

ETSI Green Agenda 26 November 2009

HOW TO REDUCE-GREEN HOUSE GAS EMISSIONS FROM ICT EQUIPMENT

Wireless Networks, EARTH research project

Alcatel-Lucent, Bell Labs Stuttgart

Ulrich Barth

A horizontal green band with a pattern of concentric circles on the right side, transitioning from a solid green to a pattern of white and green rings.

Energy Usage in Wireless Networks

Contribution of ICT to global CO₂-Emission

- Carbon footprint of the entire ICT industry is estimated to be 2% of the total human carbon footprint.
 - comparable to the world-wide CO₂ emissions by airplanes or
 - 1/4 of the world-wide CO₂ emissions by cars



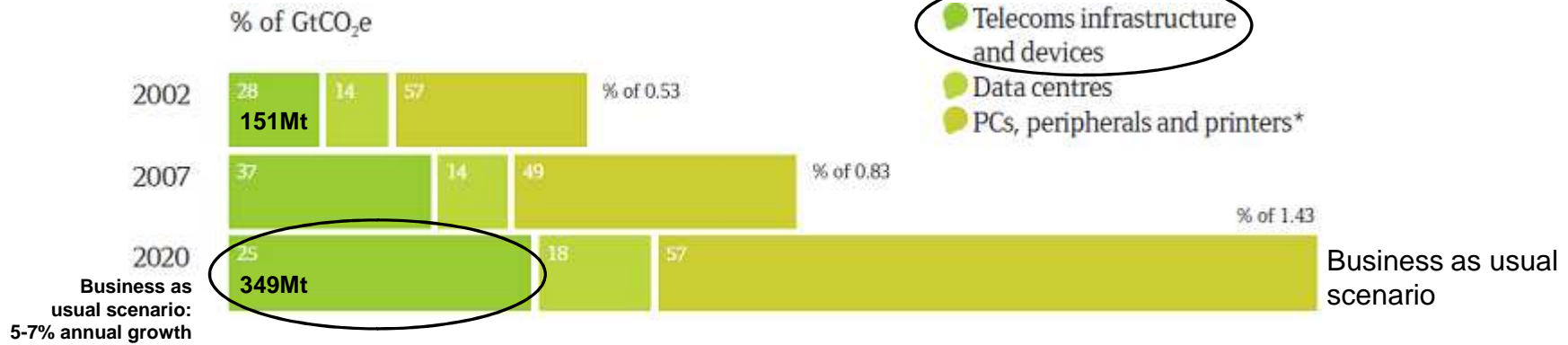
Foto: Oliver Blume

Source: Gartner, Gartner Symposium/ITxpo 2007

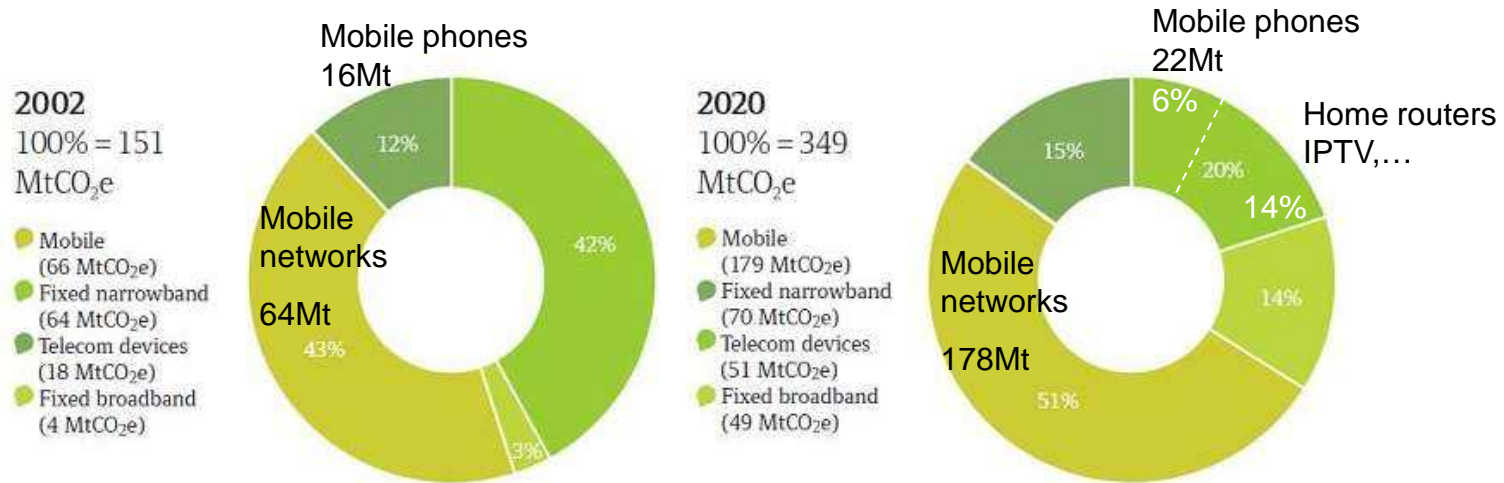
other studies claim 3-4% when including total life cycle

