



ARTIST4G

FP7 call 4 Integrated Project

(Advanced Radio Interface Technologies for 4G SysTems)

Presentation prepared for the Future Networks 5th FP7 Concertation Meeting

Brussels, January 27, 2010

Project participants: **Alcatel-Lucent, CEA, Chalmers, Docomo, Eurecom, France Telecom, Mitsubishi, Nomor, Nokia Siemens Networks, Qualcomm, Sequans, Telecom Italia, Telefónica, TU Dresden, Vodafone**

Coordination: **France Telecom**



ARTIST4G drivers

- **Mobile Data traffic explosion**
 - Customers use of 3G has moved from **Mbytes to Gbytes** monthly
 - Rising availability of USB dongles, data cards and Mobile Internet devices is a clear leverage
- **Limited and non-uniform** Broadband Mobile experience
 - New traffic demand poses a considerable **capacity challenge** on future systems (4G)
 - Existing systems favor peak performances



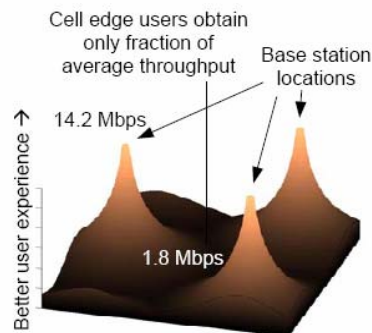
Artist4G



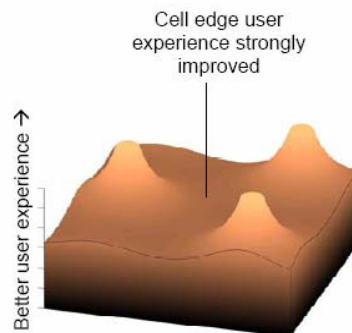
SEVENTH FRAMEWORK
PROGRAMME

Which focus in ARTIST4G ?

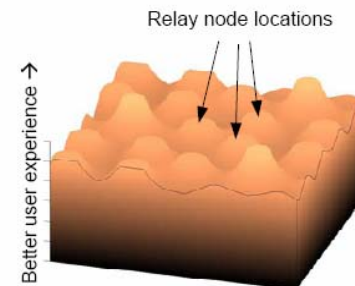
- **Improve user experience** of cellular radio systems
 - Reduce the gap between cell-centre rates and average/cell-edge rates, to provide:
 - High spectral efficiency across the whole coverage area
 - Fairness between users
 - Reduce the latency
- Achieve low **cost** per information bit
- Focus on adaptive and efficient combination of the most promising technologies:
 - Interference avoidance
 - Interference exploitation
 - Advanced relay techniques



Conventional LTE system



System with ARTIST4G techniques (e.g. interference management)



System with ARTIST4G techniques (e.g. advanced relaying)



Main objectives and expected impact

building on results from WINNER+ and EASY-C

Produce:

strong technical consensus to foster the development of 4G standards

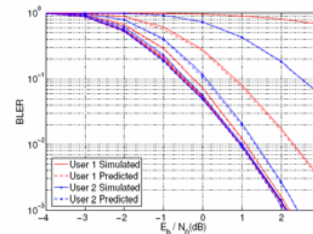
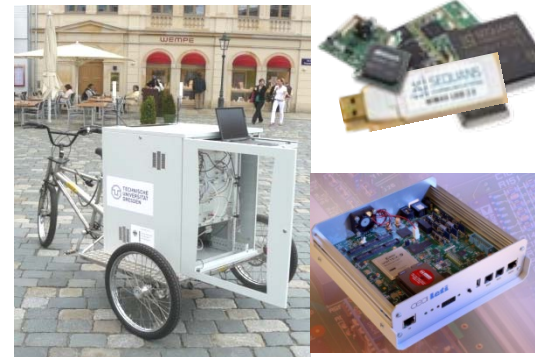


