mobile vce
: research innovation application :

Analytic tools to determine optimal 3G to WiFi energy savings

Industry brief

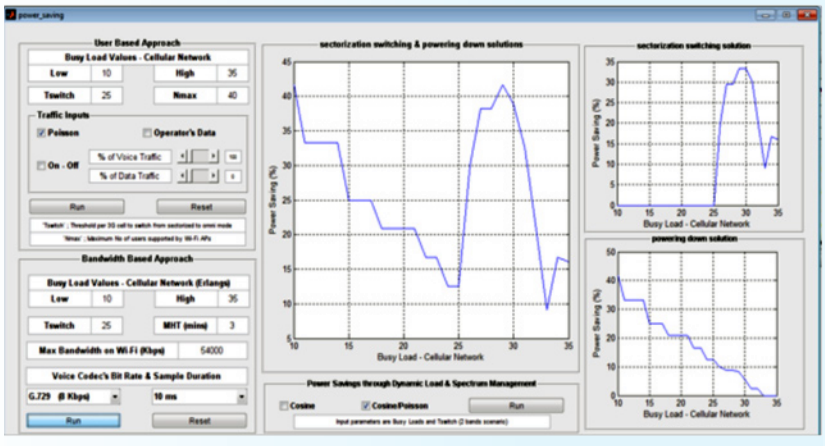
Strategic Business Relevance: Mobile Network Operators are increasingly offering connectivity over heterogeneous networks; blending licensed (3G) and unlicensed (WiFi) spectrum for economically optimal capacity. The trend towards smaller cell networks increases the challenges of energy management. The effect of principle parameters needed for dynamic spectrum access, including sleeping 3G cells, are prototyped through this GUI based tool. Results point to viable solutions for power consumption reduction in 3G networks, and enhancements to networking planning tools to include energy efficiency awareness.

Saving energy by offloading users from 3G to WiFi

Whenever possible the powering down of 3G radio network equipment (sleep modes) is a sound technique for energy saving. Sleeping encompasses basestation coverage modification on-the-fly from sectorised to omni-directional. Coverage and service provision may be supplemented by WiFi.

Results show that the power savings, by turning the base station off at low loads, are up to 85%. At high loads, the primary contribution is from sectorisation switching, with savings up to 40%

The tool enables both user centric and network centric perspectives.



Core Research: Green Radio

Through the perspectives of both architecture and state of the art techniques, the Green Radio research programme is discovering innovative ideas to significantly reduce the power consumption of radio access networks.

The Techniques element spans the protocol stack and when optimally combined seeks to address the aspiration of 100x power reduction.

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Key aspects of balancing 3G and WiFi coverage

Industry brief

Saving energy vs Quality of Experience

Dynamic spectrum access improves power efficiency. To improve power efficiency in dynamic access selection there is a requirement to balance the system such that both the user and the network perspectives are taken into consideration.

From the user perspective, users may wish to use a combination of several networks, each of which is optimised for a particular service. On the other hand, from the network point of view, operators need to consider a dynamic access selection based on factors such as energy, available spectrum bands, and traffic within the network. By taking into account both perspectives a viable solution is available to reduce power consumption whilst having a minimal impact on the user experience.

The modeling tool

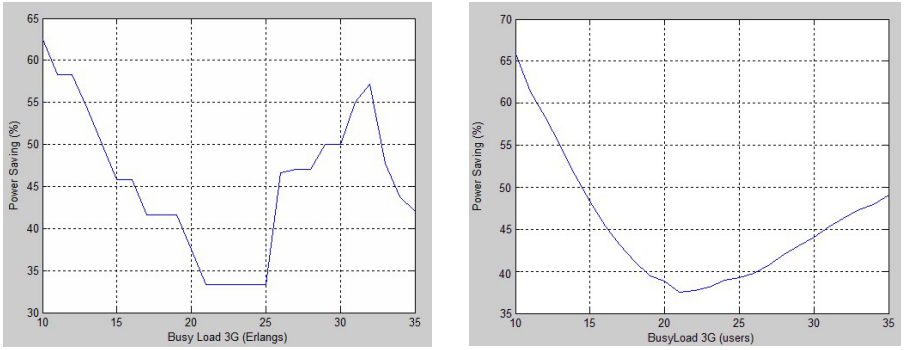
The tool works by considering a simple topology of a single 3G cell in which a cluster of WiFi access points exist. The tool supports both the user and bandwidth based approach.

The user based approach considers the maximum number of users supported by a group of WiFi access points and a 3G cell threshold value at which the cell can switch from omni-directional mode to tri-sectored mode. The bandwidth based approach considers the maximum data rate (bandwidth) supported for each WiFi access point.

Results

The graphs shown below give the percentage of 'from the socket' power savings for the 3G network. From these results, it can be seen that very significant power savings can be achieved by applying the sectorization switching and powering down solutions in tandem.

The power savings by turning the BS off at low loads are most notable (up to 85%). At high loads, the primary contribution is from sectorization switching (up to 40%). The power savings are primarily dependent on the capacity of the WiFi network in terms of the number of Access Points (AP)s available and the maximum number of user supported per AP.



Power savings when applying sectorization switching and powering down solutions in tandem.

Key Points

- A unique way for calculating energy savings by dynamically moving users from 3G to Wi-Fi
- Quantification of the energy saved by turning the base station off completely, or by removing sectorization.
- Results point to a viable solution to reduce power consumption in 3G networks

Industry focused research, innovation & application

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