Smart 2020 Report: CO₂ contribution of ICT

ICT



Mobile communications



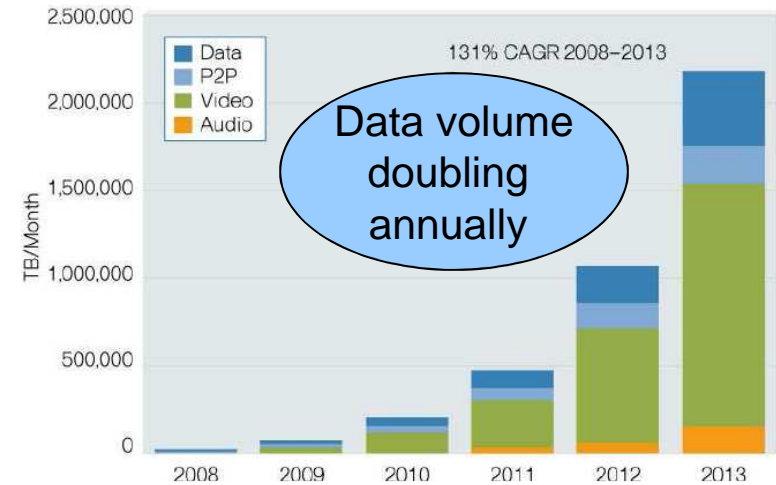
Energy is a significant portion of the *OPEX* for a Mobile Operator

Country	Network	Energy Consumption	% of Country Total Energy Consumption
USA	Verizon 2006	8.9 TWh	0.24%
Japan	NTT 2001	6.6 TWh	0.7%
Italy	Telecom Italia 2005	2 TWh	1%
France	France Telecom-Orange 2006	2 TWh	0.4%
Spain	Telefonica 2006	1.42 TWh	0.6%

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Sources: Verizon Corporate Responsibility Report 2006; ETSI Work Program on Energy Savings, Benjamin Gorinc Intelec 2007 Proceedings and Life Cycle assessment for Information Communication Technology; NTT Corporation; Energy Efficiency-an enabler for the next Generation Network; F. Cuccietti, Telecom Italia, Bruxelles, January 30, 2006; France Telecom Energy Consumption, HVDC, Cooling improvements, Didier Marquet and Marc Aubré, France Telecom; Datacenter Code of Conduct Meeting in EA, July 2007; Telefonica Corporate Responsibility Report, 2006.

