

**CHENNAI – PONDICHERRY**

**Measurement-driven Modeling for Connection Density and Traffic Distribution in Large-scale Urban Mobile Networks**

**Abstract:**

In the diverse usage scenarios of mobile networks, we have different performance requirements on connection density and user experienced data rate, and modeling such diversity is crucial to the strategy evaluation in addressing the problem of high traffic load and scalability of network resources. Therefore, it is necessary to build a network capability model in two dimensions of connection density and user experienced data rate. This paper aims at addressing this challenge based on an investigation of network capability in large-scale urban environments. First, our statistical study shows that the spatial distribution of these two parameters can be accurately modelled by the log-normal mixture distribution. Second, we find that only six basic capability patterns exist among the 9,000 cellular base stations, which indicates different levels of network capabilities. More importantly, these discoveries are similar in a cellular network deployed in a different city. Therefore, based on these two discoveries, we build a network capability model that can generate synthetic base stations with diverse connection density and user experienced data rate. We believe that this methodology of modeling network capability, with accuracy, generality and flexibility, can help telecommunication operators to design and standardize mobile networks of the next generation.

**Existing System:**

There exists no previous work on modeling network capability from aspects of connection density and user experienced data rate. Mostly, cellular traffic dynamics are directly characterized by stochastic process theories, such as batch Markovian arrival process (BMAP) in [3], and multi-order Markov chain. If we want to build a capability model considering both connection density and user experienced data rate, there still remain three challenging problems to solve:

\_ How to obtain and analyze connection density and user experienced data rate of a real cellular network?

A large-scale trace data containing these two parameters is vital in the analysis. Also, to build a capability model, we need to consider the spatial distribution of connection density and user experienced data rate. These tasks are challenging.

\_ How to extract the key patterns of connection density and user experienced data rate from the trace data? Note that we can combine the base stations with similar capability characteristics together and obtain a handful number of groups. Then we can build independent and also more accurate models for each of these groups. Therefore, a suitable clustering method is required, which helps us to understand the network capability in these two dimensions.

\_ How to build a model with generality? Since our analysis is measurement-driven, bias existed between different datasets may impact our built model. For example, if the dataset of cellular network is collected in one certain city, then the methodology of building model may only be workable in that dataset. Therefore, we can consider checking the generality of our modeling methodology in different mobile networks.

**Proposed System:**

First, we discover that the spatial distribution of subscriber density and per-subscriber demand can be accurately fitted by a log-normal mixture model. Our theoretical proof shows that the product of subscriber density and per-subscriber demand, i.e., traffic density, also follows a log-normal mixture distribution spatially, which is further validated by empirical data. In addition, the generality of this distribution model is also verified across different cities.

We build a base-station-level capability model as the function of subscriber density and persubscriber demand. The highlight of our model is that we only need to input the urban function context information, and it can then generate synthetic base stations with realistic diverse capabilities in terms of the two key parameters.

Our extensive analysis provides a precise characterization of individual base station capability and clusters base stations into several types (6 types in Shanghai and 4 types in Kunming) according to subscriber density and per-subscriber demand. We also explore the relationship between the base station capability and urban functional regions where base stations are deployed.