The LENA project

an open source product-oriented
LTE/EPC Network Simulator

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About CTTC

- Non-profit research center focused on telecommunications
- Funded in 2001, after a public initiative
- Mission:
  - foster innovation by making new scientific knowledge accessible
  - consolidate Barcelona’s position as an important center of technology
  - help expand Spain’s role within the European telecommunications research community and industry
  - contribute to the economic growth of the Catalan industrial context
- Financial support from the Generalitat de Catalunya and from research projects (both industrial and competitive funds)
- Research is both applied and fundamental
- More information: http://www.cttc.es
LENA project overview

- CTTC is working with Ubiquisys on the development of LENA, a simulation platform for LTE/EPC

- Objective: to allow LTE small/macro cell vendors to design and test Self Organized Network (SON) algorithms and solutions
The LENA project: an open source product-oriented LTE/EPC Network Simulator

• A Product-oriented simulator:
  • designed around an industrial API: the Small Cell Forum MAC Scheduler Interface Specification
  • Allows testing of real code in the simulation
  • Accurate model of the LTE/EPC protocol stack
  • Specific Channel and PHY layer models for LTE macro and small cells

• An Open source simulator:
  • Development open to the community
  • Fosters early adoption and contributions
  • Helps building confidence and trust on simulation model
  • Candidate reference evaluation platform
  • Based on ns-3
  • Free and open source licensing (GPLv2)
The LENA project: an open source product-oriented LTE/EPC Network Simulator

Target applications for LENA include the design and performance evaluation of:

- DL & UL Schedulers
- Radio Resource Management Algorithms
- Inter-cell interference coordination solutions
- Load Balancing and Mobility Management
- Heterogeneous Network (HetNets) solutions
- End-to-end QoE provisioning
- Multi-RAT network solutions
- Cognitive LTE systems
LENA timeline

2010

- LTE module project starts
- GSoC 2010 proposal: LTE module for ns-3

2011

- First contact with Ubiquisys
- LENA project kick-off
- LENA M1 release

2012

- LENA M4 release
- LENA code review starts
- GSoC 2010 LTE module merged with ns-3-dev
- First LENA public release

2013

- LENA M3+M5 release
- LENA merged with ns-3-dev
- LENA M3+M5 code merged with ns-3 dev?

2014

- LENA M6 release?
- GSoC 2012 LTE schedulers project starts
- GSoC 2012 : LTE schedulers
- GSoC 2012 LTE schedulers merged with ns-3-dev
- GSoC 2013?
LENA in numbers

- 90k lines of code in src/lte
  - about 19.4% of the ns-3 code in src/
- 116 pages of LTE module documentation
  - about 46% of the ns-3 models library documentation
- 45 PM original LENA workload estimate
- 5 CTTC LENA developers
  - N. Baldo, M. Miozzo, M. Requena, J. Nin, L. Parcerisa
- 2 GSoC student projects related with LENA
  - G. Piro, D. Zhou
Final remarks

• ns-3 is a great tool to work with
• Contributing to the ns-3 community pays off
• ns-3 is a good choice for industry

• More on the LTE module by the LENA project in the tutorial this afternoon!