Source : "Road map to reduce energy consumption", Green Telco World Congress 2009



CAGR: Compound Annual Growth Rate

Source: Cisco, 2009

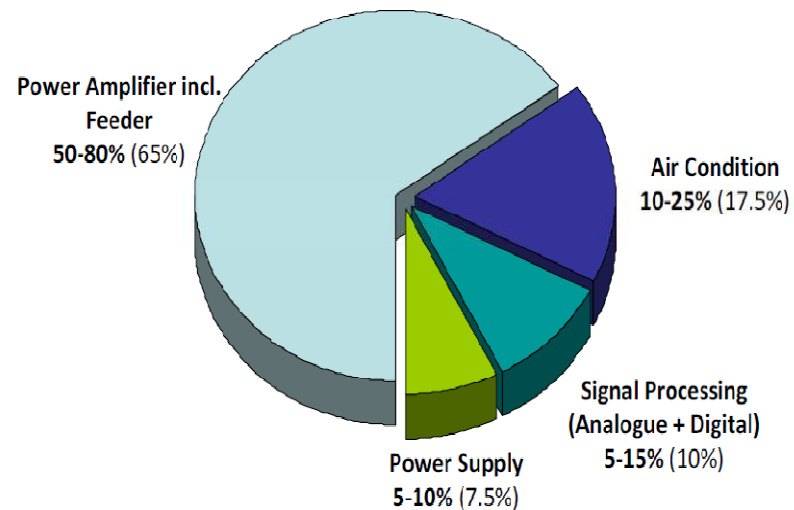
Contribution of energy cost to OPEX

- growing with network build-up (3G densification and 4G rollout)
- growing with energy price increase
- 20-35% of OPEX (developed markets / emerging markets)

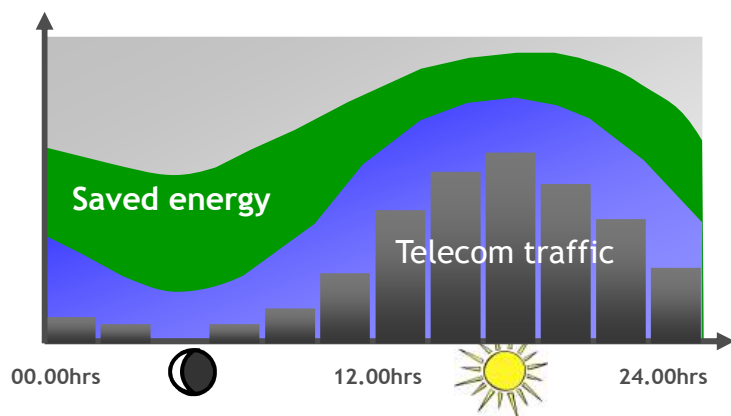
Where the Energy goes

Mobile networks energy use:

- 80% Base Station equipment
- 20% Mobile Core Network



Study on Energy Efficient Radio Access Network Technologies, 2009 Bell Labs, Alcatel-Lucent

