Cutting Edge Technology Feasibility Study

Author: Ecova (formerly Ecos Consulting)   *Date: July 2011*

Commissioned by: Australian Government, DCCEE

Download available @[4e Standby Power Annex](#)

Focus of Report	The focus of this research was to investigate the feasibility of power saving cutting edge technologies for set-top boxes, game consoles and IP phones (i.e. internet protocol phones). These three products were chosen, as the majority of products in these categories consume as much power while in idle mode as when performing a function. These product categories also have high energy saving potential by implementing or increasing time spent in low power modes.
Description of Research	The research used a literature review of academic articles, industry reports, previous Ecova (formerly Ecos Consulting) work, and product websites that examined each product category as well as telephone interviews with the relevant stakeholders - academics, component vendors, industry analysts, service providers and manufacturers.
Key Findings	**Set-top Boxes (STBs)** Ecova examined the cutting edge components that will be offered in upcoming STBs. They identified four areas where manufacturers can reduce STB energy consumption: **1. Client/server multi-room networks** – Put simply, industry is starting to deploy STB systems that involve one DVR server that can stream video to client STBs or directly to smart televisions in the house. This shift averts an energy-wasting scenario where homes own multiple DVRs to enable time-shifting on each television. **2. Reducing on-mode power** – Apple TV 2 is cited as a benchmark case in this area operating extremely efficiently at approximately 2 watts while functioning as an OTT (over the top) video streaming device. On-mode power consumption can be reduced by: including efficient channel tuners with new efficient chips; and/or removing the need for a hard drive in STBs via multi-room networks and/or by the provision of remote data storage in the provider's server. **3. Reducing sleep-mode power** – Ecova expects that as STBs move toward media gateways with built-in broadband and VoIP modems, low-power battery backup mode will become the norm. This will provide an opportunity for manufacturers to reduce the sleep-mode power consumption without reducing the consumer's start up time. **4. Increasing time in low power sleep** – This area is the most problematic of the cutting edge technologies for STBs. One US manufacturer is using a power management micro-processer to power down the STB to a deep sleep of 0.5 watts that can be woken remotely. Maintaining constant connectivity with the network, this STB can power down components when not in use. However there are problems with wake-up latency. Cultural differences are apparent on acceptable latency time for waking up a STB from sleep mode. European consumers who manually turn STBs on and off, to US consumers expecting the STB to wake up as fast as the TV (about 6 seconds). Satellite TV also has latency challenges; when the STB goes into deep sleep contact with the satellite is lost and reconnection can be slow. A new concept (prototype not yet available) with the goal of maximising energy savings proposes that the STB could "learn" the users schedule and go into deep sleep when user is absent and power up when user typically returns. **Game Consoles**

Game consoles can be differentiated from PCs as they allow local multiplayer gaming, use a controller as input and the TV as output. The latest game consoles also act as home theatre PCs consisting of a hard drive, DVD player, OTT (over the top) video streaming and the capability to be networked to a computer to access photos, music, movies etc.

1. **Reducing on-mode power** - Ecova reports that up to 50% of the time game consoles are on they are not performing gaming tasks. Power scaling could be improved and therefore game consoles use unnecessary amounts of power when in functions other than gaming such as listening to music, playing movies and when idling.
2. **Increasing time in deep sleep** - Collaboration between hardware and software developers of gaming consoles could increase the time consoles are saving power in deep sleep. Maintaining quality of service is problematic as the console must be able to save game state information before powering-down so it awakes in the appropriate place in the game. Mobile devices already employ this technology as energy efficiency extends their battery life.

iPad 2 – There is a growing trend of game play towards mobile devices which will increase as tablets offer increased functionality for gaming. With mobility in mind, designers build these games with the ability to save the game state at any time. Increasing time in deep sleep the iPad 2 can be put in standby mid game and reactivated hours later at the same place. Thus demonstrating it is possible for games to go into low power state without loss of quality. The iPad 2 uses 5 watts when playing a game and idles at 3 watts. While not the same as the high-end graphic processors in game consoles this demonstrates how efficient a device can be when energy saving is a primary consideration.

IP Phones

IP phones send voice signals over an IP network instead of the traditional analog telephone network. Many variations exist such as software applications Skype or Google Voice, or connect the standard phone to a computer via a USB dongle. All require constant network connectivity. Office phones were the focus for this research as commercial market penetration is much greater than the residential market. Many IP phones use almost the same amount of power whether in use or idle, presenting an opportunity to save power when not in use i.e. most of the time. Proxying and Energy Efficient Ethernet are two technologies capable of reducing idle-mode power.

1. **VoIP Proxy** - A proxy is an "entity that maintains network presence for a sleeping higher-power host"[1]. This technology only requires the compliance of one device such as the IP phone, allowing the phone to go to sleep without losing network connectivity and allowing other devices to remain on. The main issue is latency – where a two second wake-up might be acceptable for computers and STBs, an IP phone is required to wake in 250 milliseconds before it impacts quality of service.[2] This technology is only suitable to phone networks using Session Initiation Protocol (SIP) signalling.
2. **Energy Efficient Ethernet** - A typical IP phone has multiple built-in interfaces to work with older devices however they use the top speed regardless if the data flow requires it. Two options have been presented to fix this:
   1. Adaptive link rate scaling – changing the interface based on the amount of data. Latency problems are again cited as problematic here.
   2. IEEE protocol 802.3az, Energy Efficient Ethernet (EEE) is preferred as it saves same amount of power with three millisecond latency. EEE uses the fastest interface to transfer the data and goes to sleep when not working reportedly scaling power down from 380 – 105mW when idle. Downside is that the protocol requires all

---

[1] Ecma 2010, "ProxZzzy for sleeping hosts." February 2010. http://.ecma-international.org/publications/files/ECMA-ST/ECMA-393.pdf

[2] Cisco 2008, Cisco Unified IP Phones: Conserve Energy with Intelligent Power Allocation. July 1 2008.
http://www.cisco.com/en/US/prod/collateral/voicesw/ps6788/phones/ps379/white_paper_c11-481292.html

	devices on a local area network be compliant in order to achieve the energy savings benefits of EEE.
Conclusions	The report has identified multiple energy efficiency opportunities for each of the product categories however the challenge is to bring these cutting-edge energy efficient technologies to market saturation as quickly as possible. **Summary of Cutting Edge Technology by Category**

Set Top Boxes	Game Consoles	IP Phones
Multi-room architecture	Power scaling	Proxying
Decrease light sleep and on-mode consumption	User-friendly auto-power down	Energy Efficient Ethernet
Increase time spent in deep sleep		

Standby power policy Implications	Ecova suggest that different policy approaches to reduce energy consumption may be necessary for the three product categories. For STBs, they suggest a voluntary approach based on the success of Europe's voluntary approach. For game consoles direct engagement with manufacturers to discuss ways to incorporate energy efficient technologies is advised. While for IP phones reducing energy consumption is largely dependent on underlying network infrastructure, so as newer SIP-based networks emerge proxy technologies should be broadly applied.