Cognitive radio and Cooperative strategies for Power saving in multi-standard wireless devices

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C2POWER At a Glance

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C2POWER Motivation

- **4G higher data rates and multi-mode functionality**: As energy per bit decreases, in order to operate with acceptable signal-to-noise ratios, the transmitted power needs to be increased.

- **4G extra functionalities** like advanced imaging features, camera, high-definition display, GPS, … are power demanding.

- **4G ability to provide users with a continuous connection**, or as it is typically referred to “always being connected”. From the battery standpoint, this can also be interpreted as “always being drained”.

- High power dissipation in terminals means that the temperature of the small handheld devices would rise to unpleasant values for the user, and make **active cooling** necessary.

- **Battery capacity** has only increased by 80% within the last ten years, while the processor performance follows Moore’s law..

- **4G users will be left searching for power outlets rather than network access**!

- **4G devices will get hot !!!**

- **Increased human exposure to radiation**
C2POWER Objectives I

- **C2POWER** main objective is to research, develop and demonstrate energy saving technologies for wireless mobile devices, exploiting the combination of cognitive radio and cooperative strategies while still enabling the required performance in terms of data rate and QoS to support active applications.

- **C2POWER** focus on the power that is consumed in the wireless transmission and reception process, i.e., the wireless subsystem of the mobile devices without considering any power issues at the other mobile phones functionalities (display, memory, camera,..)
C2 POWER Objectives II

- Investigate how context information can be used by cooperative strategies to achieve power efficiency at the wireless interface of mobile devices.
- Investigate and demonstrate the potential of cooperative techniques based on advanced short range communications for the goal of power/battery lifetime saving of mobile wireless devices.
- Investigate and demonstrate minimum energy consumption handover procedures and policies between heterogeneous technologies and associated tradeoffs in realistic scenarios.
- Investigate, design and demonstrate energy efficient reconfigurable multi-standard transceivers able to switch from one standard to another according to a power saving strategy.

- Investigate methods and incentives to encourage cooperation and develop attractive business models for the network/service provider (Stimulate and motivate cooperative networking among users and between heterogeneous networks, e.g. financial incentives / bio-inspired reputation mechanisms).
C2Power Concept
Short range Cooperation for homogeneous RATS

Centralized RAT
UMTS, WiFi, WiMax, DVB

Advanced Short-range
Enhanced Short Range (cognitive UWB, ...)
Cooperative cluster
Distributed, reconfigurable
Low power / High data rate

Cooperative cluster between nodes connected to the same RAT
C2POWER Concept
Energy-Efficient Vertical Handovers

Energy efficient vertical handover
C2POWER Concept

Cooperative cluster between nodes connected to different RATs
Technical Approach and Key Issues

WP2
Scenarios requirements and business models

WP3
Context awareness and signaling for power saving strategies

WP5
Cooperative short range communications for power saving

WP6
Energy-efficient cognitive handover procedures and policies

WP4
Energy-efficient reconfigurable radio transceivers

WP7
Integration and demonstration

WP8
Dissimination and standardization

Network Discovery
Cooperation protocols
Cognitive Vertical Handovers
Multimode Transceiver
Cooperative Relaying
Routing
Node Discovery

enabling technologies

WP1
Project Management
Cognitive radio and cooperative networks is still in its infancy and Europe can be considered to be currently level with its major competitors in the USA and Far East. However, this situation is only short-term unless European industry undertakes a concerted research effort on these new disruptive technology paradigms.

Partners involved are active members of various standardisation organisations (that include IEEE 1900.6, Bluetooth Special Interest Group (SIG), Femto forum, and the ETSI EMTEL Working group) and are capable and committed to place the key project outcomes in these relevant standards.

C2POWER tangible outputs includes demonstrators for energy efficient short-range cooperation, and vertical handovers; where the aim is to reduce the power consumption at the mobile device by up to 50%.

Reduction in energy consumption together with the lowering of the “radio pollution” through energy-aware and more effective radio resource usage will help facilitate more sustainable ICTs in Europe, aligned with the vision set forth by the Lisbon agenda.