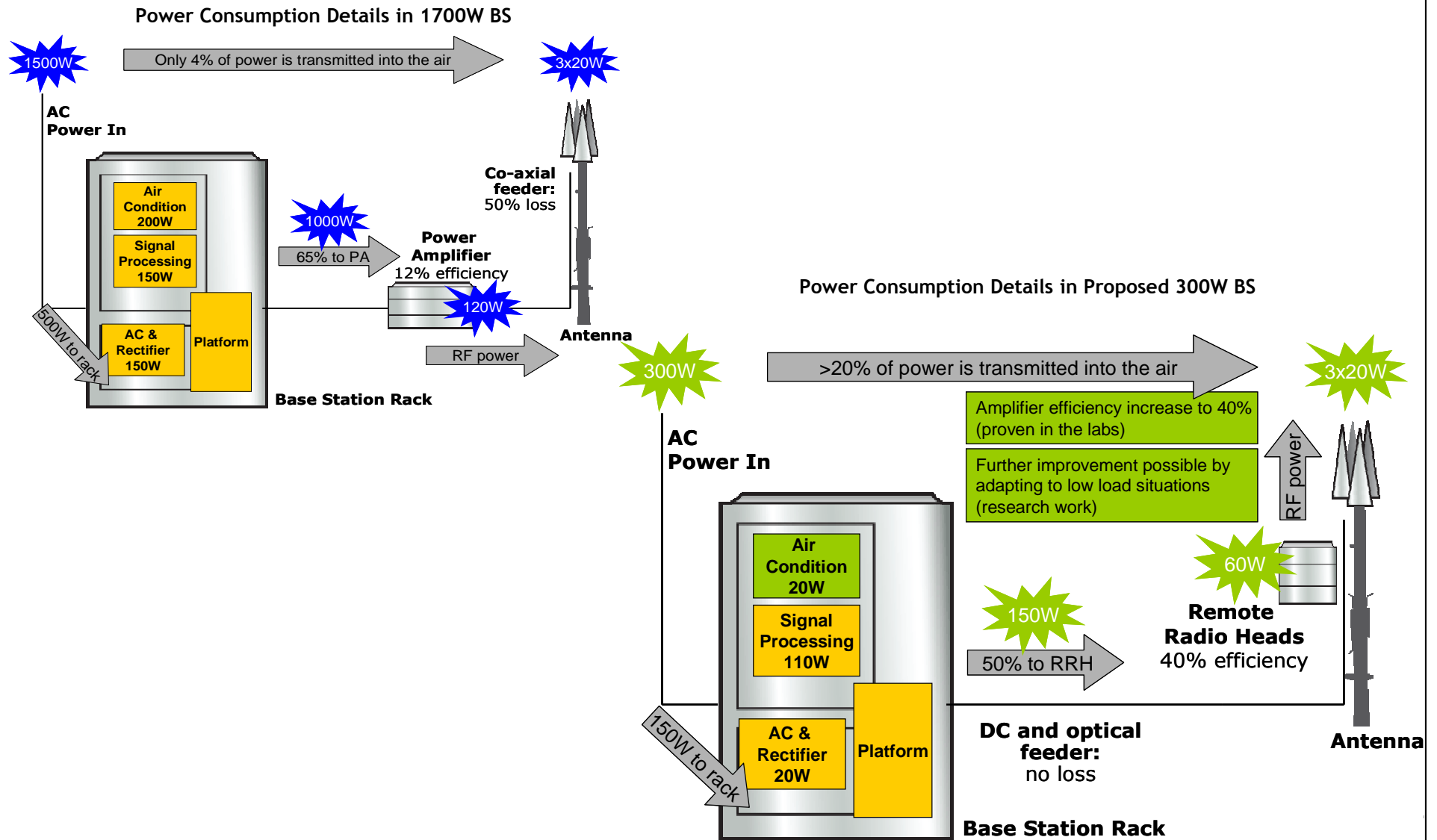


Large savings potential not only for quiet hours.

- Typically 10% of the sites carry 50% of all traffic.
- 50% of sites are lightly loaded, carrying only 5% of the traffic

Energy Efficiency Trends for Base-stations

Trend 2000-2010 and schematic breakdown



The European Integrated Project





The goal of the project is to address the global environmental challenge

- by investigating and proposing effective mechanisms to drastically reduce energy wastage & improve energy efficiency of existing and future communication systems
- in particular in low-load conditions (which are most commonly experienced in most base stations) these savings could be even considerably higher.
- without compromising users' perceived "quality" of service

