Momentum Data Scenarios for Radio Network Planning and Simulation (Extended Abstract)*

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Abstract. We present publicly available data sets related to research on wireless networks. The scenarios contain a wide range of data and are detailed in all aspects. To our knowledge, this is the most realistic, comprehensive, and detailed *public* data collection on mobile networking. We indicate example uses of this data collection in applications related to UMTS.

Within the EU-project MOMENTUM, a detailed and realistic collection of data concerning UMTS network design was assembled in three publicly available [2] scenarios (Berlin, Lisbon, and The Hague). The data is available in XML [3] The wide scope and modular structure of the data allow a use beyond UMTS technology, for several research activities in the field of mobile communications. The data contents are:

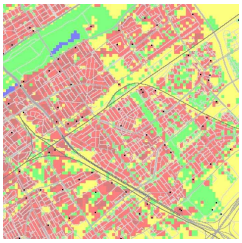
Environment: "World" in which the scenario is located. Contains *land use* data, a pixel-based *mobility model* [5] for different user types (e. g. vehicular, pedestrian), and *isotropic radio propagation* predictions. The mobility model is based on land use and vector data (e. g. streets, highways). The predictions are calculated with an adaptive COST-Hata model [4] involving clutter-specific loss.

Services and Traffic: several *services* are described in up- and downlink in terms of data rates, link quality demand, and stochastic data source model. The impact on the radio access network of different usage types is considered. For the different services, there are *call arrival rate* maps (for dynamic user simulation) and *average load* grids for static system-level simulation, an example is shown in Fig. 1(c). The traffic load is estimated based on population data and zone characteristics (e. g. business vs. residential).

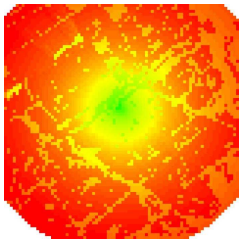
Network Configuration: hierarchical *network structure* with sites, Node-Bs, and cells is specified together with *radio resource management* (RRM) settings. Radio propagation features of different cells (derived from isotropic predictions and antenna diagrams) are stored as *cell specific propagation grids*.

UMTS Specifics: concern mainly the relevant *hardware*: base station controllers (Node-B), user equipment, and antennas. All relevant properties such as gains and losses, or antenna diagram are described. For the UMTS radio bearers, block error rate (BLER) vs. Carrier to Interference Ratio (CIR) tables are given.

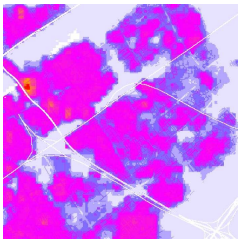
* This work is a result of the EU project MOMENTUM, IST-2000-28088



(a) Land use/sites

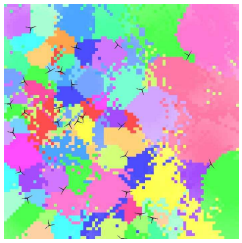


(b) Isotropic pred.

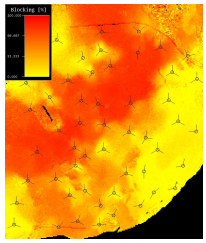


(c) Av. load, Video

Fig. 1. Data contents (The Hague)



(a) Netw. planning



(b) Simulation

Fig. 2. Data use and results

Table 1. Data usage in network planning tasks: ○ considered, ● fully modelled

		Automatic Design	Simulation	
			Static	Dynamic
Environment	Clutter Type/Operational Env.	●	●	●
	Mobility			●
	Radio Propagation (isotropic)	●		
	Potential Sites	●		
Traffic/Services	Traffic: Average Load	●	●	
	Traffic: Call Arrivals			●
	Services	○	●	●
	Source Models	○	○	●
	Velocity	○	○	●
Configuration	Network	(result)	●	●
	Cell Predictions	(result)	●	●
	Radio Resource Management		●	●
UMTS Specific	Bearer	○	●	●
	Node B	○	○	○
	User Equipment	●	●	●
	Antenna Diagrams	●		

The MOMENTUM data sets were created for application in *automatic network design* and *network simulation*. These tasks use the data differently, as is illustrated in Table 1. In network design, the task is to select sites and to configure antennas such that the resulting radio network delivers good performance for the given traffic in a cost-efficient way. Figure 2(a) shows the best server map of a resulting network for the The Hague scenario. Within MOMENTUM, network design is based on snapshots created from the average load maps. Based on the data, realistic CIR targets and attenuation coefficients are calculated. A model and solution approaches for this are presented in [6–8]. Network simulations aim at a detailed analysis of performance indicators. Static snapshot simulations and dynamic simulations have been carried out on the basis of the data [9, 10]. Simulations consider a configured network (as opposed to *potential* configurations in planning), but with more details on RRM and source parameters. Figure 2(b) shows the total blocking probability for a network in Lisbon scenario, a typical result obtained from static simulations. For dynamic simulations, user mobility and data source models are in addition modeled in detail using the data.

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