

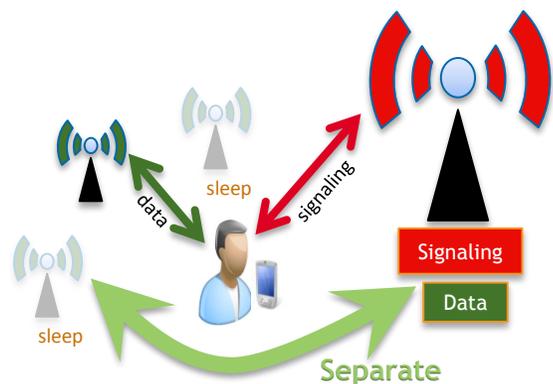
Green Meter for Mobile Networks





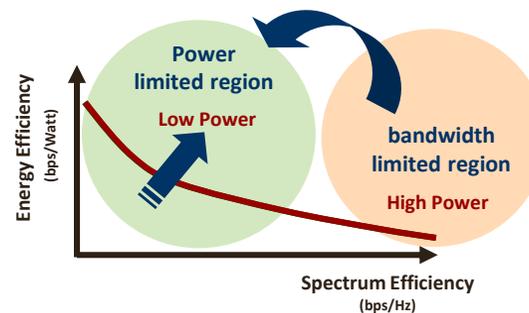
Green Approaches to a Future Mobile Networks Architecture

CHALLENGE AND BREAKTHROUGHS



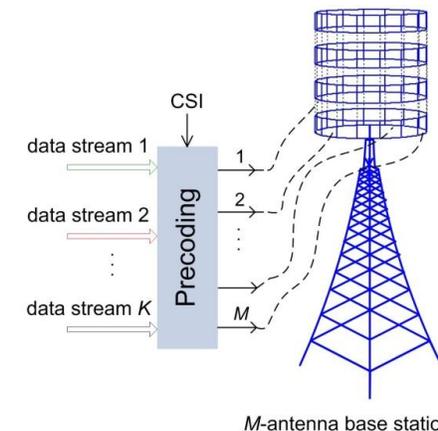
BCG² - Beyond Cellular Green Generation

Enabling fully dynamic operation of macro and small cell networks by introducing a separate control layer



GTT - Green Transmission Technologies

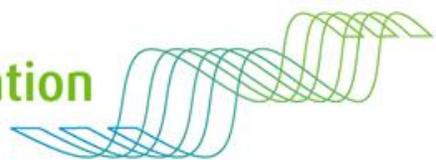
Leveraging Interference control, Multi-User MIMO and CoMP for adaptive radio transmission



LSAS - Large Scale Antenna Systems

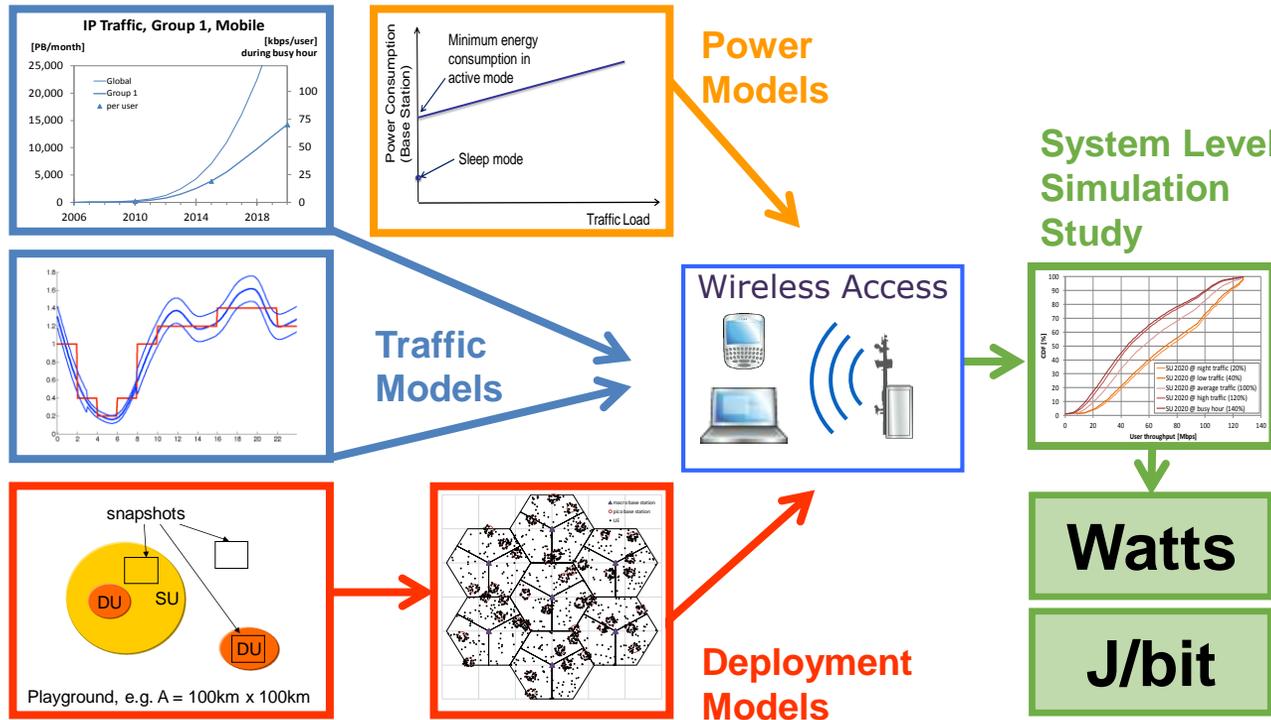
Massive MIMO antenna arrays for directed transmission and minimized interference