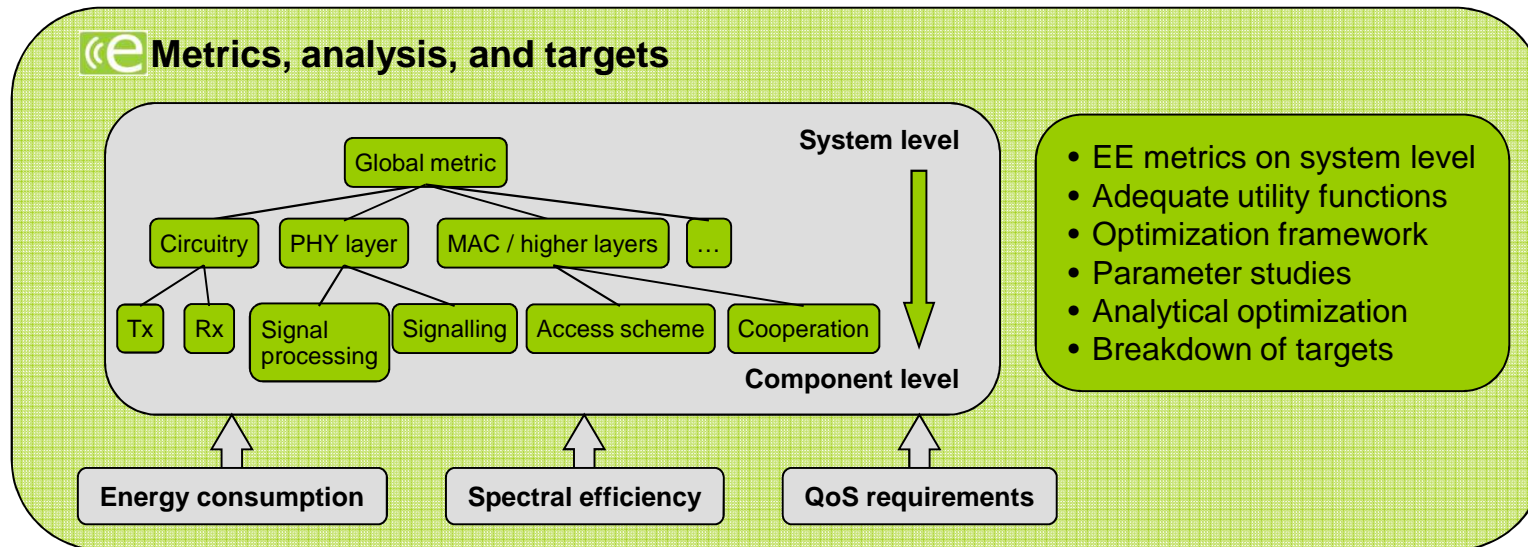
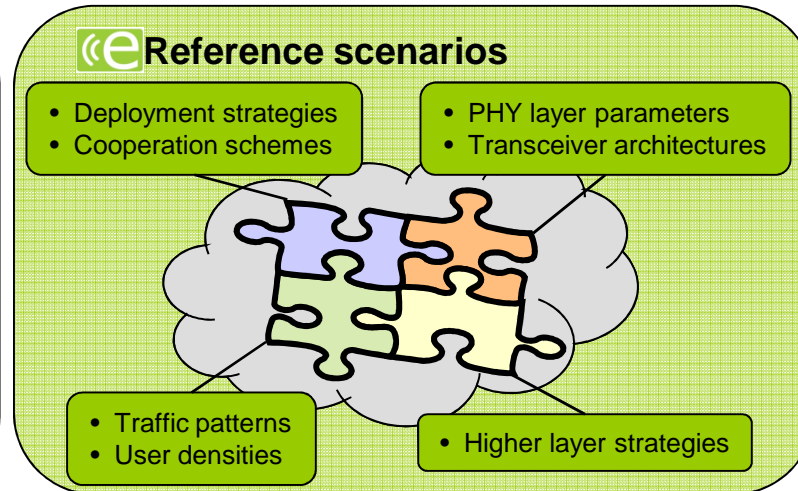
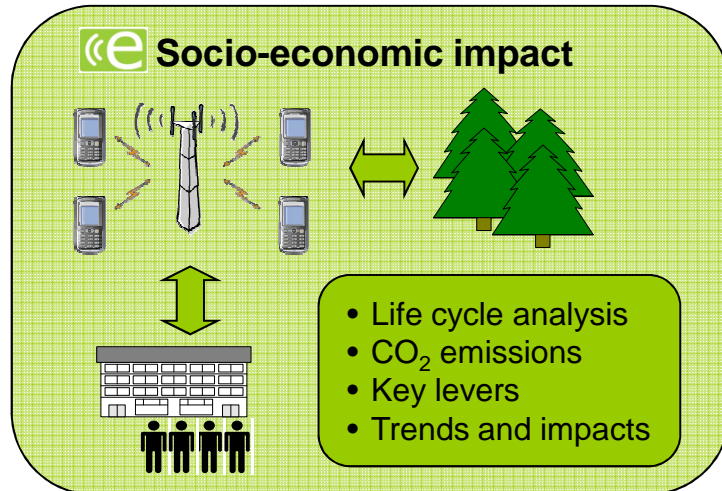
to make ICT ecologically and economically sustainable for all sectors of society .