Fig. 1. MMSE-IC, 5 iterations

Demonstrate

key technologies

- interference avoidance
- interference exploitation
- advanced relays



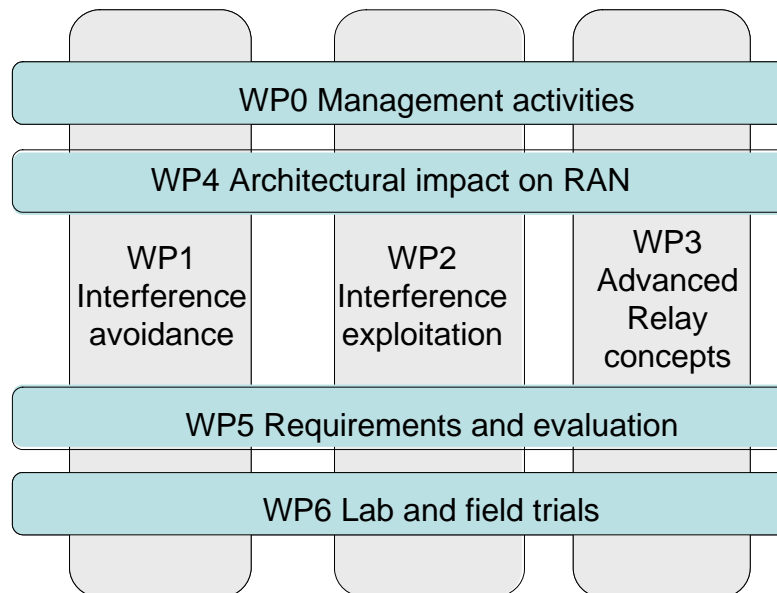
Disseminate:

- towards standards
- into fora (eMobility, WWRF)
- into international workshops (ICT...)



Project Description and Organisation

- 7 Work Packages (3 dedicated to research delivery, 3 to transversal activities, 1 to overall management activities)
- "Integrated Project" of 15 partners
- 120 person-year over 30 months
- Operators, Industry, SME, Public Research Organizations, Universities
- 9 countries (Finland, France, Germany, Italy, Netherlands, Poland, Spain, Sweden, UK)



Focus per actor type in ARTIST4G (1/3)

Operators

Coordination

France Telecom-Orange

Project coordinator
WP5 leader

Telecom Italia

WP1 leader

Telefonica

WP4 leader

Vodafone

NTT-DOCOMO

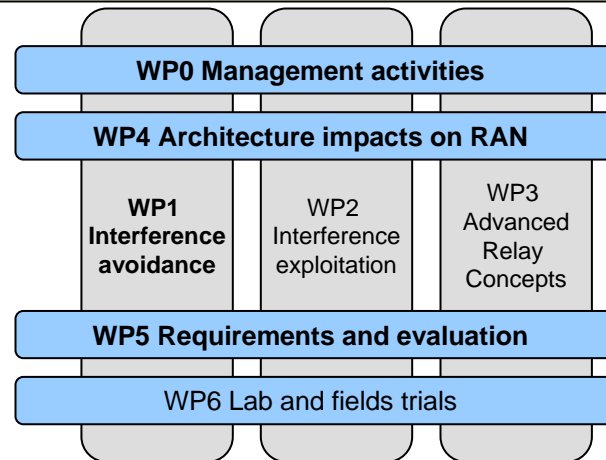
Dissemination

-Bridge between NGMN and the project to leverage the results at 3GPP

-Liaise with the global research ecosystem via WWRF

Contributions

- **Animate** and lead the project
- Steer the **requirements**
 - Build upon 3GPP and NGMN requirements
 - New scenario definition
- **Ensure user-centric** objective throughout the project
- **Evaluate** concepts performance by simulations
- Provide **field trial facilities**
- Propose **innovations**
 - work out the most efficient combinations among interference avoidance, exploitation and relays
- Take care of impacts on the **architecture**



Focus per actor type in ARTIST4G (2/3)

Industry & SMEs

Composition:

Qualcomm

WP2 leader

Nokia Siemens Networks

WP3 leader

Alcatel-Lucent

Mitsubishi Electric

Sequans

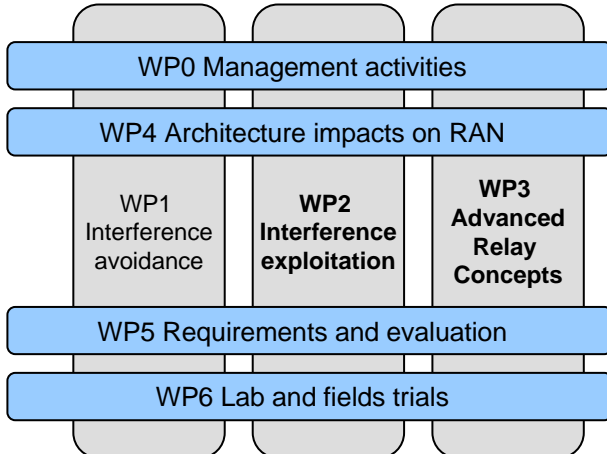
Nomor

Contributions:

- Evolve 3GPP LTE-A cellular systems by **designing innovative** ARTIST4G technology **concepts**
- **Evaluate** concepts performance by simulations
- Perform **field testing** of selected concepts and algorithms
- **Align design** and evaluation of concepts with standardization requirements and roadmaps
- **Prepare transfer** of research assets **to standardization** bodies
- Translate the concepts into RAN requirements and architectural features

Dissemination:

- Leverage project results at 3GPP
- Feed LSTI with projects learnings
- Ensure public visibility of ARTIST4G through publications



SEVENTH FRAMEWORK
PROGRAMME



Focus per actor type in ARTIST4G (3/3)

Universities, Public Research

Composition:

Techn. University Dresden

WP6 leader

Chalmers Univ. of Tech.

Eurecom

CEA

Contributions:

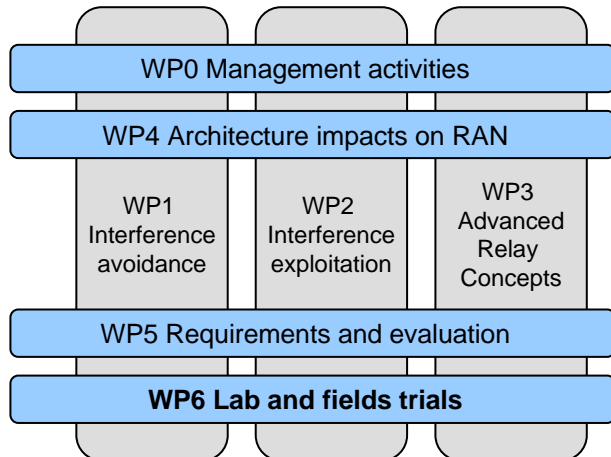
Most upstream contribution in the following research fields:

- **Advanced Tx & Rx signal processing** techniques
- Scheduling and **Cross-layer Design**
- **Link-to system modeling**, Scheduling
- Interference measurement techniques
- **Interference avoidance** & control methods
- Advanced **Relaying Techniques** (interference coordination, protocols & distributed mechanisms)
- Test Scenario Specification and Proof-of-Concept of selected algorithms

A **key role in Labs and Field trials**

Dissemination:

- Conference and Journal publications
- Academia education (M.Sc. E.E., PhD)
- future Mobile Telecom Experts



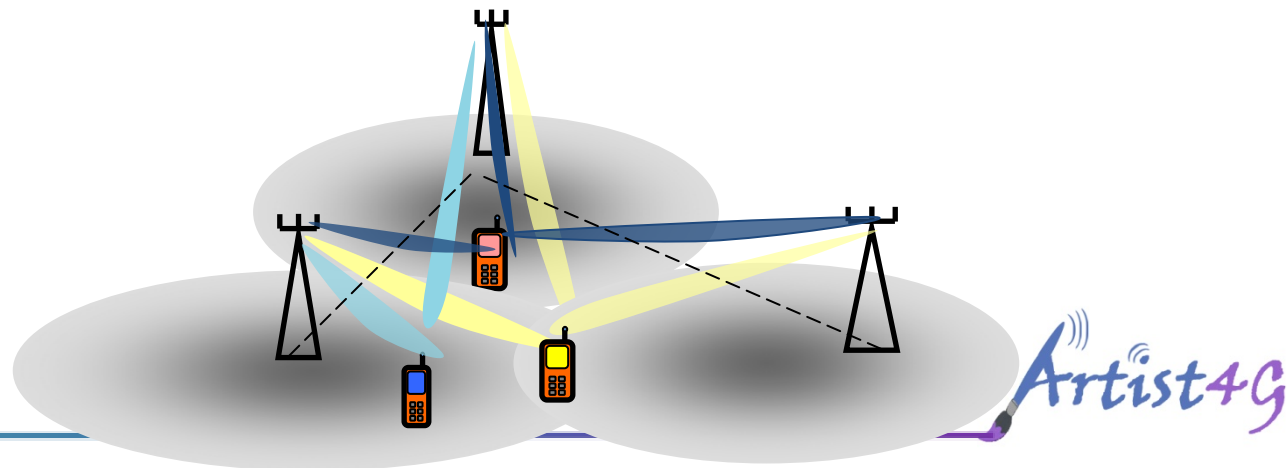
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Project intended results (1/3)