Three Technology Directions Studied and Combined to the Best Possible Architecture



Green Meter Methodology for Wireless Access

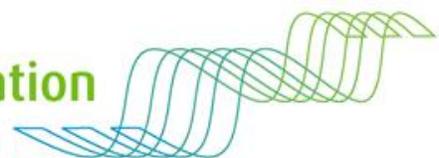
KEY ACCOMPLISHMENT AND RESULTS



Providing scientifically sound simulation models for the Green Meter study

- Temporal and spatial traffic models derived from operator data
- Scalable base station power models
- Quality of Service requirements
- Aggregation to a nation wide mobile network

Comprehensive Modeling for Quantitative Performance Simulations



Computation of the GreenTouch Gain Factor for Mobile Networks

Reference 2010

- LTE rollout, replacing legacy deployment
- Reusing existing sites
- Full coverage in all areas
- 4 competing operators serving the market

Performance evaluation
at 2010 traffic level



J/bit
Watt

89x Traffic

GreenTouch 2020

- Strictly optimized deployment with shared infrastructure
- Best projected 2020 hardware components
- Selection of BCG², GTT, LSAS technologies

Performance evaluation
at 2020 traffic level



J/bit
Watt

Improvement
Factors

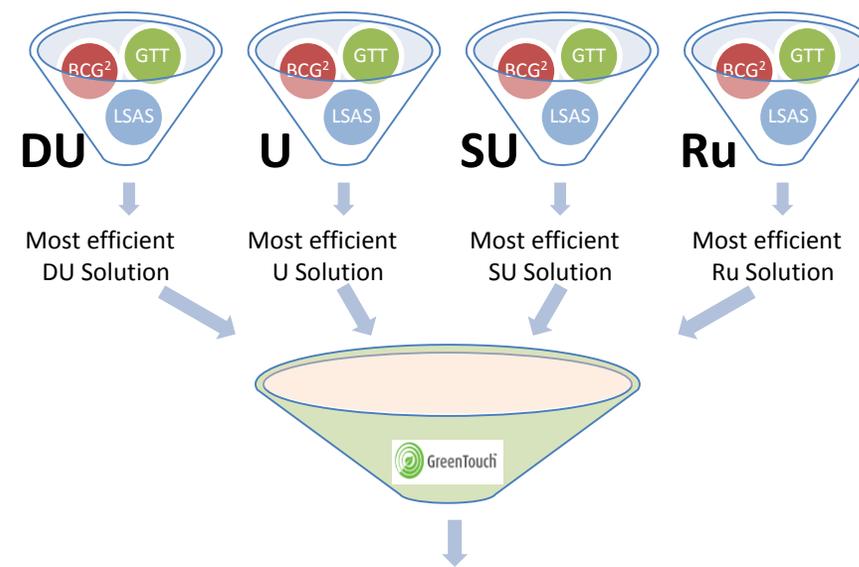
Providing the Best Achievable Energy Efficiency and Energy Consumption Gains



GreenTouch Wireless Access Architecture

KEY ACCOMPLISHMENT AND RESULTS

Technology	Daily energy intensity [J/Mb]			
	DU	U	SU	R
2010 Reference	1989	5528	6126	10849
BCG ²	0.24	0.6	2.33	2.74
GTT	0.37	0.75	0.88	2.08
GTT with BCG ² Layer	0.26	0.39	0.50	1.47
LSAS with BCG ² Layer	0.14	0.52	2.41	6.62



GreenTouch Mobile Architecture

Mobile Architecture Enables a Total Efficiency Gain of 10,000x and Reduction of Annual Energy Consumption by 99% Compared to 2010 Reference Scenario