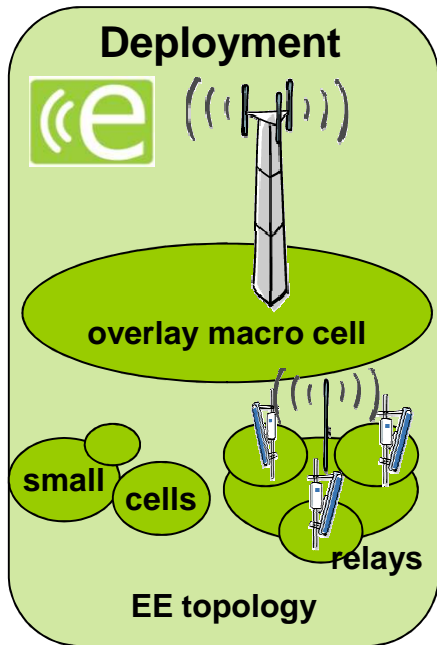
Holistic approach to EE cellular networks

- ❖ Energy efficient network topologies, architectures & protocols
- ❖ Network management
- ❖ Radio devices
- ❖ Radio transmission

- For each topic (radio, networking, ...), baselines and metrics will be defined.
- EARTH project will focus on research topics with a potential target of **at least 50% of energy saving** (with respect to current status).

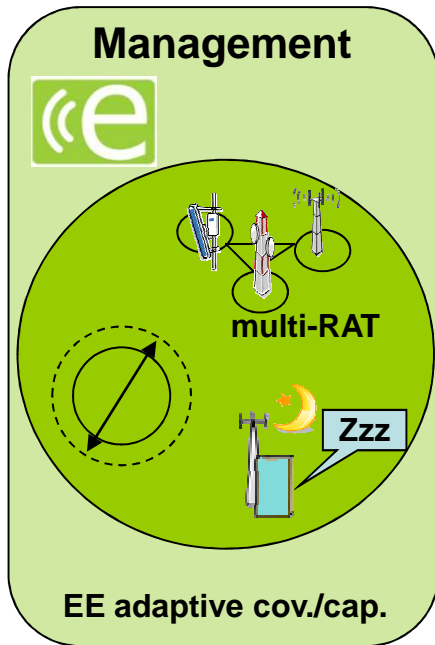
Energy efficiency analysis, metrics and targets





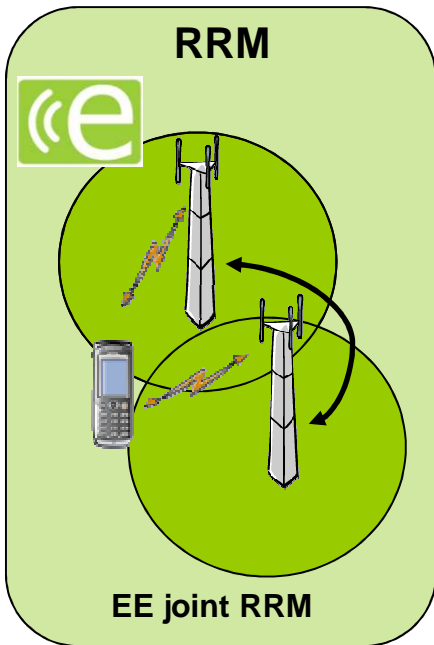
Deployment scenarios:

- optimum cell size
- mix of cell sizes
- hierarchical deployment
- multi-RAT deployments
- relays & repeaters



