operations, due to these reasons, the power management techniques of voice-oriented wireless networks are not applicable for next-generations wireless data networks

TECHNIQUE AND STATE IN MOBILE STATION

In mobile networks an MS can be in one of the following states ,the state of the mobile station can be initiated by the mobile station all can initiated by the base station transversal. • State I: Receive or send traffic • State II: Do not receive or send traffic while in active session(s) • State III: Not in an active session

The mobile station tend to save the ability to save then energy when it enter in the state 2 and 3 is due to the fact that the transmitter and the receiver are shutdown in the particular mobile station

POWER MANAGEMENT IN STATE II

When an MS is in an active session it has the power all the capability of it could initiate sleep mode in IEEE 802.16m for power saving during inter-burst intervals the power saving mode this is simple the phone enters in sleeping mode whereby this is called a sleep cycle that is having a lasting window and sleeping window

The sum of LW and SW is defined as a sleep cycle. During SW, the base station (BS) does not transmit any packet to the MS, Sleep mode operation of IEEE 802.16m

The sleep mode can be initiated by a BS or an MS when the MS is in the connected state.

Sleep mode operation: While in sleep mode, an MS alternates SW and LW and can be dynamically or statically changed in order to

During LW, the MS monitors the downlink to check for a traffic indication message. The traffic indication can be either positive or negative,Upon receiving a positive traffic indication, the MS shall wait for pending downlink traffic. Upon receiving a negative indication, the MS terminates the current LW and starts SW

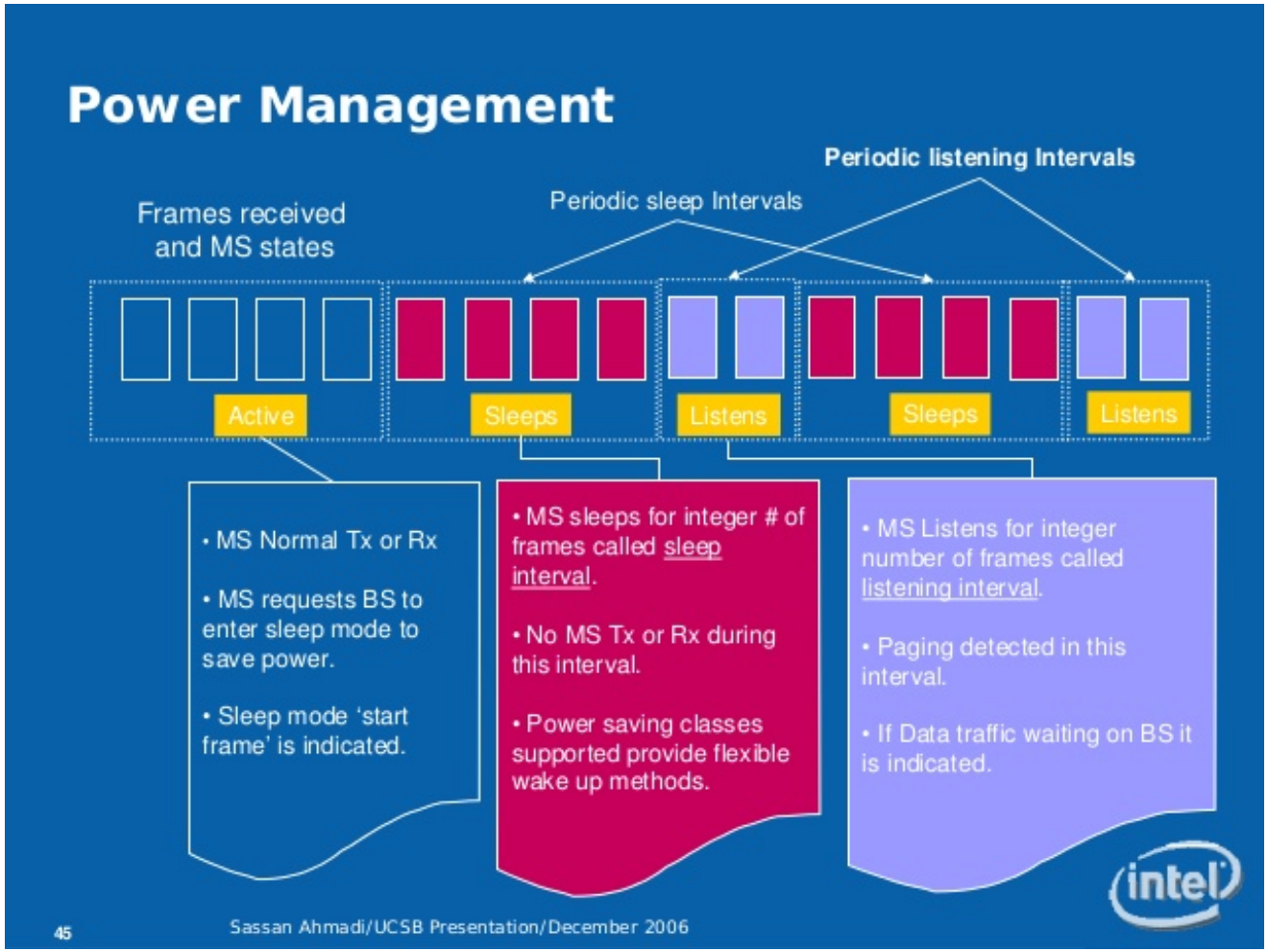
The sleep mode can be terminated in case of handover, idle mode initiation or return to normal mode. The sleep mode termination can be initiated by a BS or an MS. The sleep mode operation in IEEE 802.16m.

POWER MANAGEMENT IN STATE III

In idle mode the MS relinquishes its connections and states associated with its BS. However, the MS's context referred to as idle mode retention information (IMRI), such as security keys, service flow parameters, and the MS's capabilities, are stored in a network entity (e.g., a paging controller [PC]).

Idle mode initiation: The idle mode can be initiated by a BS or an MS when the MS is not in a session. During idle mode initiation, the MS and the network can negotiate the IMRI that can be used to expedite the MS's network reentry from the idle mode. And at this stage the MS can inform the network of its mobility information so that the network can assign PGs of appropriate size to the MS.

The figure below show the Mapping of power management modes to a generic traffic model.



Idle mode operation: While in idle mode, the MS alternates between paging unavailable intervals (PUIs) and paging listening intervals (PLIs).The MS monitors paging messages during PPLIs.When P-PLI is not available due to the MS's movement to a secondary PG, the MS monitors S-PLI. A more detailed procedure is explained in the following section

Idle mode location update: An MS performs location update upon meeting location update trigger conditions: PG-based location update, timer-based location update, and power down location update. The main objective of the location update is for tracking MSs' location and manage idle mode MSs' context information

The idle mode have further evolved and can be found in the mobile devices where by this facilitate also in the maintenance of the power management by regulation of the processor power(CPU) and graphic processing unit(GPU) example, an ARM11^{TM} processor core could have doze, sleep and stop modes. The deeper modes yield more power savings, but usually come with a greater "cost" penalty in time and transition power when entering and exiting the mode

Finally the power management issue is still a problem and in order to have well efficient mobile station we should develop a better architecture, optimizing the operating system. Improving the wireless communication standard, developing a Freescale's XEC technology, which is an architected to be extensible for future enhanced generations and easily deployable across multiple hardware platforms and operating system software.