

Optimizing the Cellular Network Planning Process for In-Building Coverage using Simulation

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ABSTRACT

The global scenario of mobile telecommunications networks suggests that the next years the number of mobile users will continue growing as well as the services demand. The biggest growth is expected mainly in Asiatic and developing countries. Particularly, the Mexican telecommunications market suggests that if the number of mobile users will continue growing in Mexico as in the last years, then the mobile networks operators should increment the network capacity and the in-building coverage in order to maximize the quality of service. Also, network operators should offer attractive plans to users in order to maximize their economic benefits. Therefore, this research study aims to develop a simulation model to analyze the services transmission in a Third Generation mobile network and maximize the network coverage and the theoretical economic benefit of network operators. The delivered services included are voice, data and video. Using this simulation model we obtained the optimal cost-effective network design in a scenario of a Mexican airport. This design consisted of six cells, each one configured with an Omni-directional antenna and capacity of seven traffic channels. Through the traffic channels were delivered the services: sound, multimedia, narrow band and wide band, with a data rate of 12 kb/s, 128kb/s, 384 kb/s, and 1920 kb/s, respectively. The maximum economic benefit was 46.6% using the optimal network design. We propose this simulation model as a tool for decision-making support of mobile network operators in Mexico.

Keywords: mobile network, telecommunication services, simulation model, optimization.

RESUMEN

El escenario global de las redes móviles de telecomunicaciones sugiere que en los próximos años el número de usuarios y la demanda de servicios continuarán creciendo, sobre todo en países asiáticos y en desarrollo. Particularmente, el mercado mexicano sugiere que si el número de usuarios en México continua creciendo como en los últimos años, entonces los operadores de las redes deberán incrementar la capacidad de red y la cobertura en interiores para maximizar la calidad del servicio. Además, deberán ofrecer planes atractivos de renta a los usuarios a fin de maximizar sus beneficios económicos. Por lo tanto, el objetivo de este estudio de investigación es el desarrollo de un modelo de simulación para analizar la transmisión de servicios en una red móvil de tercera generación y en consecuencia, maximizar los beneficios económicos teóricos de los operadores y la cobertura de red, para la distribución de servicios de voz, datos y video. Utilizando modelo de simulación, se obtuvo el diseño de red óptimo basado en costo-beneficio en el escenario de un aeropuerto mexicano. Este diseño consistió de seis celdas, cada una configurada con una antena omni-direccional, y con una capacidad de siete canales de tráfico, resultando un beneficio económico máximo de 46.6%. Así, este modelo de simulación se propone como una herramienta para el apoyo en la toma de decisiones de los operadores de redes móviles en México.

1. Introduction

Since the late 1970s, when the cellular era started, mobile communications have gone through an evolutionary change every decade in terms of technology and usage. At the beginning, Japan took the lead in the development of cellular technology, which resulted in the deployment of the first cellular networks in Tokyo [1]. The First Generation Mobile Systems (1G) permitted the distribution of speech services and were based

mainly on analogue transmission techniques. In the early 1990, the Second Generation Mobile System (2G) appeared in the market when the digital transmission technology came into force. Then, the distribution of services such as the voice mail, text messages, and call waiting, apart from just calls, was available. One of the advantages for users using the Second Generation Mobile System was the low cost alternatives to making call, such