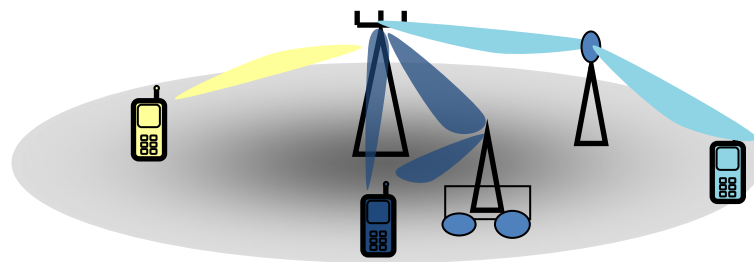
Towards more uniform throughput distribution

- **Interference Management:** avoid & exploit
 - **Coordinated resource allocation** across cells
 - **3D beamforming**
 - **Inter-topology** interference management (macro, micro, femto)
 - **Flexible interference** control wrt required QoS per service type
 - **Advanced receivers** turning interference into benefit
 - **Soft-tuning interference control** (avoidance & exploitation)
 - **Adaptive CoMP** based on different user requirements



Project intended results (2/3)

Towards improved coverage and capacity

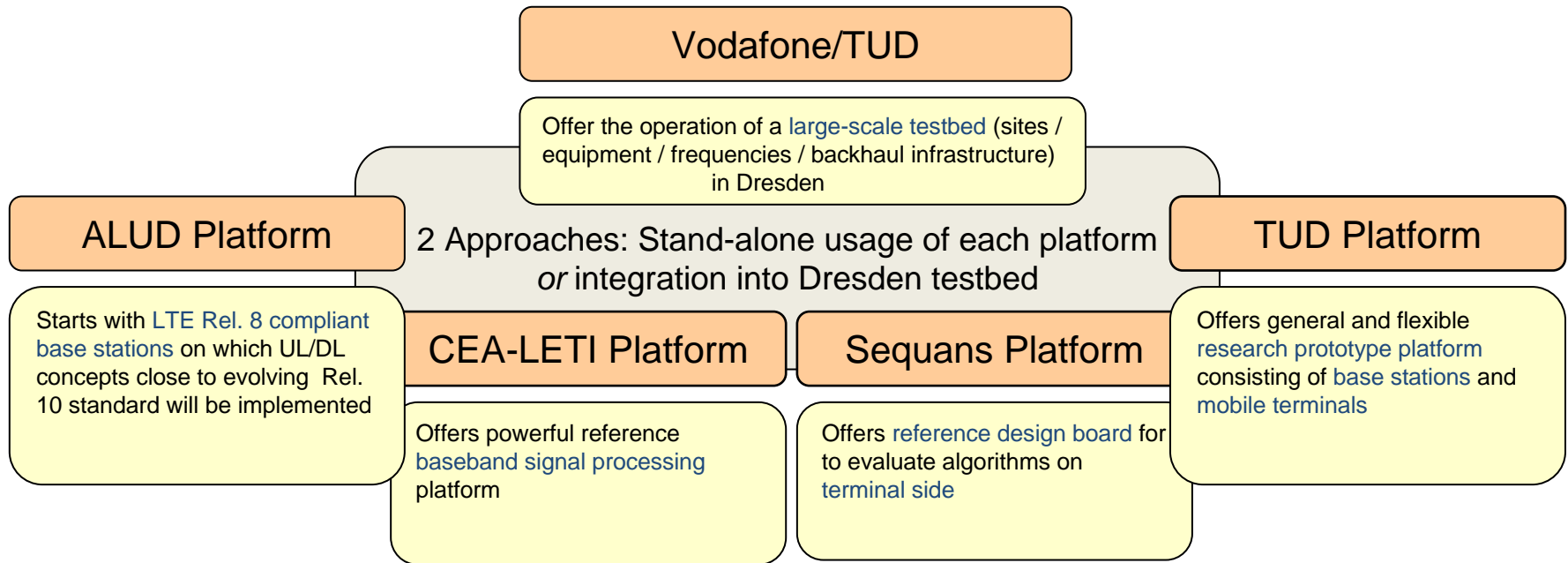


- Advanced relay techniques
 - **Improved diversity with CoMP** combining relays and BS
- Multi-hop relays
- **Moving cells** with strong requirements on UE throughput (laptops in a train)



Project intended results (3/3)

Accelerating transition from research to standards



Field evaluation

- The **most promising innovations** will be supported
- Two objectives
 - Take account of **practical impairments**
 - Step from performance predictions to **reliable measurements**



Thanks

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