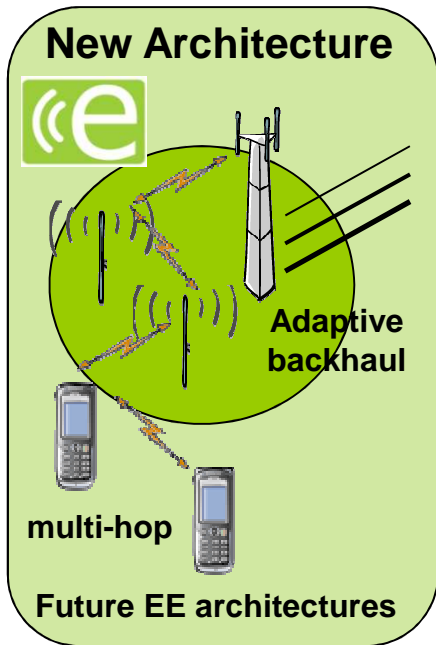
Management algorithms:

- coverage adjustment
- capacity management
- Multi-RAT coordination
- base station sleep mode
- prototype protocol design



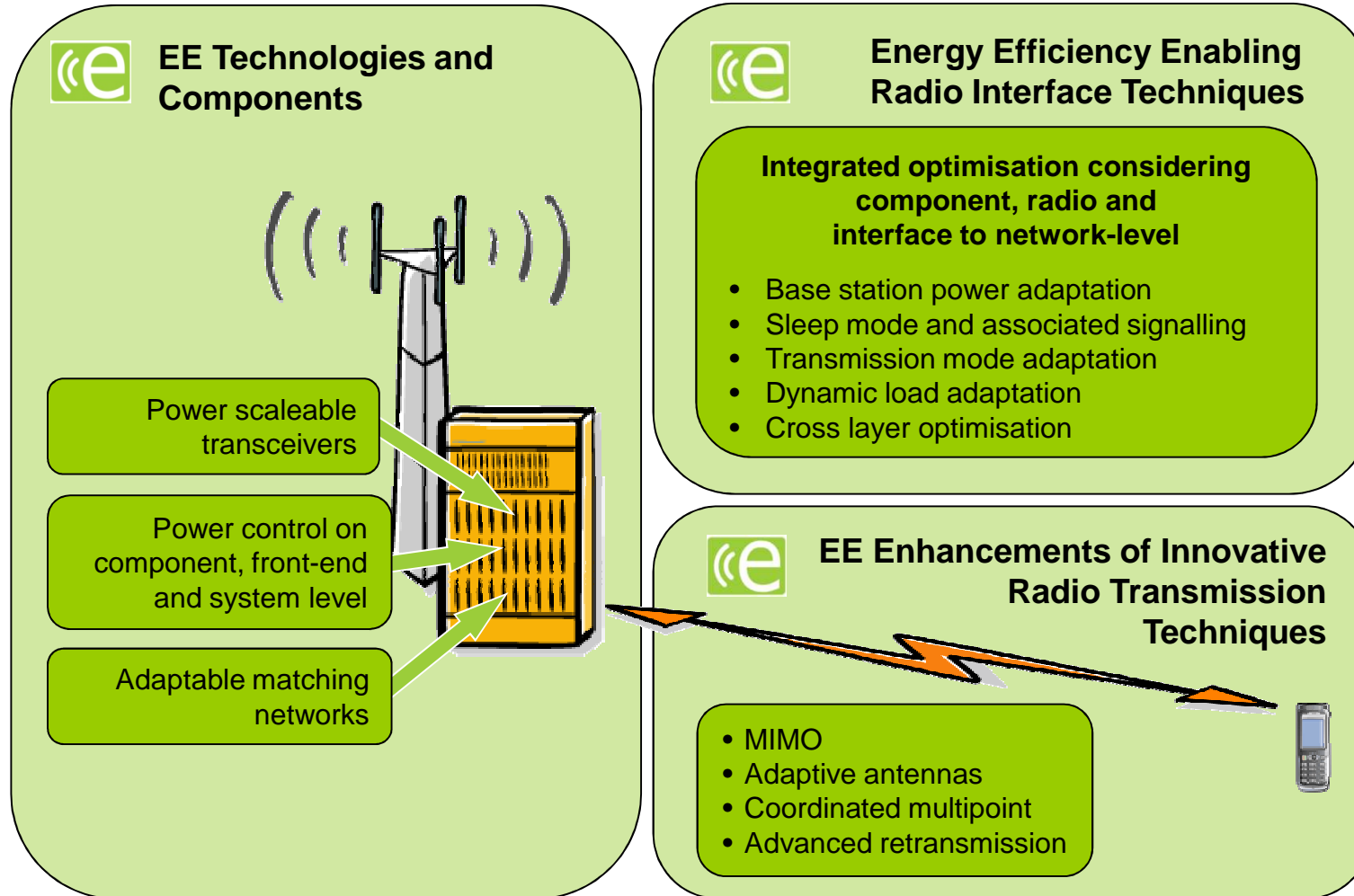
RRM algorithms :

- cooperative scheduling
- interference coordination
- joint power allocation and resource allocation
- EE vs spectral efficiency



Disruptive approaches:

- multi-hop transmission
- adhoc networks
- terminal-terminal-transmission
- cooperative multipoint arch.
- EE adaptive backhauling



EARTH Consortium

Alcatel-Lucent 

ERICSSON 

NXP founded by Philips

NTT **docomo**
DOCOMO Euro-Labs

 **TELECOM**
ITALIA

 **cea**

 **UNIVERSITY OF SURREY**

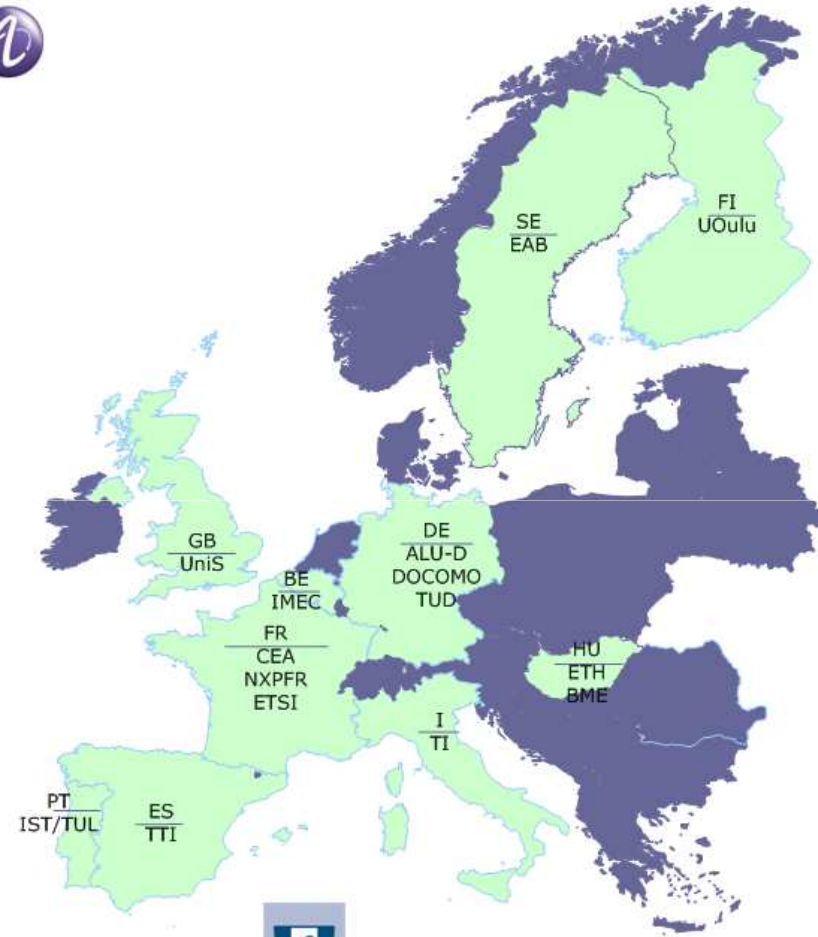
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